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John GRIVAS | Adam BYLSMA | Nicole LETCH

WORKBOOK
for PSYCHOLOGY
VCE UNITS 3 AND 4

SEVENTH EDITION

jacaranda
A Wiley Brand

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INTRODUCTION

This workbook provides students with a variety of worthwhile learning activities to assist development and understanding of key knowledge and skills specified for VCE Psychology Units 3 & 4. The activities complement those in the textbook and are designed for use in conjunction with the text to enhance learning and revision options.

All chapter titles and activities are sequenced in line with the textbook and can be answered from the text, thereby enhancing ease of use. All activities have been selected in collaboration with Psychology teachers and many have been trialled in classrooms. All activities are different from those in the textbook and can be completed independently by students in the classroom or at home.

Each chapter has a matrix showing the relationship of each activity to key knowledge and skills in the Psychology study design. Each activity has an assessment guide specifically designed to support self-assessment. These guides are published separately but easily accessed in the eBookPLUS.

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Text

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PSYCHOLOGY — RESEARCH METHODS

CHAPTER 1

Research methods in psychology

	Activities																	
Key science skills	1.1	1.2	1.3	1.4	1.5	1.6	1.7	1.8	1.9	1.10	1.11	1.12	1.13	1.14	1.15	1.16	1.17	1.18	1.19
Develop aims and questions, formulate hypotheses and make predictions																			
• determine aims, research hypotheses, questions and predictions that can be tested	✔		✔														✔		
• identify and operationalise independent and dependent variables	✔	✔															✔		
Plan and undertake investigations																			
• determine appropriate type of investigation: experiments (including use of control and experimental groups); case studies; observational studies; self-reports; questionnaires; interviews; rating scales								✔	✔	✔	✔	✔		✔			✔	✔	✔
• use an appropriate experimental research design including independent groups, matched participants, repeated measures and cross-sectional studies								✔	✔								✔	✔	✔
• select and use equipment, materials and procedures appropriate to the investigation							✔	✔						✔			✔	✔	✔
• minimise confounding and extraneous variables by considering type of sampling procedures, type of experiment, counterbalancing, single and double blind procedures, placebos, and standardised instructions and procedures			✔	✔		✔	✔	✔	✔								✔	✔	✔
• select appropriate sampling procedures for selection and allocation of participants including random sampling, stratified sampling, convenience sampling and random allocation of participants to groups				✔	✔	✔			✔	✔				✔			✔	✔	✔

continued

Key science skills	Activities																		
	1.1	1.2	1.3	1.4	1.5	1.6	1.7	1.8	1.9	1.10	1.11	1.12	1.13	1.14	1.15	1.16	1.17	1.18	1.19
Comply with safety and ethical guidelines																			
• understand the role of ethics committees in approving research															✔				
• apply ethical principles when undertaking and reporting investigations, including consideration of the role of the experimenter, protection and security of participants' information, confidentiality, voluntary participation, withdrawal rights, informed consent procedures, use of deception in research, debriefing and use of animals in research															✔	✔	✔		
Analyse and evaluate data, methods and scientific models																			
• process quantitative data using appropriate mathematical relationships and units																✔	✔		
• organise, present and interpret data using tables, bar charts, line graphs, percentages, calculations of mean as a measure of central tendency and understanding of standard deviation as a measure of variation around the mean																✔		✔	✔
• recognise the difference between statistics that describe a specific sample and the use of statistics to make inferences about the population from which the data were drawn																✔		✔	
• use basic principles of reliability and validity in evaluating research investigations undertaken													✔	✔			✔	✔	✔
• explain the merit of replicating procedures and the effects of sample sizes in obtaining reliable data													✔						✔
• evaluate investigative procedures and possible sources of bias, and suggest improvements, with reference to identification of potential extraneous and confounding variables including individual participant differences, non-standardised instructions and procedures, order effects, experimenter effect and placebo effects			✔			✔		✔						✔			✔		✔

	Activities																		
Key science skills	1.1	1.2	1.3	1.4	1.5	1.6	1.7	1.8	1.9	1.10	1.11	1.12	1.13	1.14	1.15	1.16	1.17	1.18	1.19
Draw evidence-based conclusions																			
• determine to what extent evidence from an investigation supports the purpose of the investigation, and make recommendations, as appropriate, for modifying or extending the investigation																	✔	✔	✔
• draw conclusions consistent with evidence and relevant to the question under investigation																	✔	✔	
• identify, describe and explain the limitations of conclusions, including identification of further evidence required																	✔		
• discuss the implications of research findings and proposals																	✔		

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ACTIVITY 1.1

Formulating research hypotheses

For each of following research scenarios, construct a testable hypothesis that predicts the outcome and identify the operationalised independent and dependent variables.

Scenario 1

A researcher will randomly allocate 50 year 6 students to one of two groups. Group 1 will receive praise by their teacher for correctly spelling words given for homework. Group 2 will not receive praise. The researcher will then measure the number of words correctly spelled by each group.

research hypothesis: e.g. Students who receive praise from their teacher for correctly spelling words given for homework will correctly spell more words than students who do not receive praise.

independent variable: praise received from the teacher

dependent variable: number of correctly spelled homework words

Scenario 2

A sleep researcher is concerned about the safety consequences when public transport drivers are sleep deprived. He plans to conduct an experiment to test the effects of amount of sleep on tram drivers' reaction time. One group of tram drivers will be allowed to go to sleep at a normal time and will be awakened at 7 am. A second group will be kept awake until 3 am, allowed to go to sleep, then awakened at 7 am. Both groups will undertake a computer-assisted reaction time test every two hours during the 8-hour period after awakening. Mean test scores will be calculated for each group so that a comparison can be made.

research hypothesis: e.g. Tram drivers who have their normal amount of sleep will achieve higher mean scores on a reaction time test than do tram drivers who have a reduced amount of sleep.

independent variable: amount of sleep

dependent variable: mean score on reaction time test

Scenario 3

A psychology teacher investigates whether he can significantly improve his students' test scores. He instructs students in one of his classes to study for a topic test using their own self-directed approaches and asks students in another class to attend a teacher-directed intensive revision program run each lunchtime during the week leading up to the test.

research hypothesis: e.g. Students who attend a teacher-directed intensive revision program will score higher on a topic test than students who use self-directed study.

independent variable: teacher-directed revision program

dependent variable: scores on the topic test

Scenario 4

A researcher is concerned about the reduced size of a popular outdoor rabbit enclosure sold in pet stores. She believes the small enclosure causes stress which can be measured by taking blood samples and recording the level of the stress hormone cortisol. She asks five people with a pet rabbit kept in a small enclosure and five people who keep their rabbit in a big enclosure if she can take weekly blood samples from their rabbits over a four-week period to investigate the stress effects.

research hypothesis: e.g. Rabbits housed in small enclosures will have a higher level of cortisol in their blood compared to rabbits housed in big enclosures.

independent variable: size of enclosure

dependent variable: level of cortisol in the blood

ACTIVITY 1.1 *continued*

Scenario 5

A researcher wants to find out whether people actually respond to hypnotism by going into a deep trance. A qualified and experienced practitioner will use hypnotism with 20 adult volunteers who have never previously experienced hypnotism. The results will be analysed to find out the percentage of participants who go into a deep trance compared to the percentage in the general population who do not respond at all to hypnotism.

research hypothesis: e.g. A higher percentage of participants exposed to hypnotism will go into a deep trance compared to the percentage of participants who do not respond at all to hypnotism.

independent variable: exposure to hypnosis

dependent variable: response to hypnotism

ACTIVITY 1.2

Identifying and operationalising independent and dependent variables

For each of the following research questions, identify a possible independent and dependent variable and how each variable could be operationalised.

Example: Does regular exercise increase self-esteem?

	Variable identified (named)	Variable operationalised (how manipulated or measured)
IV	amount of exercise	number of minutes of aerobic activity per day
DV	self-esteem	score on a standardised test that measures self-esteem

(a) What effect do workplace noise levels have on stress?

	Variable identified (named)	Variable operationalised (how manipulated or measured)
IV	noise/sound level	number of decibels generated from a noise source machine (e.g. during 5-minute periods every 60 minutes over an 8-hour day shift in a factory setting)
DV	stress/stress level	resting heart rate (bpm) (e.g. after each noise exposure)

ACTIVITY 1.2 *continued*

(b) Is brain function improved by omega-3 foods?

	Variable identified (named)	Variable operationalised (how manipulated or measured)
IV	food with omega-3	a diet high in fatty acids and fish oils
DV	brain function	number of creative problems correctly solved in a 30-minute test (e.g. compared to participants not on an omega-3 diet)

(c) How does our perception of time change when in a relaxed meditative state?

	Variable identified (named)	Variable operationalised (how manipulated or measured)
IV	being in relaxed meditative state	brain wave pattern (e.g. recorded by an EEG)
DV	perception of time	participants' estimation of time spent carrying out a simple procedure (e.g. compared to participants who did not use the meditative relaxation technique)

(d) Do people work better or worse if they are constantly monitored?

	Variable identified (named)	Variable operationalised (how manipulated or measured)
IV	monitoring staff in the workplace	constant video surveillance in the workplace (e.g. compared to no video surveillance)
DV	workplace performance	number of finished products correctly assembled over an eight-hour shift (e.g. in a factory workplace)

(e) Can symptoms of Parkinson's disease be relieved by increasing the level of dopamine in the brain?

	Variable identified (named)	Variable operationalised (how manipulated or measured)
IV	level of dopamine	use of a dopamine enhancing medication (e.g. by patients diagnosed with PD compared with non-use by PD patients)
DV	Parkinson's disease symptoms	type, number and intensity of motor symptoms associated with Parkinson's disease

ACTIVITY 1.2 *continued*

(f) Do newborn infants prefer to look at objects or human faces?

	Variable identified (named)	Variable operationalised (how manipulated or measured)
IV	type of visual stimulus	exposure to a range of simple and complex visual patterns (e.g. include various objects and a human face)
DV	visual preference/preferential looking	time spent attending to different visual stimuli

(g) Is cognitive behaviour therapy (CBT) more effective than psychoanalysis in treating depression?

	Variable identified (named)	Variable operationalised (how manipulated or measured)
IV	type of psychotherapy	application of a 10 session CBT or psychoanalysis treatment program by a qualified practitioner
DV	depression	number of symptoms of major depressive disorder

ACTIVITY 1.2 *continued*

(h) Will using this workbook improve VCE Psychology results?

	Variable identified (named)	Variable operationalised (how manipulated or measured)
IV	use of this workbook	self-directed completion and assessment of 10 exercises per chapter
DV	VCE Psychology results	VCE Psychology Units 3&4 study score

ACTIVITY 1.3

Distinguishing between extraneous and confounding variables

(a) Complete the following table to summarise and compare similarities and differences between extraneous and confounding variables. Tick the variable to which each characteristic applies. A characteristic may be given more than one tick.

Characteristics	Extraneous variable	Confounding variable
a variable additional to the IV and DV	✔	✔
may be an uncontrolled variable	✔	✔
an unwanted variable that may have an unwanted effect on the IV or DV	✔	✔
may impact the relationship between the IV and DV	✔	✔
not intentionally studied as are the IV and DV	✔	✔
may cause the type of change in the DV that is predicted by the research hypothesis	✔	✔
may cause a problem in isolating the real effect of the DV	✔	✔
may affect the validity of the results	✔	✔
presence does not necessarily mean that the IV did not cause the predicted change in the DV	✔	✔
may compromise interpretation of the results or drawing of conclusions	✔	✔
effect on the DV can be isolated from the effect of the IV if sufficiently controlled	✔	
effect on the DV cannot be isolated from the effect of the IV		✔
may suggest an explanation of the results that is not due to IV manipulation	✔	✔
provides an alternative to the IV as an explanation for the results		✔

ACTIVITY 1.3 *continued*

(b) Identify two crucial extraneous variables Mr H should have considered when planning the following investigation. Explain why each of these variables may also be considered to be potential confounding variables that Mr H has overlooked when interpreting the test results.

Mr H is a secondary school mathematics teacher who likes to experiment with new ways of teaching. He has decided to investigate if allowing students to listen to their preferred music in class while they complete mathematical exercises will affect their learning. His teaching allotment includes two year 8 Maths classes. He has already noticed that one of the classes is academically 'stronger' than the other even though he has only been teaching these students for a few weeks.

Over a period of two weeks Mr H allows the 'weaker' class to listen to music through headphones when completing Maths exercises. He believes that this may increase their Maths motivation and enjoyment, thereby improving their performance. The stronger class is not allowed to listen to music during Maths. In the third week he assesses both classes using the same test. The no-music group are tested on Wednesday morning during period one. The music group are tested on Friday afternoon during period six.

Mr H finds that the music group performed worse than the no-music group. Consequently, he abandons the idea of allowing music to be listened to in all his classes because he believes it may actually impair performance by adversely affecting students' concentration through distraction.

The two most crucial variables are:

- **Extraneous variable:** different academic/Maths ability of the two year 8 classes

  Explanation: The music group performed worse than the no-music group but they are also the less academically able class. It is therefore impossible to isolate the effect of listening to music (i.e. the IV) because their test results may also be attributable to their 'weaker' ability (i.e. a confounding variable). Similarly, the better performance of the no-music group may also be attributable to their 'stronger' ability rather not listening to music.

- **Extraneous variable:** time of testing

  Explanation: The music group performed worse than the no-music group but they were also tested last period Friday when they may be feeling tired, lacking motivation, distracted by thoughts about the weekend etc. It is therefore impossible to isolate the effect of listening to music (i.e. the IV) because their weaker test results may also be attributable to the potentially unfavourable test time (i.e. a confounding variable). Similarly, Wednesday morning during period one may be a more favourable test time that contributed to the better test performance of the no-music group.

ACTIVITY 1.3 *continued*

Other extraneous variables that could become confounds because of Mr H's lack of control may refer to teacher/ experimenter effects, possible lack of standardised instructions or other participant variables that may account for test performance. However, any alternative extraneous variable must be reasonably justified.

ACTIVITY 1.4

Matching exercise on experimental conditions and variables

Match each description with the most appropriate term on the right. Write the letter of the term you select on the line to the left of each description. Each term can be used only once.

(m)	**1** Any variable other than the independent variable that may cause a change in the dependent variable.	**(a)** placebo effect
(j)	**2** The variable in an experiment the researcher chooses to measure in order to assess the effect(s) of the independent variable(s).	**(b)** control group
(k)	**3** Task information that is not the same for different groups of participants in an experiment and can therefore be an extraneous or confounding variable.	**(c)** order effect
(l)	**4** The unique combination of characteristics, abilities and backgrounds each participant brings to an experiment or research study.	**(d)** independent variable
(n)	**5** The group of research participants selected from the larger group of research interest.	**(e)** experimenter effect
(b)	**6** The group in an experiment that is not exposed to the independent variable.	**(f)** confounding variable
(d)	**7** The variable that is systematically manipulated by the researcher to test its effects on the dependent variable.	**(g)** population
(o)	**8** Defining and describing specific variables in terms of the procedures used to study them in a research investigation.	**(h)** placebo
(f)	**9** A variable other than the independent variable that has an unwanted effect on the dependent variable making it impossible to determine which variable produced the predicted change in the dependent variable.	**(i)** experimental group
(a)	**10** A change in a participant's behaviour or response due to their belief that they are receiving some kind of experimental treatment rather than due to the effect of the independent variable.	**(j)** dependent variable
(g)	**11** The entire group of research interest from which a sample is selected.	**(k)** non-standardised instructions
(i)	**12** The group in an experiment that is exposed to the independent variable.	**(l)** individual participant differences
(e)	**13** An unwanted influence on research participant performance produced by a person carrying out the research that can affect the results of an experiment.	**(m)** extraneous variable
(c)	**14** When a participant's response relevant to the dependent variable is influenced by the specific order in which an experimental task, treatment or condition is presented rather than the independent variable.	**(n)** sample
(h)	**15** An inactive substance or fake treatment that is like the independent variable treatment but which has no expected effect.	**(o)** operationalise

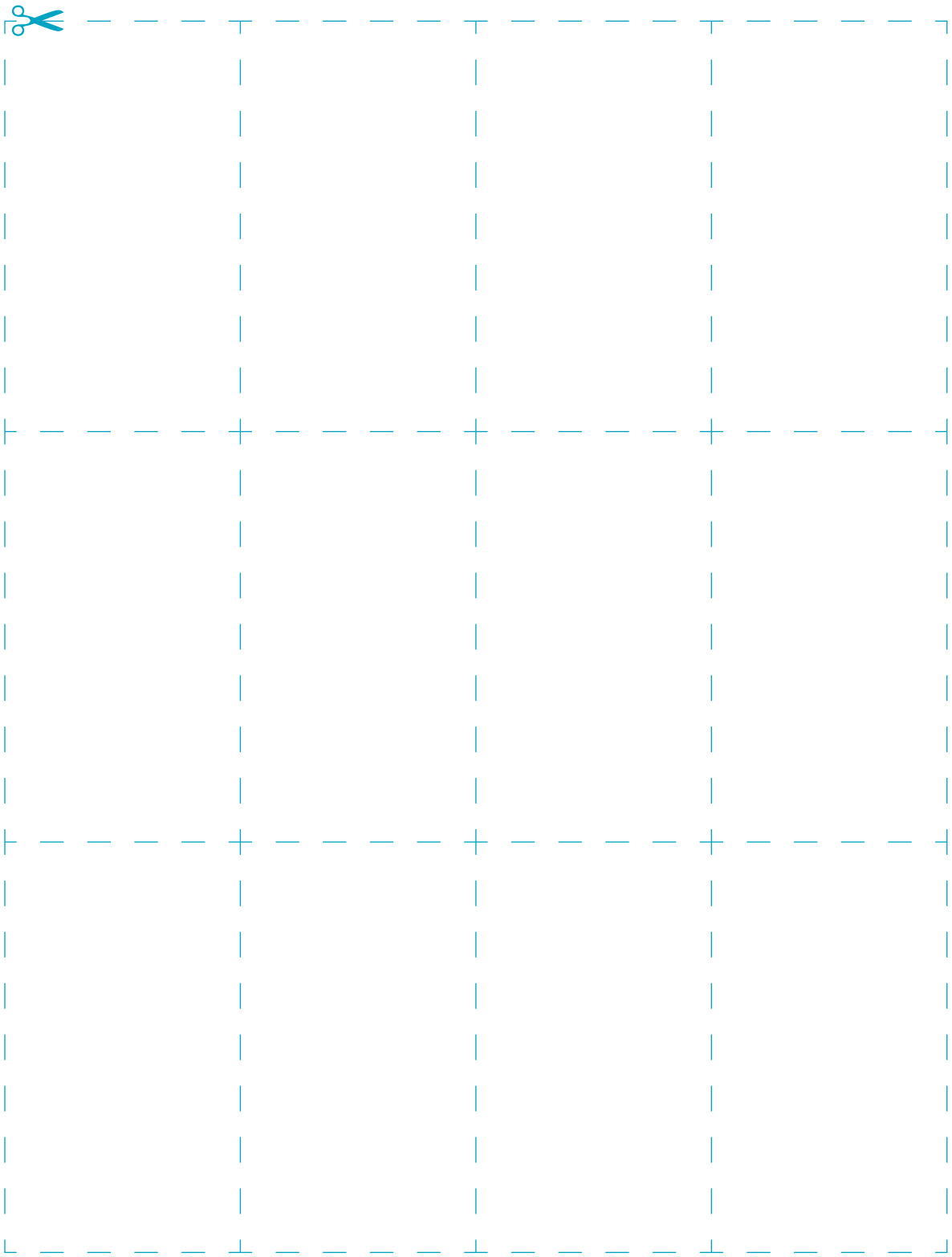
ACTIVITY 1.5

Comparing sampling procedures

Complete the following table by cutting out the relevant sections on the next page and pasting them in the most appropriate cells.

Sampling procedure	Description	Example	Advantage	Limitation
random sampling	Sample selection procedure used to obtain a representative sample from a population by ensuring every member of the target population has an equal chance of being selected as a participant.	A complete enrolment record of an entire student population in a school is used to randomly select 30 students using a lottery system or random number generator.	Helps ensure selection of a representative sample, thereby minimising sample bias in relation to participant variables.	Requires access to a relatively complete and up-to-date list of the target population and contact details to help ensure representativeness.
stratified sampling	Sample selection procedure that targets specific subgroups within a population and seeks to achieve proportional representation of those subgroups within the final sample.	A complete record of student enrolment at a school is referenced to proportionally select students from every year level in the same ratio as the enrolments in each year level.	Useful for comparing specific subgroups within populations and when randomly selected increases sample representativeness.	Can be very time consuming and resource intensive to select a large sample and not using random sampling for subgroup selection results in a non-representative sample.
convenience sampling	Sample selection procedure involving choice of participants who are readily or most easily available.	The first 30 students who walk through the school gates one morning are asked to participate in a student wellbeing survey.	Usually time and cost effective as participants can be accessed relatively easily due to their availability.	Tends to produce sample bias and non-representativeness, thereby limiting generalisations to the population of research interest.

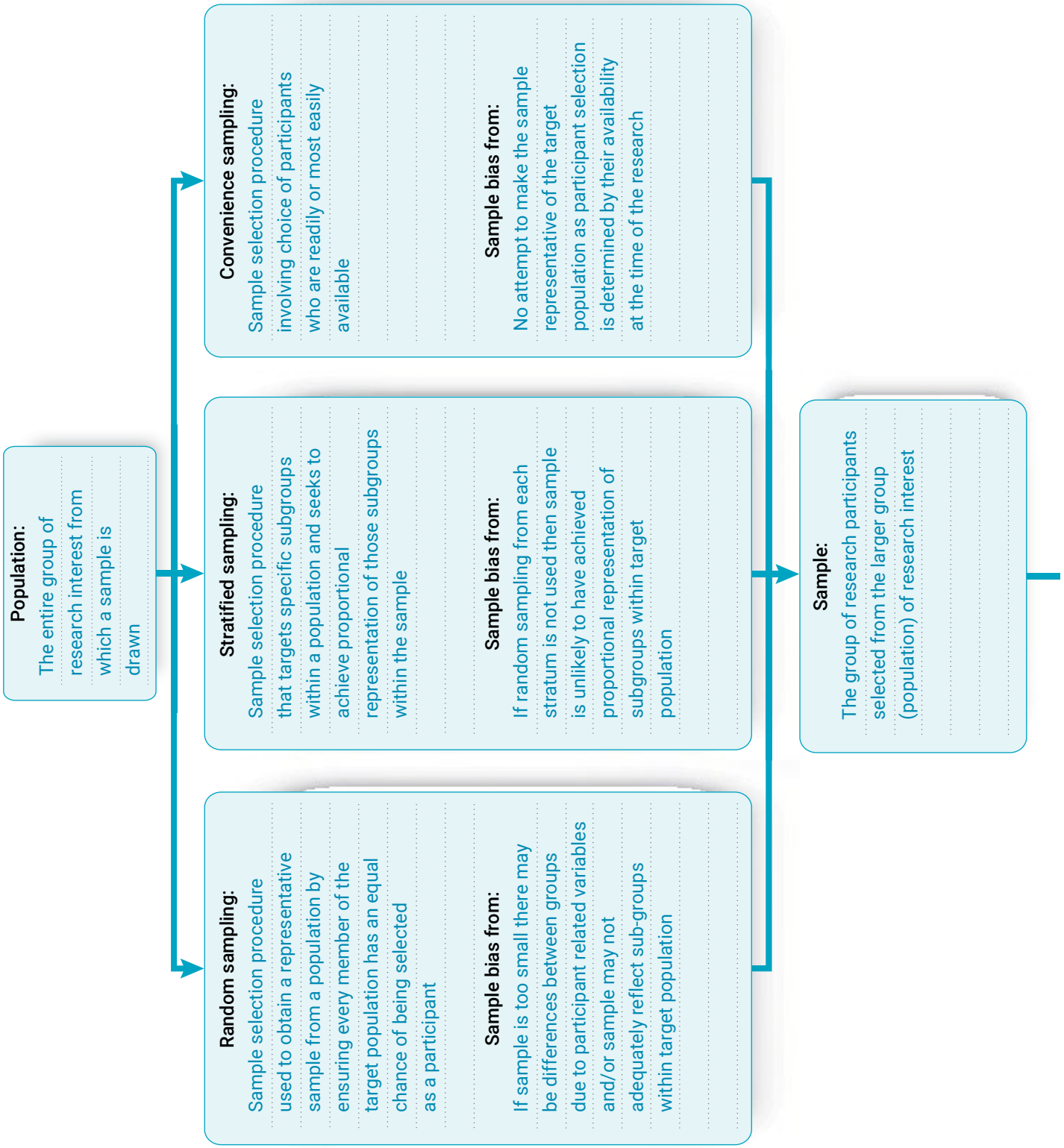
Helps ensure selection of a representative sample, thereby minimising sample bias in relation to participant variables.	Sample selection procedure involving choice of participants who are readily or most easily available.	The first 30 students who walk through the school gates one morning are asked to participate in a student wellbeing survey.	Tends to produce sample bias and non-representativeness, thereby limiting generalisations to the population of research interest.
Useful for comparing specific subgroups within populations and when randomly selected increases sample representativeness.	A complete record of student enrolment at a school is referenced to proportionally select students from every year level in the same ratio as the enrolments in each year level.	A complete enrolment record of an entire student population in a school is used to randomly select 30 students using a lottery system or random number generator.	Can be very time consuming and resource intensive to select a large sample and not using random sampling for subgroup selection results in a non-representative sample.
Sample selection procedure that targets specific subgroups within a population and seeks to achieve proportional representation of those subgroups within the final sample.	Sample selection procedure used to obtain a representative sample from a population by ensuring every member of the target population has an equal chance of being selected as a participant.	Usually time and cost effective as participants can be accessed relatively easily due to their availability.	Requires access to a relatively complete and up-to-date list of the target population and contact details to help ensure representativeness.

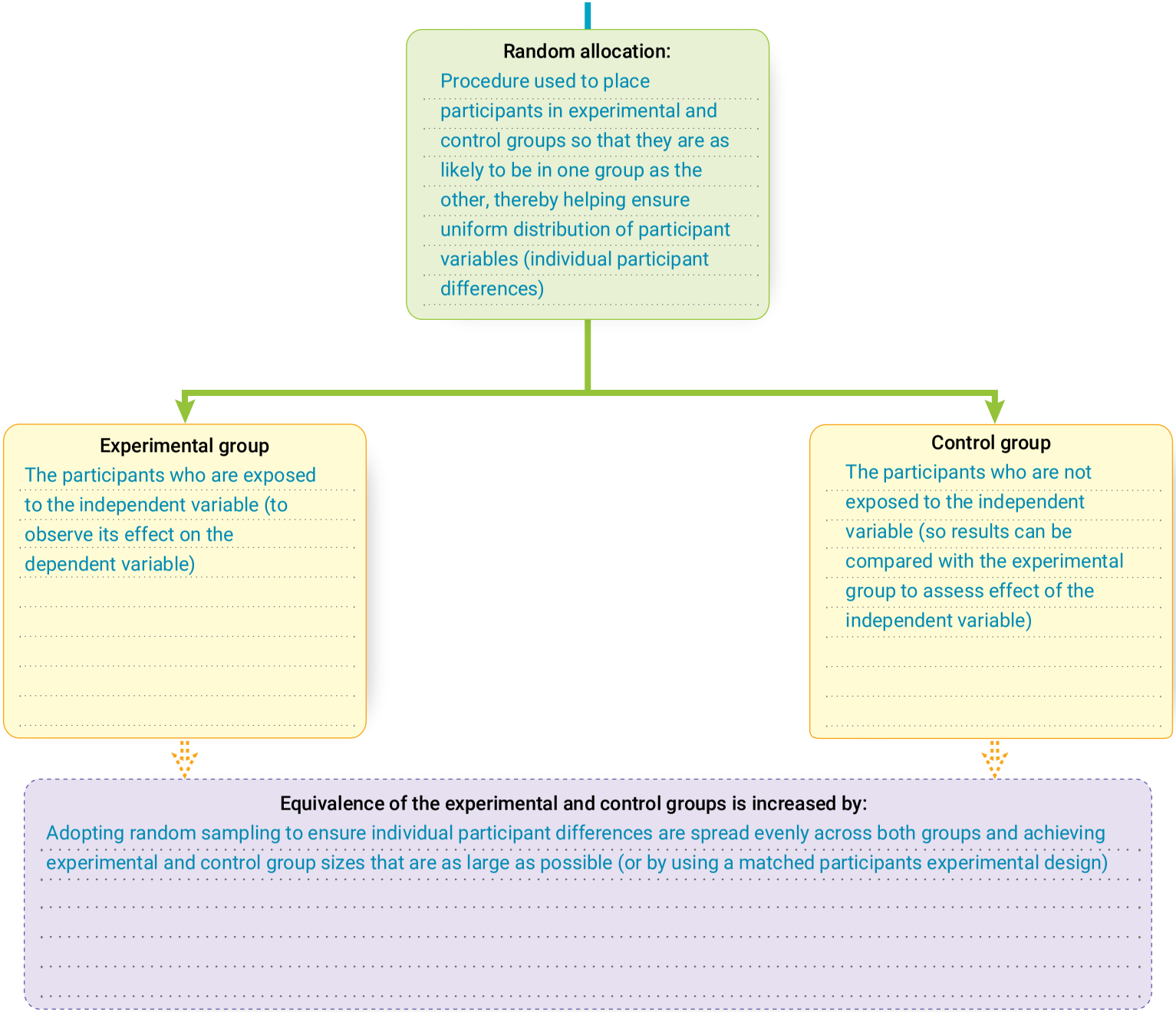


ACTIVITY 1.6

Participant selection and allocation for an experiment

Complete this flow chart by inserting definitions and summarising key points about how participants could be selected and then allocated to different groups or conditions for a simple experiment.




Random allocation:
Procedure used to place participants in experimental and control groups so that they are as likely to be in one group as the other, thereby helping ensure uniform distribution of participant variables (individual participant differences)
Experimental group
The participants who are exposed to the independent variable (to observe its effect on the dependent variable)
Control group
The participants who are not exposed to the independent variable (so results can be compared with the experimental group to assess effect of the independent variable)
Equivalence of the experimental and control groups is increased by:
Adopting random sampling to ensure individual participant differences are spread evenly across both groups and achieving experimental and control group sizes that are as large as possible (or by using a matched participants experimental design)

ACTIVITY 1.7

Distinguishing between the single and double blind procedures

Use the following statements to complete the comparison table on the next page. Each statement should be used once only.

• Neither the researcher nor participants know which participants are in which experimental condition.	• A procedure commonly used when controlling experimenter effects.	• Participants in a control group are given a placebo treatment and the experimenter knows who they are.
• A procedure that can be used to control the placebo effect.	• A research assistant knows which participants are in which group but the experimenter intentionally remains unaware.	• An experimenter can conduct all the procedures without the use of a research assistant.
• Either the experimenter or the participants do not know who is in the experimental group and who is in the control group.	• Will help control the potential influence of participant beliefs and expectations but not potential experimenter bias when carrying out the research.	• A procedure that can be used to control both the placebo effect and experimenter effects.
• The participants may know what the experiment is about but, unlike the experimenter, they do not know which group they are in.	• The experimenter will not interact with the participants as they do not want to know who will receive the experimental treatment.	• The experimenter uses this procedure to avoid self-fulfilling prophecies that may occur if participants or the experimenter who carries out the investigation are aware of the research hypothesis.

Single blind procedure	Double blind procedure
• Participants in a control group are given a placebo treatment and the experimenter knows who they are.	• Neither the researcher nor participants know which participants are in which experimental condition.
• A procedure that can be used to control the placebo effect.	• A procedure that can be used to control both the placebo effect and experimenter effects.
• An experimenter can conduct all the procedures without the use of a research assistant.	• A research assistant knows which participants are in which group but the experimenter intentionally remains unaware.
• Either the experimenter or the participants are not aware of who is in the experimental group and who is in the control group.	• The experimenter uses this procedure to avoid self-fulfilling prophecies that may occur if participants or the experimenter who carries out the investigation are aware of the research hypothesis.
• Will help control the potential influence of participant beliefs and expectations but not potential experimenter bias when carrying out the research.	• The experimenter will not interact with the participants as they do not want to know who will receive the experimental treatment.
• The participants may know what the experiment is about but, unlike the experimenter, they do not know which group they are in.	• A procedure commonly used when controlling experimenter effects.

ACTIVITY 1.8

Comparing experimental research designs

Complete the table to compare the key features of three different experimental research designs and their main advantages and limitations.

Experimental design	Key features of the design	Advantages of the design	Limitations of the design
independent groups	Each participant is randomly allocated to either the experimental or control group and is in one group (condition) only.	• no order effects between conditions to control • participant attrition less common e.g. unlike repeated measures, can usually be completed on one occasion so not often a need to spread out time period between different conditions • use of random allocation avoids time-consuming participant matching on key variables (as per matched participants design)	• less control over participant characteristics than repeated measures and matched participants • often need a larger number of participants to help ensure spread of participant variables within the sample matches the distribution within its population

Experimental design	Key features of the design	Advantages of the design	Limitations of the design
repeated measures	Each participant is involved in both the experimental and control groups i.e. all groups (conditions).	• strict control of relevant participant variables/ individual participant differences (including known and unknown characteristics) • requires a relatively smaller number of participants when compared with other experimental designs as same participants are in all conditions • pre-testing on key variables not often required (unlike matched participants), so is often less time consuming and resource demanding than comparable studies using other designs	• order effects are more likely • can become a confounding variable if uncontrolled e.g. not using a counterbalancing procedure • does not necessarily control all participant variables that can influence the results e.g. participants may guess what the experiment is about as they experience/ compare different conditions, creating expectations and beliefs that may lead to unnatural responses • participant attrition, especially when a long time period between conditions

Experimental design	Key features of the design	Advantages of the design	Limitations of the design
matched participants	Each participant in one group/condition 'matches' a participant in the other group(s) on one or more participant variables.	• ensures every condition/ group is fairly equivalent in spread of relevant personal characteristics that can influence the DV, thereby controlling them as potential confounds • participant attrition less common than repeated measures e.g. can usually be completed on one occasion so not often a need to spread out time period between different conditions	• practical problems e.g. time consuming to identify and recruit participants who are sufficiently alike in the variable, pre-testing may be required and can lead to order effects requiring control • loss of a participant through attrition means loss of a whole pair, triplet etc.

ACTIVITY 1.9

Applying three different experimental research designs

This task requires you to think about how a researcher who is interested in investigating the effect of caffeine ingestion as brain wave activity could proceed using any of three different experimental designs.

(a) A researcher is interested in investigating whether caffeine ingestion changes brain wave activity.

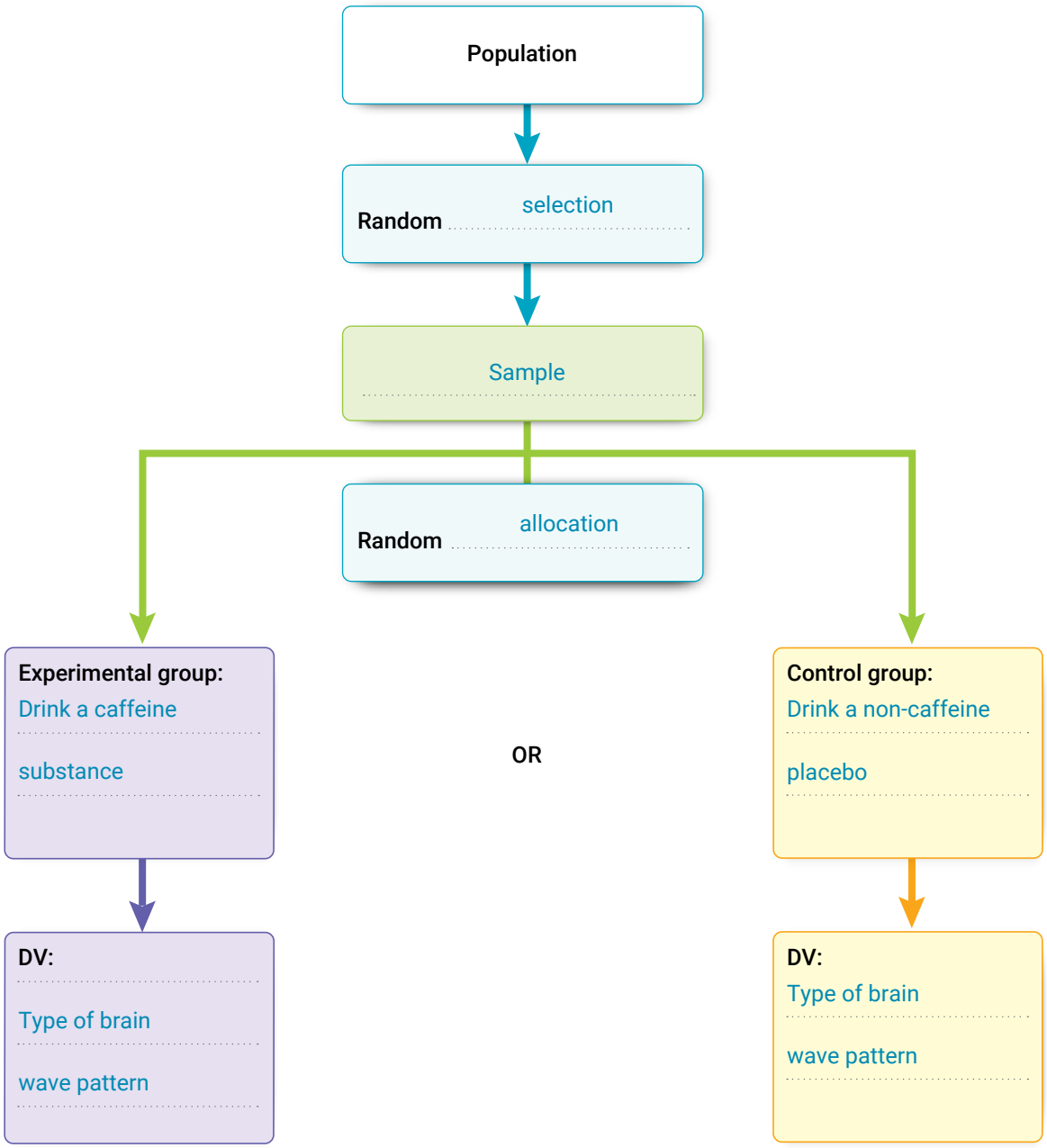
Identify an operationalised IV for the experiment

level of caffeine in the blood

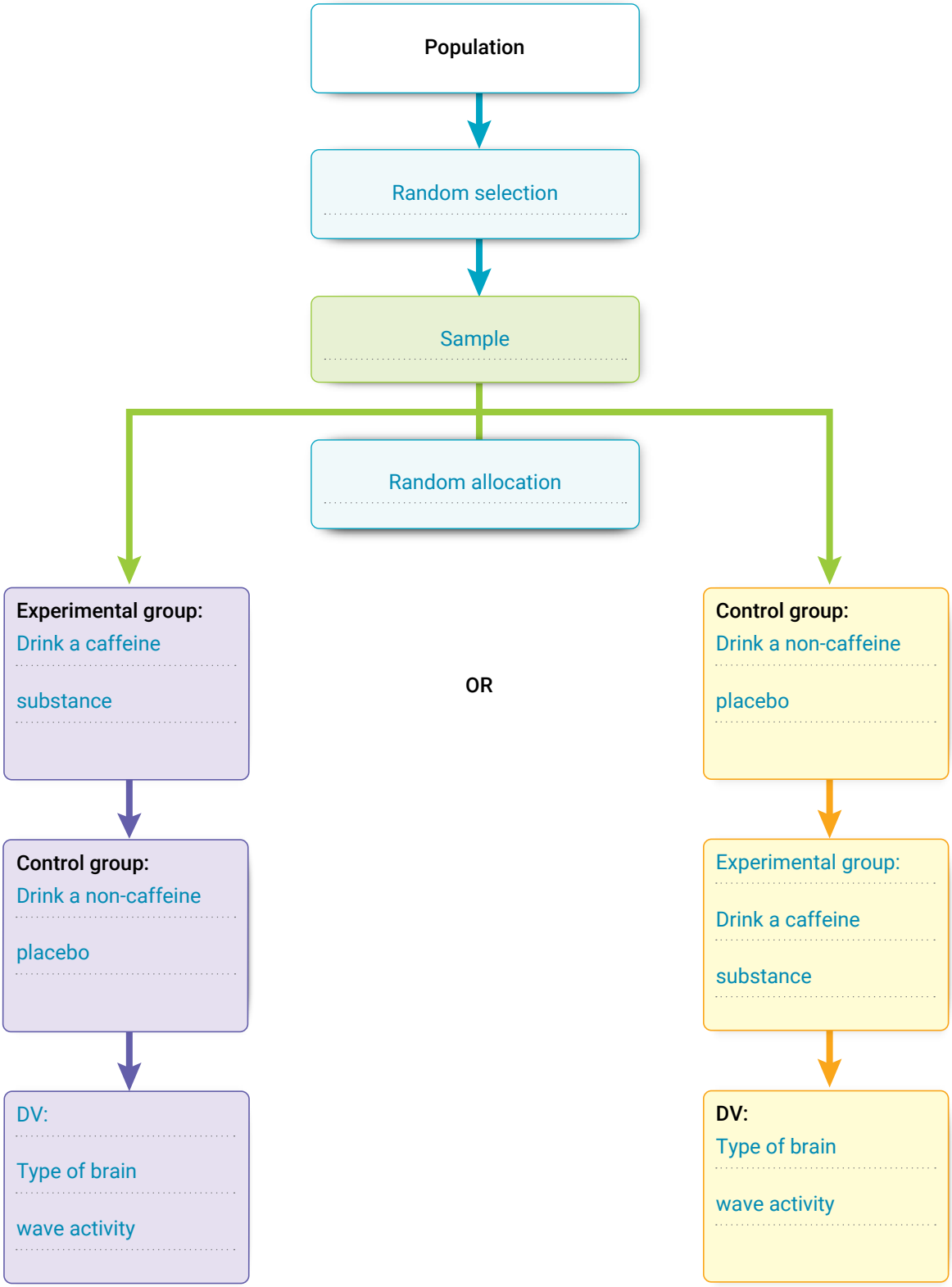
Identify an operationalised DV for the experiment

type of brain wave pattern

(b) Show how this research could be conducted using an **independent groups design** by completing the following diagram. Ensure you clearly specify tasks to be required of the experimental and control groups.



(c) Show how this research could be conducted using a **repeated measures design** by completing the following diagram.



ACTIVITY 1.9 *continued*

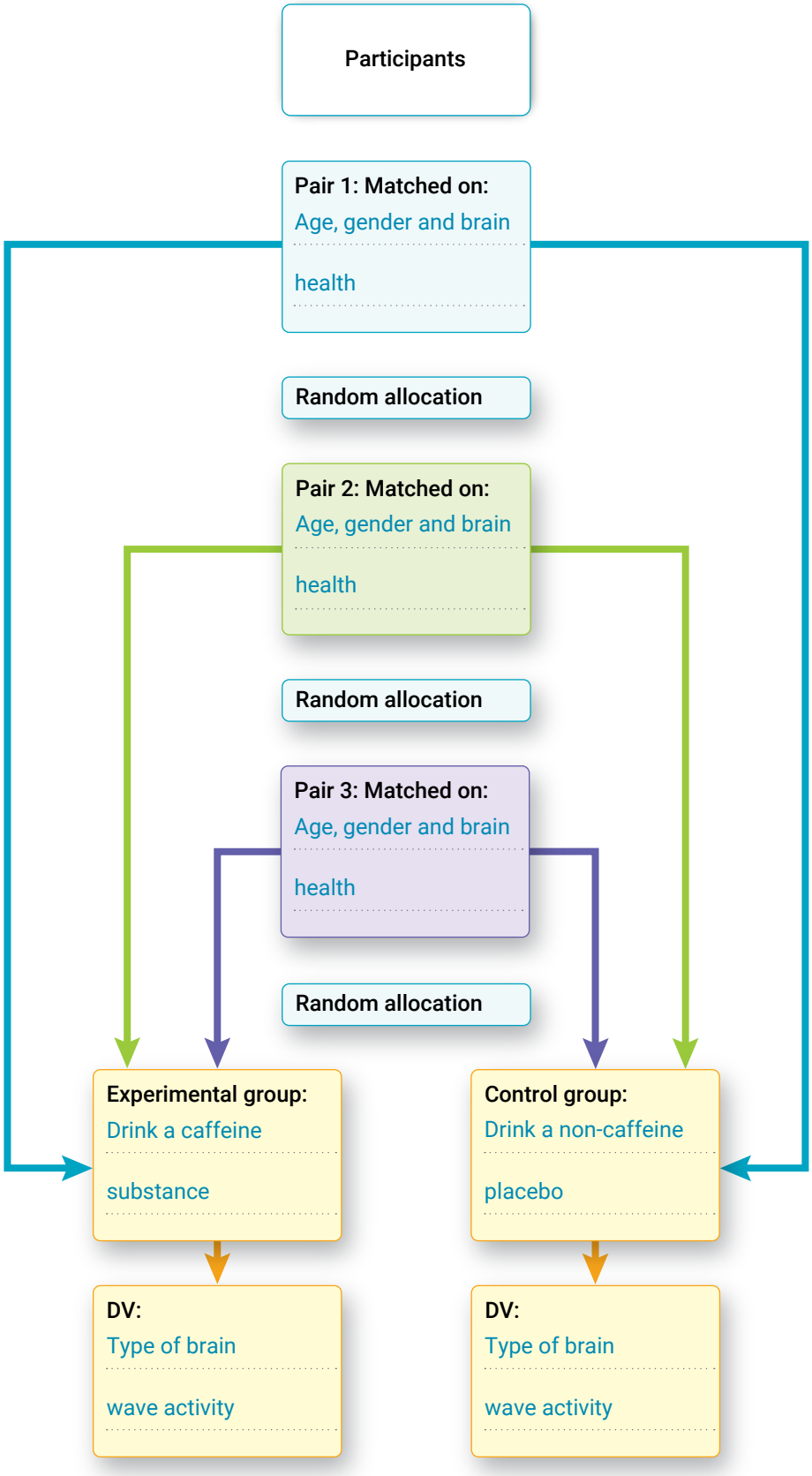
(d) In the repeated measures experiment, the two groups of participants will systematically undergo both conditions in a different order. Name the procedure that has been applied and explain when it is most appropriate to use it.

Procedure: counterbalancing

Explanation: Counterbalancing is commonly used to control or minimise order effects such as practice and carry-over. Counterbalancing involves systematically changing the order of treatments or tasks for participants in a 'balanced' way to 'counter' the unwanted effects on performance of any one order. By counterbalancing, the researcher recognises that an order effect is a potential confounding variable and cannot be controlled or eliminated through other means. Experiments with a repeated measures design are most vulnerable to order effects.

(e) When using a **matched participants design**, participants are matched on psychological and/or physical characteristics that are considered relevant to the experiment then systematically allocated to an experimental or control group. In this way, the different groups can be considered equivalent in terms of key participant variables.

Suggest three characteristics that should be matched for this particular experiment and use them to complete the following diagram to show how the research could be conducted using a matched participants design.


Participants
Pair 1: Matched on:
Age, gender and brain
health
Random allocation
Pair 2: Matched on:
Age, gender and brain
health
Random allocation
Pair 3: Matched on:
Age, gender and brain
health
Random allocation
Experimental group:
Drink a caffeine
substance
Control group:
Drink a non-caffeine
placebo
DV:
Type of brain
wave activity
DV:
Type of brain
wave activity

ACTIVITY 1.10

Summarising key features of a cross-sectional study

Select terms from the shaded panel below to correctly complete the passage describing a cross-sectional study. A term should be used only once and not all terms are used.

age	cause–effect	certainty	children	close
compares	control	convenient	dependent	efficiently
ethical	extraneous	groups	impractical	independent
interviews	limited	naturally	participants	practical
quasi-experiment	randomly	single	unethical	variables

A cross-sectional study compares different groups of participants on one or more variables of interest at a single point in time. In doing so, it provides a 'snapshot' of information in relation to the variables being studied.

A cross-sectional study may use an independent groups or repeated measures design but in such cases it is not considered a true experiment. Instead, it may be called a quasi-experiment because unlike a true experiment, participants cannot be randomly assigned to experimental and control groups. Instead a cross-sectional study uses existing, naturally formed or occurring groups of participants. In addition, the researcher measures characteristics or events that already exist or occur naturally in a population of research interest without directly manipulating any variable. These naturally occurring differences may be used as levels of the independent variable.

An advantage of using a cross-sectional study is that it provides a means of conducting research on topics that could be unethical or impractical to conduct through experimentation. A limitation is that, unlike a true experiment, a cause–effect relationship between variables of interest cannot be tested or determined. There is also less control over extraneous variables that may influence participant responses of relevance to the study.

ACTIVITY 1.11

Identifying key features of non-experimental research methods

For each of the following statements, tick the relevant research method(s).

Research statement	cross-sectional study	case study	observational study	questionnaire	interview	rating scale
1 Directly watching and recording behaviour as it occurs in a natural or contrived setting			✓			
2 A quick way to collect readily available data from a large number of people in a relatively short period of time				✓		✓
3 Participants will read questions and write responses.				✓		✓
4 Often used to collect data that enable a snapshot of age-related differences at one point in time	✓					
5 Cannot be used to test a cause–effect relationship between variables of interest	✓	✓	✓	✓	✓	✓
6 Answer options always require a response in terms of levels or degrees of something.						✓
7 The sample is often a convenience sample of one.		✓				
8 The researcher can watch and record behaviour as it usually occurs without the need for manipulation or intervention.			✓			
9 Most commonly used to collect self-reports from a small sample directly in a face-to-face interaction					✓	
10 One of the problems with this method is that participants have been known to intentionally give false or misleading answers to create a favourable impression of themselves.				✓	✓	✓
11 Uses fixed response questions or statements only						✓
12 An in-depth study of one person		✓				
13 Enables comparison of one or more variables of interest in sampled groups at one specific point in time	✓					
14 Behaviour for which data are to be collected is usually decided in advance and operationalised into a standardised check list for use as the behaviour of interest occurs.			✓			
15 Because the sample is so limited it can provide only tentative support for applying the finding to others.		✓				
16 The questions will require participants to rank something by selecting from a number of choices.						✓
17 Most commonly used to collect self-reports from a large sample without one-to-one interaction with participants				✓		✓

ACTIVITY 1.11 *continued*

Research statement	cross-sectional study	case study	observational study	questionnaire	interview	rating scale
18 Typically consist of easily answered questions in a form that can be given to many participants simultaneously				✓		✓
19 Questions are asked by the researcher in a one-to-one contact situation and the questions may vary from participant to participant.					✓	
20 Most often used when large numbers of participants are not available for study		✓				
21 Data cannot be collected unless the behaviour of interest is clearly visible.			✓			

ACTIVITY 1.12

Distinguishing between research methods

Identify the research method used for each of the following studies. Select from the terms in the shaded panel below. Each term may be used more than once.

case study	cross-sectional study	experiment
observational study	self-report	

Studies	Research method
1 Studying age-related differences in cognitive function by asking groups of people aged 55–64, 65–74, 75–84 or 85+ years to perform various speed and accuracy tests	cross-sectional study
2 Using a questionnaire to study client satisfaction with mental health services provided by a psychiatric unit in a public hospital	self-report
3 Recording all that can be known about how an individual with a surgically removed brain hemisphere thinks, feels and behaves	case study
4 Half of the participants who volunteered for a study believed to be on learning were told they would receive a painful electrical shock whenever they gave a wrong answer. The other half were told the shocks would only tingle and were not at all painful. Participants were then asked if they preferred to wait alone or with others, which related to the real purpose of the study. Comparisons were made between the preferences of males and females. Participants were randomly allocated to groups and a learning phase of the study was not actually required.	experiment
5 Recording behaviours of intoxicated adolescent males and females at a 'schoolies' event	observational study

ACTIVITY 1.12 *continued*

Studies	Research method
6 Studying the effects of parental loss on the mental health of children by comparing children who have already lost a parent with children who have not	cross-sectional study
7 Studying whether partners who have similar attitudes rate each other as more desirable than partners with dissimilar attitudes	self-report
8 Studying social behaviour in a fast food restaurant by watching whether children discard rubbish or clear their table	observational study
9 To measure how shyness affects presentation skills, a researcher uses participant scores on a standardised measure of shyness to assign them to a high, medium or low in shyness group. Participants are then required to give a speech on a controversial issue to an audience of strangers. Verbal errors made during the speech are recorded and the mean number of errors (e.g. pauses, mispronounced words, overuse of 'um' and 'like') made by each group is compared.	cross-sectional study
10 Two groups of randomly assigned participants watch either a humorous 5-minute video clip of animal 'bloopers' or an emotionally neutral video of the same length. Each group is then required to complete a boring and meaningless paper-stacking task so that the effect of a positive mood state on motivation and performance can be measured.	experiment

ACTIVITY 1.13

Reliability and validity in research

Select terms from the shaded panel below to correctly complete the passage about reliability and validity. A term may be used more than once but not all terms need to be used.

accurate	bigger	can	cannot	characteristics
conclusions	consistent	different	evaluated	External validity
generalised	identical	Internal validity	laboratory	levels
measured	objective	real-world	repetitions	smaller
stable	subjective	time	uncertain	variables

A goal of research is to obtain results that are both reliable and valid. Reliability means that the results are stable/consistent, whereas validity means that the results are accurate. The quality of research and its results can be assessed in terms of the levels of reliability and validity achieved on a scale ranging from low to high.

Highly reliable research produces results that are dependable and remain stable/consistent over numerous repetitions of an investigation. Generally, the smaller the sample size, the less likely it is that the results will be reliable when a research study is replicated. A research study with low reliability will produce substantially different results each time the same behaviour of interest is measured, leading to different conclusions each time, so that we are uncertain about which conclusion is correct.

Highly valid research means that the study actually measured what the researcher claimed to have measured. A research study with low validity means that the conclusions drawn by the researcher cannot be trusted.

Researchers often distinguish between internal and external validity. Internal validity refers to the extent to which the results obtained for a study are actually due to the variables that were tested or measured and not due to any other factor. External validity refers to the extent to which

ACTIVITY 1.13 *continued*

the results obtained for a study can be generalised to the population from which the sample was drawn or to other people in other settings and over time.

A study cannot have external validity without internal validity, which means that internal validity is a precondition of external validity. Furthermore, a study that is said to have external validity is also said to have internal validity. It does not necessarily follow, however, that an effect observed in a strictly controlled laboratory experiment with a high level of internal validity will also have the same effect in a real-world situation.

ACTIVITY 1.14

Procedures for increasing reliability or validity

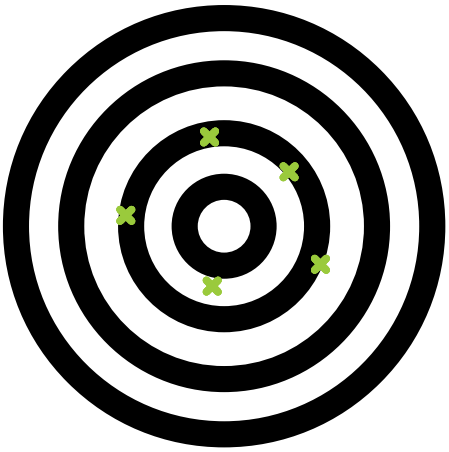
Arrows on a target can be used to demonstrate both validity (accuracy) and reliability (consistency).

High validity and high reliability

Low validity and low reliability

High validity and low reliability

Low validity and high reliability



Medium validity and medium reliability

ACTIVITY 1.14 *continued*

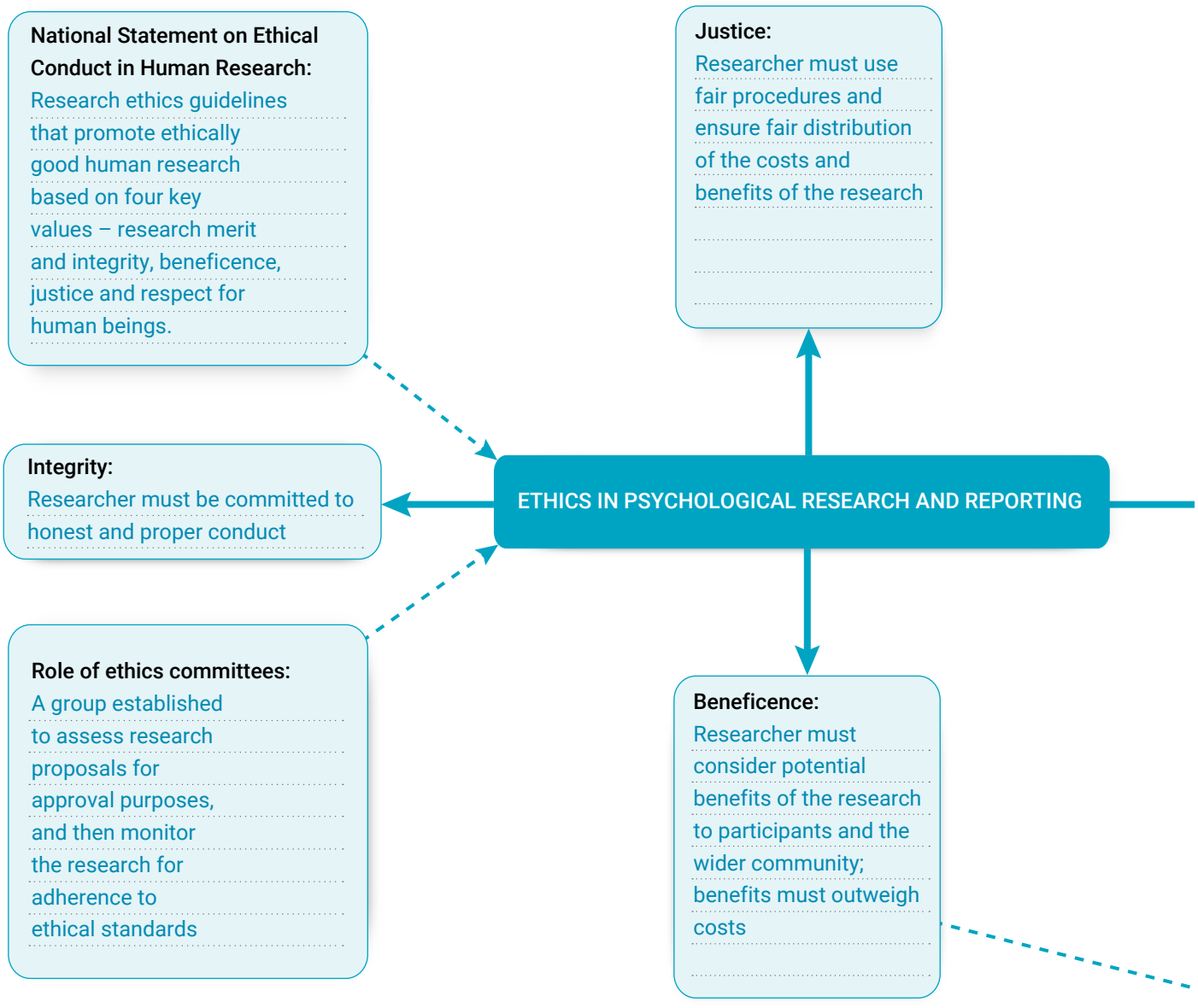
Choose whether the action taken in each statement is more likely to increase the reliability or validity of the research by circling the correct response on the right.

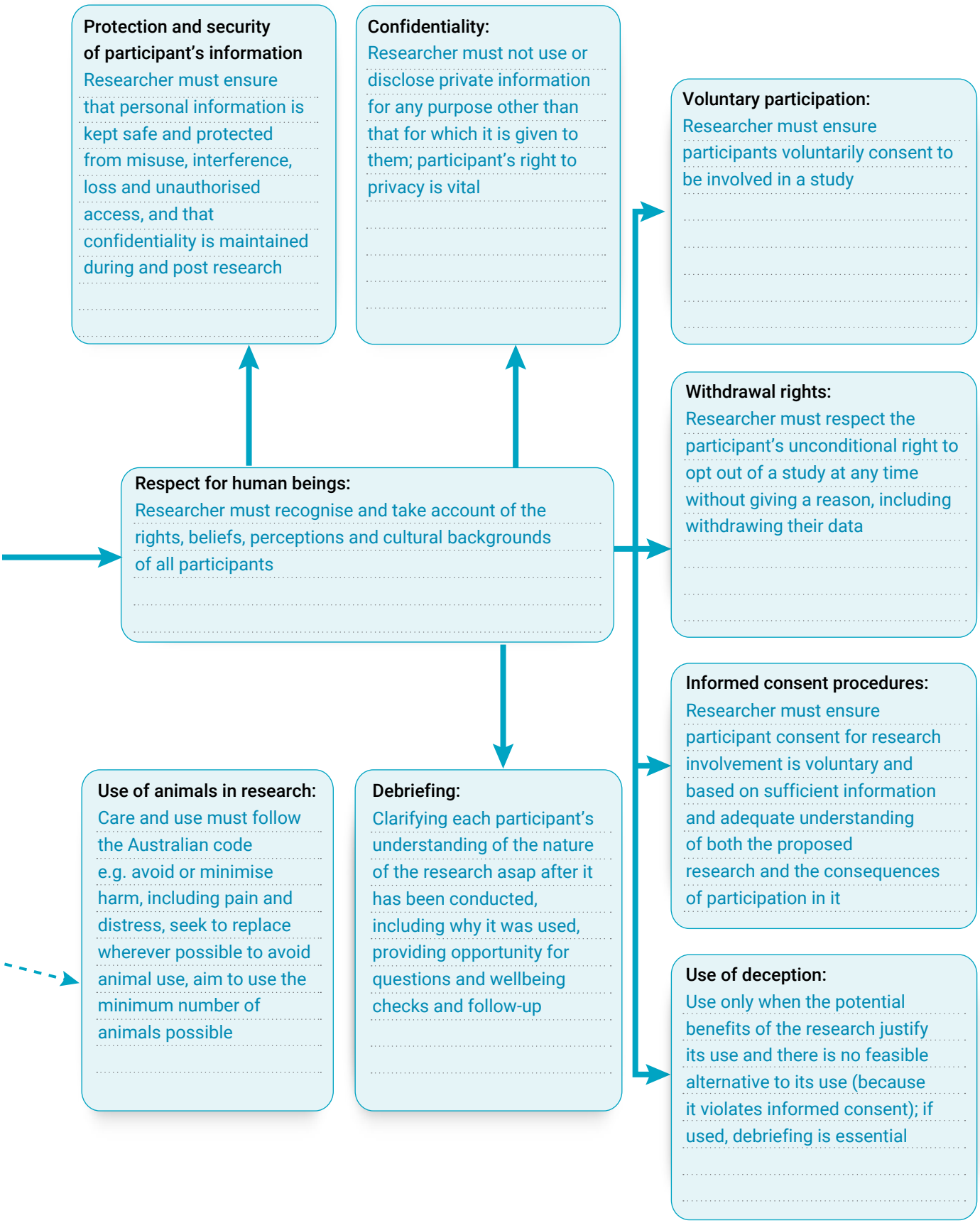
1 Replacing human taste testing with chemical analysis to determine the level of sweetness in a particular food product	WILL INCREASE	**RELIABILITY** / **(VALIDITY)**
2 Adjusting the operationalisation of a dependent variable so that it better reflects what the researcher is measuring	WILL INCREASE	**RELIABILITY** / **(VALIDITY)**
3 When a second researcher independently produces a similar set of results by conducting an experiment using the same procedures and a similar sample	WILL INCREASE	**(RELIABILITY)** / **VALIDITY**
4 Ensuring that ratings of the target behaviours recorded by different observers closely match	WILL INCREASE	**(RELIABILITY)** / **VALIDITY**
5 Using a stratified sample rather than a simple random sample when surveying public opinion on national immigration policy	WILL INCREASE	**RELIABILITY** / **(VALIDITY)**
6 Significantly increasing the size of the experimental and control groups in research investigating the effects of social media use on high school performance	WILL INCREASE	**(RELIABILITY)** / **VALIDITY**
7 Setting up an observational study of children at play in a setting that resembles a pre-school yard rather than a research facility	WILL INCREASE	**RELIABILITY** / **(VALIDITY)**
8 Using a measure that has been found to ensure that a participant's score at one point in time will be approximately the same at another point in time, even if the interval is quite large	WILL INCREASE	**(RELIABILITY)** / **VALIDITY**

ACTIVITY 1.15

Summarising ethics in psychological research and reporting

Fill in the panels to complete the chart summarising ethical considerations in psychological research.




Protection and security of participant's information
Researcher must ensure that personal information is kept safe and protected from misuse, interference, loss and unauthorised access, and that confidentiality is maintained during and post research
Confidentiality:
Researcher must not use or disclose private information for any purpose other than that for which it is given to them; participant's right to privacy is vital
Voluntary participation:
Researcher must ensure participants voluntarily consent to be involved in a study
Withdrawal rights:
Researcher must respect the participant's unconditional right to opt out of a study at any time without giving a reason, including withdrawing their data
Respect for human beings:
Researcher must recognise and take account of the rights, beliefs, perceptions and cultural backgrounds of all participants
Informed consent procedures:
Researcher must ensure participant consent for research involvement is voluntary and based on sufficient information and adequate understanding of both the proposed research and the consequences of participation in it
Use of animals in research:
Care and use must follow the Australian code e.g. avoid or minimise harm, including pain and distress, seek to replace wherever possible to avoid animal use, aim to use the minimum number of animals possible
Debriefing:
Clarifying each participant's understanding of the nature of the research asap after it has been conducted, including why it was used, providing opportunity for questions and wellbeing checks and follow-up
Use of deception:
Use only when the potential benefits of the research justify its use and there is no feasible alternative to its use (because it violates informed consent); if used, debriefing is essential

ACTIVITY 1.16

Caring for and using animals in research

The care and use of animals in research must follow the NHMRC *Australian Code for the Care and Use of Animals for Scientific Purposes*. For each of the following points made in the code, explain why it is ethically important.

Statement from code	Why is it ethically important?
Avoid or minimise harm, including pain and distress to laboratory animals	Animals should not be subjected to pain or harm unnecessarily. Animals can perceive and feel so pain and distress associated with research should be minimised.
Seek to replace wherever possible with other techniques that do not require animals	Using animals when other equally effective alternatives are available (e.g. computer models) is ethically wrong because it is not placing animal welfare ahead of expediency.
Aim to use the minimum number of animals possible	Although certain types of research require large numbers of test animals for statistical reasons, the total should always be set at the minimum possible. Using excessive animals is not only wasteful but is also ethically undesirable.

ACTIVITY 1.16 *continued*

Statement from code	Why is it ethically important?
Only undertake projects that are designed to maintain and improve human and/or animal health and welfare, or to improve animal management or production, or to obtain and establish significant information relevant to the understanding, maintenance or improvement of the natural environment, or to achieve educational outcomes.	The use of animals in research should pass the test of beneficence. The potential knowledge that might be gained from a study must outweigh the suffering and harm caused to animals in gaining that understanding. Animals should not be used in trivial experiments.

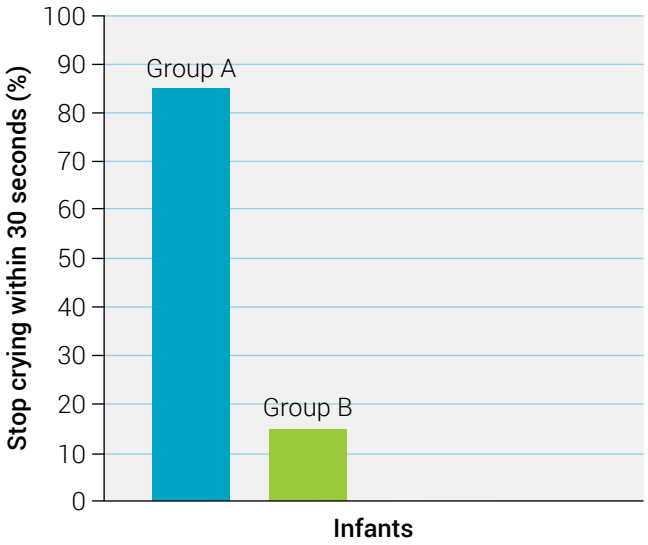
ACTIVITY 1.17

Evaluation of research scenarios

Read each scenario, then answer the questions that follow.

Scenario 1

A researcher wants to know if hearing their mother's voice will quieten a crying baby. Two groups of newborn infants aged 2–4 weeks are used. Infants in Group A hear their mother's voice whenever they cry throughout a 72 hour period and infants in Group B hear a stranger's voice. The results are shown below. The researcher does not know that almost half the infants in Group A have a severe hearing impairment.



1 Name the experimental design used in this experiment.

independent groups

2 Identify operationalised independent and dependent variables for the experiment.

IV: hearing the mother's or stranger's voice

DV: time taken for crying to stop (note the graph's Y-axis label)

3 Write a research hypothesis that would be supported by the results.

Examples: Hearing the mother's voice will quieten a crying infant.

Crying infants who hear their mother's voice will stop crying within 30 seconds.

4 Identify a confounding variable and explain why it is a confound in this particular experiment.

Variable: hearing impairment

Explanation: The results show that a much higher percentage of crying infants who heard their mother's voice stop crying within 30 seconds compared to those who heard a stranger's voice. However, almost all of these infants also had a severe hearing impairment. Therefore, the researcher cannot isolate the influence of an inability to hear the mother's voice on the better results. Perhaps many of the Group A infants stopped crying for some random factor or a reason other than hearing their mother's voice?

5 Explain how this confounding variable could have been controlled.

Explanation should demonstrate understanding that random allocation of infants to groups would have ensured relatively uniform distribution of infants with a hearing impairment across both groups, thereby neutralising or cancelling out the confounding influence of this variable.

6 Why should researchers try to anticipate and control confounding variables?

Eliminate alternative explanations (to the IV). Experimental control allows researchers to study the influence of the IV(s) on a DV while holding other potential influences constant.

Scenario 2

A researcher believes that consumption of foods naturally high in glutamate can increase synaptic plasticity within the brain. The researcher advertises for participants at the university where she works, offering a single payment of $100. 75 male and 25 female volunteers are recruited. The researcher then sets up three groups and randomly allocates 30 participants to each one. Group 1 are asked to describe their usual diet, which is then carefully recorded. These participants are instructed to maintain their 'normal' diet. Group 2 are prescribed a diet very low in glutamate. Group 3 are prescribed a diet very high in glutamate that includes fish, cured ham, vegemite, soy sauce, aged cheese, mushrooms, ripe tomatoes, broccoli and walnuts.

In order to test for brain plasticity, the researcher asks participants to solve mazes as quickly as possible on a computer screen. Each time a maze is solved, the computer generates a slightly harder version of the maze. According to the researcher, higher levels of brain plasticity equate to becoming better at solving mazes. She tests each group at the end of week 1, week 3 and week 5 and records the mean number of mazes solved by each group in 20 minutes. The results are shown below.

Group	Mean number of mazes solved		
	Week 1	Week 3	Week 5
1	17	21	24
2	18	20	22
3	17	24	28

Using inferential statistics, the researcher found that the higher scores in Group 3 were unlikely to be due to chance, whereas the score difference between Groups 1 and 2 was not significant and could be attributed to chance. It was concluded that glutamate rich foods can increase synaptic plasticity.

(a) Identify the independent and dependent variables in the investigation, including how they were operationalised.

IV: type of diet/amount of glutamate in diet prescription

DV: synaptic plasticity/number of mazes solved

(b) Write a research hypothesis for the investigation.

Examples: People on a diet high in glutamate will show greater synaptic plasticity than those who are not.

Students on a diet high in glutamate will solve more mazes than those who are not.

A diet rich in glutamate will increase brain plasticity.

(c) What was the purpose of Group 1 in this particular investigation?

Group 1 acts as the control group with a 'normal' diet (i.e. no IV exposure) against which the maze solving performance of the high and low glutamate experimental groups (i.e. both exposed to a level of the IV) can be compared. This enables the researcher to determine the effect of the IV (amount of glutamate) on brain plasticity (as measured by the DV).

(d) Identify the type of research design

independent groups

(e) Identify two ethics guidelines that would have been considered by the ethics committee when reviewing the research proposal and explain why each one is relevant to this particular investigation.

All research ethics guidelines are equally relevant and important for all human research studies. Of particular relevance to this specific investigation are: (1) ensuring the health and wellbeing of the participants on prescribed diets (i.e. must ensure no harm from the changed dietary intake) and (2) use of informed consent (i.e. must ensure all participants fully understand the nature, purpose, risks and benefits of their participation, including their right to withdraw at any time for any reason).

(f) Explain whether the conclusion drawn by the researcher is justified.

Explanation should refer to:

- the researcher's conclusion
- specific results which suggest that the hypothesis is supported e.g. a glutamate rich diet increases synaptic plasticity, as evidenced by the maze scores of Group 3 compared to the control group (Group 1) and Group 2
- at least one potential limitation of the research, including the possible influence of any extraneous or confounding variables and/or a possible alternative explanation of the results e.g. the researcher's operationalisation of synaptic/brain plasticity using a psychological measure (maze completion) rather than a biological measure does not necessarily mean that synaptic change actually occurred, whereas a biological measure (such as measuring the electrical currents produced by synapses) would be more precise; no assessment of control group diets for glutamate content; biased gender representation may skew the results to represent the effects of glutamate on brain plasticity in males more than females (and thereby reduce external validity).

Note that the use of random sampling would have ensured that participant variables that could influence the results (such as failure to maintain a prescribed diet for the entire experiment, different metabolic rates, problem-solving ability etc.) have been distributed relatively equally across all groups.

ACTIVITY 1.18

Crossword on concepts and terms in research methods

Across

3 Defining variables in terms of the procedures or actions used to measure them.
4 An experimental research design for which participants are randomly allocated to entirely separate groups.
5 What the experimenter measures to assess the effect of the IV.
6 A control procedure to prevent participants from knowing which condition of the experiment they are in.
7 A testable prediction of the relationship between two or more variables.
12 Research method involving selection and comparison of groups of participants on one or more variables at a single point in time.
16 Information collected by someone other than the original user who did so for their own purpose.
17 Type of observation that takes place in naturally occurring environments.
18 Applying the results from a sample to its population.
19 An experimental research design for which each participant is in both the experimental and control groups.
20 The group in an experiment exposed to the IV.
24 Numerical information.
26 An unwanted influence on research participant performance and therefore the results produced by a person carrying out the research.
27 A research method in which a researcher manipulates a variable under controlled conditions to measure the effect on another variable.
30 Involving personal opinion or interpretation.
31 The entire group of research interest from which a sample is drawn.
33 The variable which the researcher tests and manipulates.
34 A research sample that does not adequately represent key characteristics of the population from which it was drawn.
35 The group in an experiment not exposed to the IV so that a comparison with the experimental group can be made.

Down

1 Systematically changing the order of an experimental treatment to control unwanted effects on performance of any one order.
2 A variable other than the IV that has had an unwanted effect on the DV, making it impossible to determine which of the variables produced the predicted change in the DV.
8 Sample in which every member of the population had an equal chance of being selected.
9 In relation to research ethics, the use of fair procedures and ensuring fair distribution of the costs and benefits of the research.
10 A research participant's written or spoken responses.
11 Procedure for assigning participants to experimental and control groups by chance in order to minimise pre-existing differences between groups.
13 The extent to which the results obtained for a study can be generalised to the population from which the sample was drawn or to other people in other settings over time.
14 A statistic that summarises how far scores within a set of scores spread out from the mean.
15 A mathematical indication of central tendency.
21 A change in a participant's response due to their belief that a particular factor is having an effect.
22 The extent to which an investigation accurately measured what it claimed to have measured.
23 A sample that closely matches the population from which it is drawn.
25 A variable other than the IV that may cause a change in the IV.
28 Not involving personal opinion or interpretation.
29 The extent to which the results obtained from a research study are consistent, dependable and stable.
32 Statistics used for interpreting and giving meaning to results.
36 A general explanation of a set of observations about behaviour and/or mental processes which seem to be related.

1 C O U N T E R B A L A N C I N G
2 C O N F O U N D I N G
3 O P E R A T I O N A L I S I N G
4 I N D E P E N D E N T G R O U P S
5 D E P E N D E N T V A R I A B L E
6 S I N G L E B L I N D
7 R E S E A R C H H Y P O T H E S I S
8 R A N D O M
9 J U S T I C E
10 S E L F R E P O R T
11 R A N D O M A L L O C A T I O N
12 C R O S S S E C T I O N A L S T U D Y
13 E X T R A N E U R O T I C I S M
14 S T A T I S T I C A L S I G N I F I C A N C E
15 M E A N
16 S E C O N D A R Y D A T A
17 N A T U R A L E X P E R I M E N T
18 G E N E R A L I S A T I O N
19 R E P E A T E D M E A S U R E S
20 E X P E R I M E N T A L D E S I G N
21 P L A C E B O E F F E C T
22 V A L I D I T Y
23 R E P R E S E N T A T I V E S A M P L E
24 Q U A N T I T A T I V E D A T A
25 E X T R A N E O U S V A R I A B L E
26 E V I D E N C E B A S E D P R A C T I C E
27 E X P E R I M E N T E R B I A S
28 O B J E C T I V E J U D G E M E N T
29 R E L I A B I L I T Y
30 S E N T A T I V E N E S S
31 P O P U L A T I O N S A M P L E
32 I N F E R E N T I A L S T A T I S T I C S
33 I N D E P E N D E N T V A R I A B L E
34 B I A S E D I N T E R V I E W E R
35 C O N T R O L G R O U P
36 T H E O R Y

ACTIVITY 1.19

True/False quiz on research methods

Indicate whether each statement is true or false by writing T or F in the column at the right.

Statement	T of F
1 The smaller the sample size, the more likely it is to obtain reliable data.	F
2 The main difference between primary and secondary data is in who collects the original data.	T
3 Variables are operationalised in psychological research to ensure ethical treatment of participants.	F
4 Extraneous variables are only relevant to research involving experiments.	F
5 Members of an experimental group should be randomly allocated and exposed to the independent variable.	T
6 A cross-sectional study with an independent groups or repeated measures design may also be called an experiment.	F
7 Naturalistic observation involves re-creating natural conditions in a laboratory setting to make an experiment more valid.	F
8 Replication can be used to test the reliability of experimental findings.	T
9 If the results of an experiment are reliable, then the experiment must also be valid.	F
10 A random event is one that is due solely to chance.	T
11 Random assignment is the process by which participants are selected by chance for a research study.	F
12 Experimenter bias may influence participant behaviour in the direction of experimenter expectations.	T
13 The mean is a mathematical indication of central tendency.	T
14 Deception should only be used when it is essential for participant cooperation.	F
15 A placebo effect occurs when the specific order in which the dependent variable is presented influences a participant to respond in an unwanted way.	F
16 Using the double blind procedure eliminates all potential confounding variables.	F
17 Inferential statistics enable the researcher to evaluate the extent that chance factors may account for their results instead of the independent variable.	T
18 An extraneous variable can become a confounding variable.	T
19 Approximately 95 per cent of scores in a data set lie within two standard deviations of the mean.	T
20 In an experiment to investigate the effect of exercise on mental health, the control condition would be a group of people not permitted to exercise.	T
21 A limitation of self-reported data is that it is always qualitative not quantitative.	F
22 In an experiment using matched groups, each participant is in both the experimental and control conditions.	F
23 When a distribution is skewed, the mean can be biased by a few extreme scores.	T
24 In an experiment, the control of potential extraneous and confounding variables can be achieved only in a laboratory setting.	F
25 A research study cannot have external validity if does not also have internal validity.	T

UNIT 3

HOW DOES EXPERIENCE AFFECT BEHAVIOUR AND MENTAL PROCESSES?

CHAPTER 2

Nervous system functioning

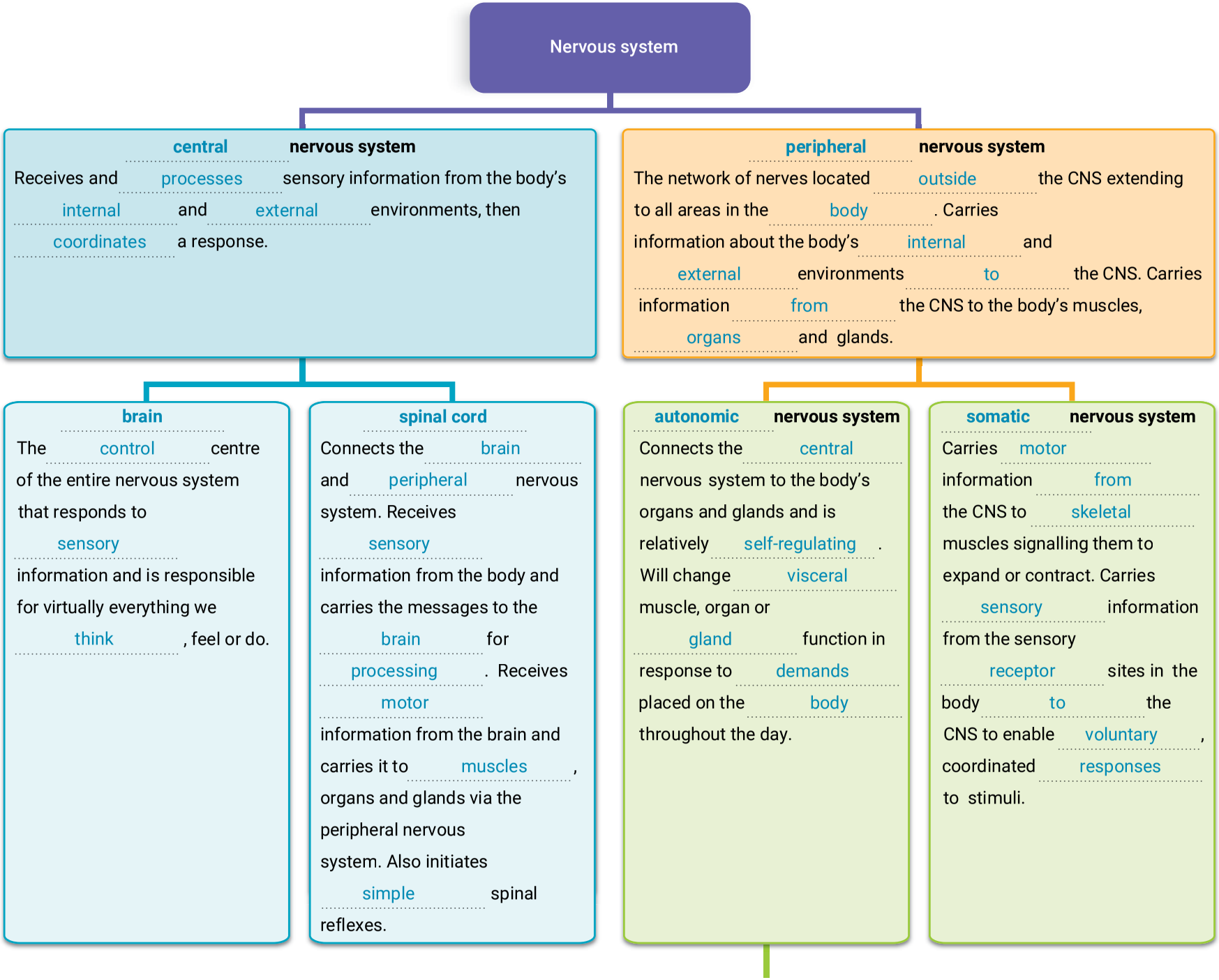
	Activities									
Key knowledge	**2.1**	**2.2**	**2.3**	**2.4**	**2.5**	**2.6**	**2.7**	**2.8**	**2.9**	**2.10**
• the roles of different divisions of the nervous system (central and peripheral nervous systems and their associated sub-divisions) in responding to, and integrating and coordinating with, sensory stimuli received by the body	✔	✔				✔			✔	✔
• the distinction between conscious and unconscious responses by the nervous system to sensory stimuli, including the role of the spinal reflex			✔	✔		✔			✔	✔
• the role of the neuron (dendrites, axon, myelin and axon terminals) as the primary cell involved in the reception and transmission of information across the synapse (excluding details related to signal transduction)						✔			✔	✔
• the role of neurotransmitters in the transmission of neural information between neurons (lock-and-key process) to produce excitatory effects (as with glutamate) or inhibitory effects (as with gamma-amino butyric acid [GABA])					✔	✔			✔	✔
• the effects of chronic changes to the functioning of the nervous system due to interference to neurotransmitter function, as illustrated by the role of dopamine in Parkinson's disease.							✔	✔	✔	✔

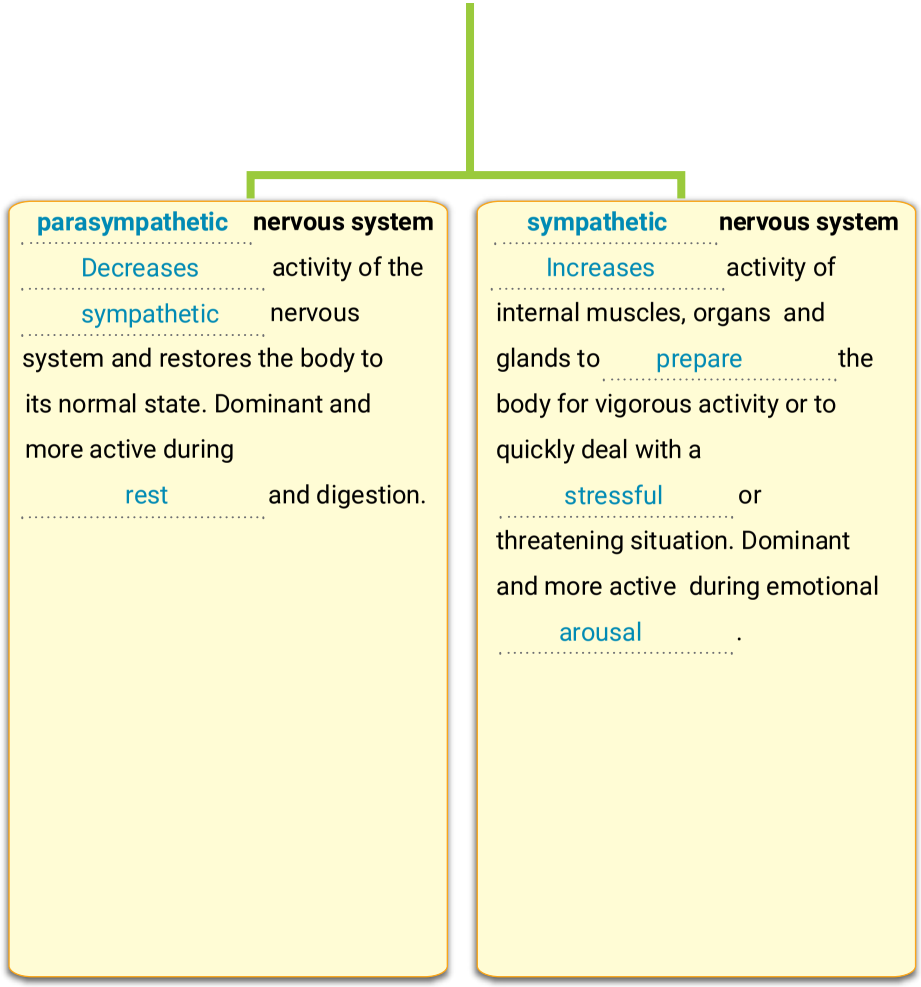
ACTIVITY 2.1

Summarising human nervous system organisation and functions

Complete the chart of the human nervous system shown on the next pages, using the terms in the following shaded panel. All terms are used, and some may be used more than once.

arousal	autonomic	body	brain	central
control	coordinates	decreases	demands	external
from	gland	increases	internal	motor
muscles	organs	outside	parasympathetic	peripheral
prepare	processes	processing	receptor	responses
rest	self-regulating	sensory	simple	skeletal
somatic	spinal cord	stressful	sympathetic	think
to	visceral	voluntary		


Nervous system
central nervous system
Receives and processes sensory information from the body's internal and external environments, then coordinates a response.
peripheral nervous system
The network of nerves located outside the CNS extending to all areas in the body. Carries information about the body's internal and external environments to the CNS. Carries information from the CNS to the body's muscles, organs and glands.
brain
The control centre of the entire nervous system that responds to sensory information and is responsible for virtually everything we think, feel or do.
spinal cord
Connects the brain and peripheral nervous system. Receives sensory information from the body and carries the messages to the brain for processing. Receives motor information from the brain and carries it to muscles, organs and glands via the peripheral nervous system. Also initiates simple spinal reflexes.
autonomic nervous system
Connects the central nervous system to the body's organs and glands and is relatively self-regulating. Will change visceral muscle, organ or gland function in response to demands placed on the body throughout the day.
somatic nervous system
Carries motor information from the CNS to skeletal muscles signalling them to expand or contract. Carries sensory information from the sensory receptor sites in the body to the CNS to enable voluntary, coordinated responses to stimuli.

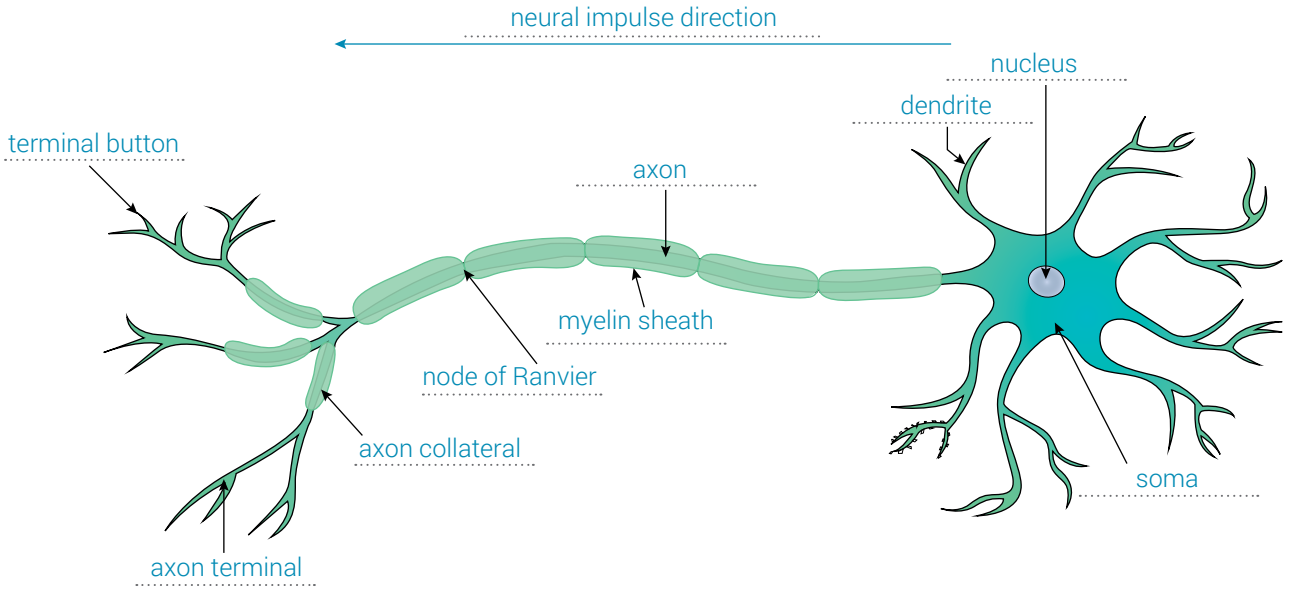

parasympathetic nervous system
Decreases activity of the sympathetic nervous system and restores the body to its normal state. Dominant and more active during rest and digestion.
sympathetic nervous system
Increases activity of internal muscles, organs and glands to prepare the body for vigorous activity or to quickly deal with a stressful or threatening situation. Dominant and more active during emotional arousal .

ACTIVITY 2.2

Structure and function of neurons

(a) Use the following terms to correctly label the diagram of a neuron and include an arrow to show the direction of travel of the neural impulse (action potential).

terminal button	axon	myelin sheath
nucleus	soma	node of Ranvier
dendrite	axon collateral	axon terminal



(b) Copy each of the following descriptions next to the correct term in the table on the next page. Each term has two correct descriptions. A description can be used only once.

- An extension of the neuron that detects and receives neural information.
- A single tube-like structure that transmits neural information to other neurons.
- A fatty white substance that forms an insulating layer around the axon.
- A small, unmyelinated gap in the protective insulation around the axon.
- Where incoming neural information collected from multiple neurons may be integrated.
- Contains the neuron's genetic material in the form of chromosomes.
- A small swelling at the very end of an axon collateral.
- Can branch and re-branch forming numerous sites where connections can be made with adjacent neurons.
- Supports rapid movement of a neural message through the neuron, without interruption or distortion.
- The neural message jumps across this site, which may actually speed up its transmission.
- The main cellular body of the neuron and contains the cell nucleus.
- Coordinates the cell's metabolism, growth and repair.
- Contains synaptic vesicles that store and release neurotransmitter into the synaptic gap.
- Can have several branches, which enables the neuron to send its message to many other neurons simultaneously.

Term	Descriptions
dendrite	• An extension of the neuron that detects and receives neural information. • Can branch and re-branch forming numerous sites where connections can be made with adjacent neurons.
soma	• Where incoming neural information collected from multiple neurons may be integrated. • The main cellular body of the neuron and contains the cell's nucleus.
nucleus	• Contains the neuron's genetic material in the form of chromosomes. • Coordinates the cell's metabolism, growth and repair.
axon	• A single tube-like structure that transmits neural information to other neurons. • Can have several branches, which enables the neuron to send its message to many other neurons simultaneously.

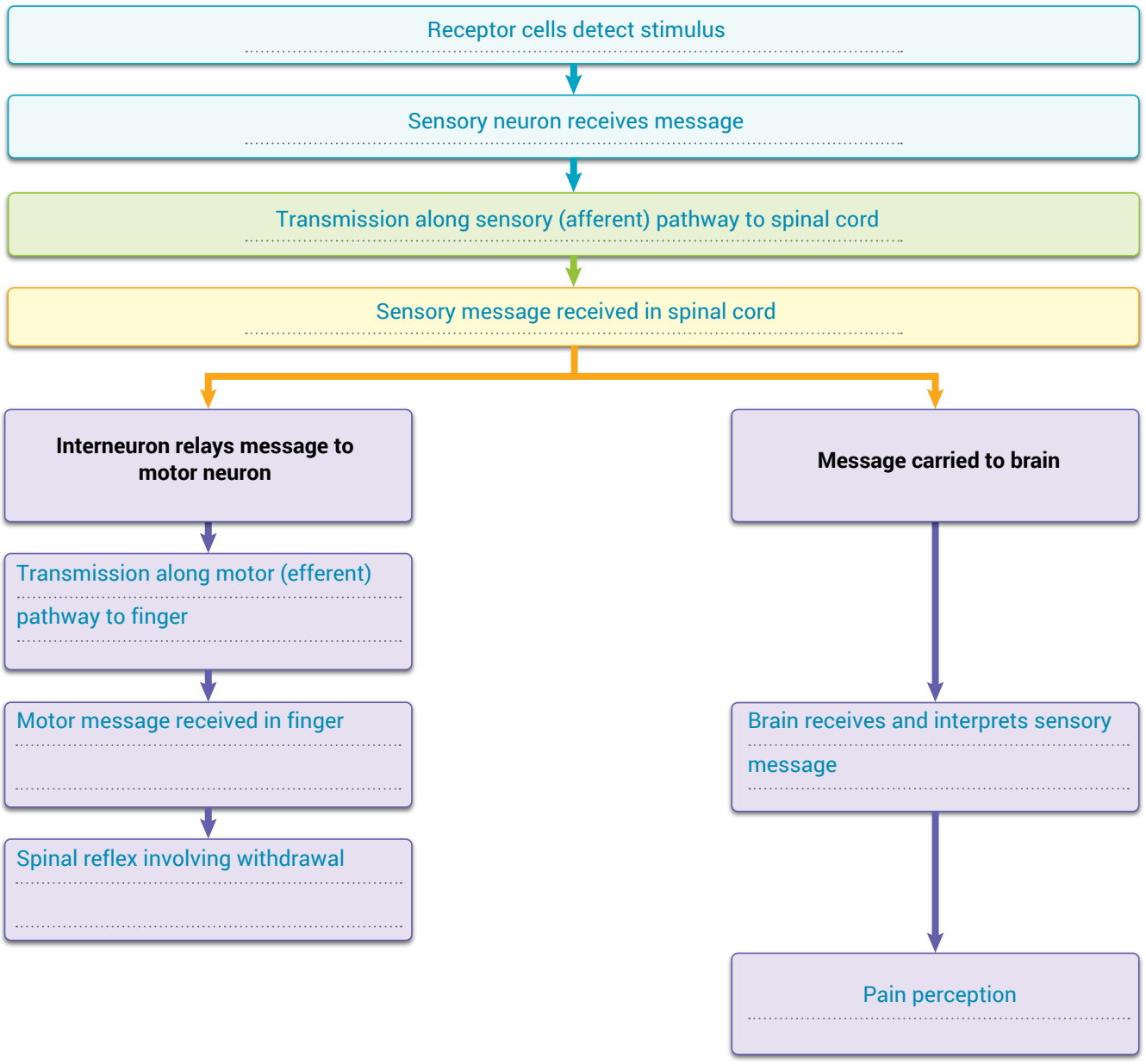
Term	Descriptions
myelin sheath	• A fatty white substance that forms an insulating layer around the axon. • Supports rapid movement of a neural message through the neuron, without interruption or distortion.
node of Ranvier	• A small, unmyelinated gap in the protective insulation around the axon. • The neural message jumps across this site, which may actually speed up its transmission.
terminal button	• A small swelling at the very end of an axon collateral. • Contains synaptic vesicles that store and release neurotransmitter into the synaptic gap.

ACTIVITY 2.3

Sequence of activity in a spinal reflex

You accidentally touch a spiky needle on an ornamental cactus when watering the plant, a spinal reflex is initiated, and you immediately withdraw your hand. Insert each of the descriptions into the flow chart below to show the correct order for your spinal reflex and pain experience.

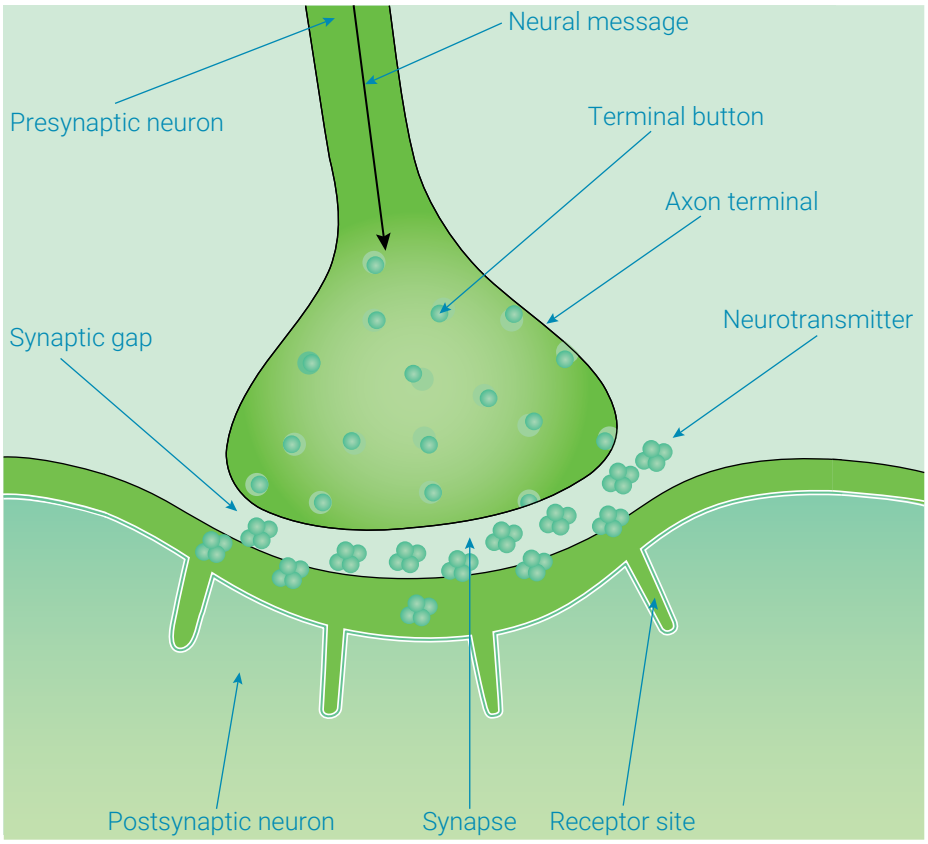
sensory message received in spinal cord	sensory neuron receives message	pain perception	transmission along motor (efferent) pathway to finger	motor message received in finger
brain receives and interprets sensory message	spinal reflex involving withdrawal	transmission along sensory (afferent) pathway to spinal cord	receptor cells detect stimulus	



ACTIVITY 2.4

Neurotransmission at a synapse

(a) Label the following diagram showing neurotransmission at a synapse. Attempt to identify up to nine biological structures without looking at your textbook.

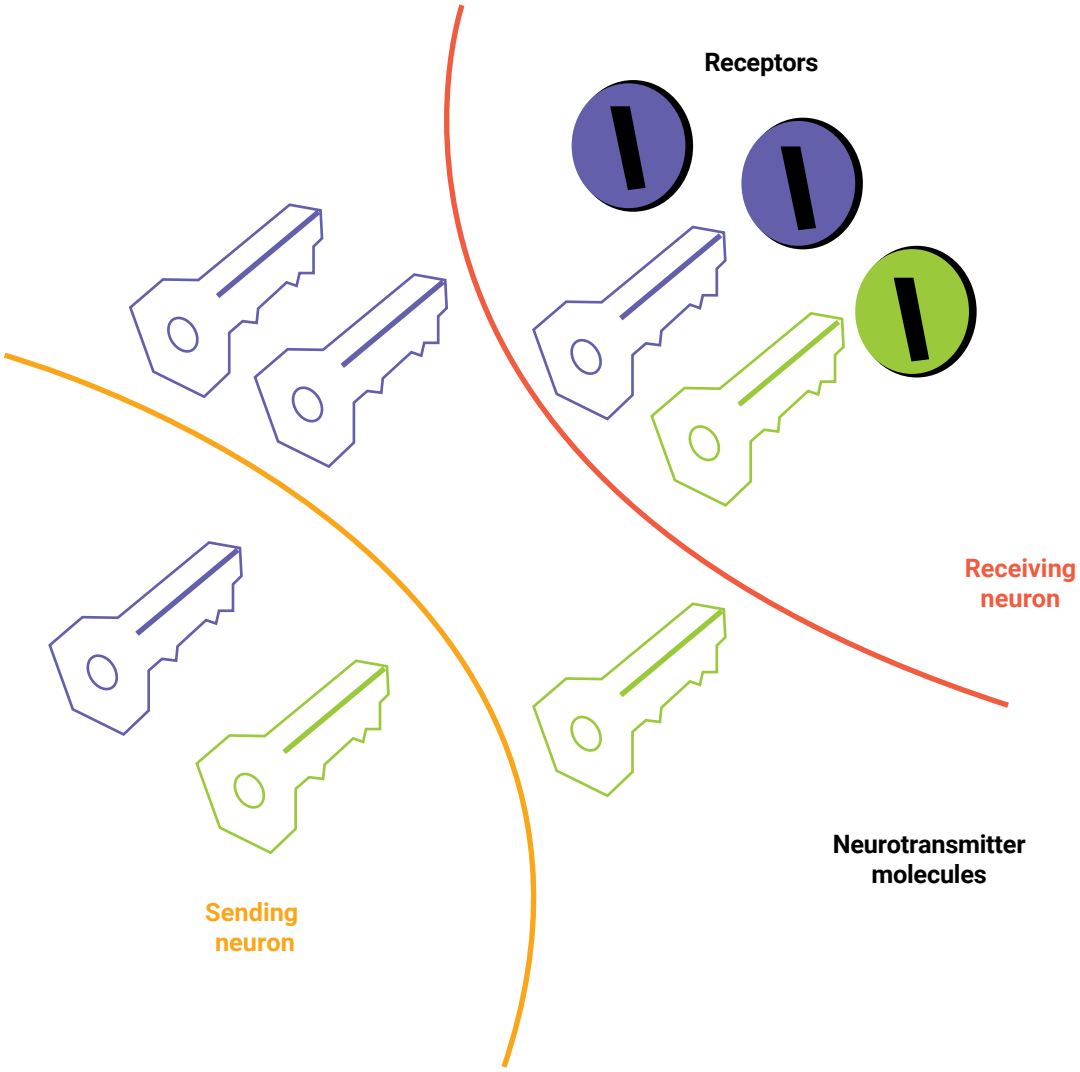


(b) The steps below describe neurotransmission at a synapse, but they are in incorrect order. Correctly order the steps by writing the appropriate number next to each step.

6	**1** Excess neurotransmitter not used is reabsorbed back into the presynaptic neuron in a process called reuptake.
5	**2** Depending on the type of neurotransmitter released, this signals the postsynaptic neuron to excite (perform its function) or inhibit (block activation).
4	**3** If the structure of the neurotransmitter matches the receptor site on the dendrite of the postsynaptic neuron it will bind with the receptor site.
2	**4** This signals the vesicles to release neurotransmitter molecules into the synaptic gap.
3	**5** Neurotransmitter molecules pass across the synaptic gap onto the surface of the dendrite of the postsynaptic neuron.
1	**6** The neural message (action potential) is carried along the axon of a presynaptic neuron in electrical form to the terminal button.

ACTIVITY 2.5

Neurotransmission as a lock-and-key process



The diagram above illustrates synaptic neurotransmission as a lock-and-key process. Explain this model of neurotransmission by completing the following passage using key terms in the shaded panel. A term may be used more than once but not all terms need to be used.

attach	can	cannot	chemical
counterbalancing	dendrite	excitatory	GABA
glutamate	inhibitory	key	less
lock	more	neurotransmitter	opened
postsynaptic	presynaptic	receptor site	synaptic gap

ACTIVITY 2.5 *continued*

Each type of neurotransmitter has a distinct chemical shape (or structure). When released from a presynaptic neuron into the synaptic gap (or synapse), neurotransmitter searches for the correctly shaped receptor site on the postsynaptic neuron.

The neurotransmitter acts as the key and the receptor site acts as the lock. Each receptor site is distinctly shaped to match a particular neurotransmitter in the same way that a lock can only be opened by a key that fits correctly. Different types of neurotransmitter cannot bind (i.e. attach) to the same receptor site in the same way that two different keys cannot fit in the same lock.

When neurotransmitter binds to its receptor site, this has the effect of 'unlocking' the postsynaptic neuron and activating a response. The neurotransmitter will have either of two effects at a receptor site – a/an excitatory effect or a/an inhibitory effect. For example, glutamate has a/an excitatory effect in the CNS making the postsynaptic neuron more likely to fire, whereas GABA has a/an inhibitory effect making the postsynaptic neuron less likely to fire.

Sentence completion on nervous system structure and function

Use the correct pairs of terms to complete the following descriptions about nervous system structure and function. Some descriptions require more than one pair to complete, and pairs of terms can be used more than once.

Word pairs	
spinal cord; brain	sensory; motor
interneuron; motor neuron	synapse; synaptic gap
neurons; glia	GABA; Glutamate
autonomic; somatic	afferent; efferent
chemical; electrical	binding; receptor sites
unconscious; conscious	autonomic; unconscious
conscious; somatic	branches; spines
central nervous system; peripheral nervous system	parasympathetic nervous system; sympathetic nervous system
sympathetic nervous system; parasympathetic	

1 The central nervous system comprising the brain and spinal cord receives and processes sensory information from the peripheral nervous system. The peripheral nervous system carries motor information from the central nervous system to muscles, organs and glands in the body.

2 GABA is an inhibitory neurotransmitter that reduces the likelihood of postsynaptic neural activation. Glutamate is an excitatory neurotransmitter that increases the likelihood of postsynaptic neural activation.

3 The somatic nervous system carries sensory information from the body to the central nervous system and motor information from the central nervous system to skeletal muscles that are under voluntary control.

4 Physiological systems that maintain our body and keep us alive are regulated mostly by the autonomic nervous system, whereas sensing our internal and external environment and activating skeletal muscles for voluntary movements is controlled mostly by the somatic nervous system.

5 In times of minimal stress and the absence of threat the parasympathetic nervous system dominates the sympathetic nervous system, consequently keeping the body in a physiological state of calm. When threatened, the sympathetic nervous system dominates the parasympathetic nervous system, consequently increasing physiological arousal.

6 Digesting food and moving it along the digestive tract is an unconscious response to sensory stimuli within our bodies that we cannot voluntarily control, whereas seeking out medication to ease a stomach ache is a conscious response to sensory stimuli that we intentionally initiate and can voluntarily control.

7 A spinal reflex is an automatic, involuntary response which is initiated within the spinal cord without any involvement of the brain.

8 When a spinal reflex involving a withdrawal reaction occurs, a sensory neuron carries a message to an interneuron, which immediately relays the message to a motor neuron so that the withdrawal reaction can be enabled via muscular activity.

9 Neural information is sent across a synapse (or synaptic gap) in chemical form, whereas neural information is sent along an axon in electrical form.

10 The peripheral nervous system may be viewed as having two sub-divisions based on conscious awareness. The somatic nervous system carries sensory and motor signals involved in voluntary control of skeletal muscles, whereas the autonomic nervous system carries sensory and motor signals involved in the unconscious control of visceral muscles, organs and glands.

11 Sensory information coming into the CNS is also called afferent information, whereas motor information leaving the CNS is also called efferent information.

12 Within the human nervous system, neurons are responsible for communicating information and glia cells support their functions.

ACTIVITY 2.6 *continued*

13 The synapse is the site of communication between two or more adjacent neurons. The tiny space that separates two adjacent neurons within the synapse is called the synaptic gap, although this space is sometimes also referred to more simply as a synapse.

14 A single neuron can have many thousands of connections to other neurons through its dendritic branches and spines.

15 Neurotransmitter works by binding to its matching receptor sites on postsynaptic neurons.

ACTIVITY 2.7

Matching exercise on Parkinson's disease

Match each description associated with Parkinson's disease with the most appropriate term on the right. Write the letter of the term you select to the left of each description.

(g)	**1** Slowness of voluntary movement	**(a)** muscle rigidity
(f)	**2** Where loss of dopamine-producing neurons occurs	**(b)** tremor
(i)	**3** Imitates effects of dopamine or promotes dopamine conversion	**(c)** motor cortex
(h)	**4** Gradual deterioration	**(d)** dopamine depletion
(c)	**5** Brain region involved in execution of voluntary movements	**(e)** restless legs
(b)	**6** Continuous, involuntary shaking of the body or a body part	**(f)** substantia nigra
(a)	**7** Difficulty relaxing bodily and facial muscles	**(g)** bradykinesia
(j)	**8** Difficulty maintaining an upright and balanced bodily position	**(h)** degeneration
(e)	**9** Legs appear to move or feel as if they are moving constantly	**(i)** medication
(d)	**10** Impairs neural messaging for voluntary movements	**(j)** postural instability

ACTIVITY 2.8

Describing key characteristics of Parkinson's disease

Select terms from the shaded panel below to correctly complete the passage about Parkinson's disease. A term may be used more than once but not all terms must be used.

anosmia	basal ganglia	bradykinesia	chronic	clarity
cognitive function	convert	degenerative	dopamine	GABA
glutamate	inherited	initiate	involuntary	mental health
mimic	motor	motor cortex	muscle rigidity	neural messages
neurons	non motor	plan	position	postural instability
skeletal	speech	substantia nigra	tremor	voluntary

Parkinson's disease is a/an degenerative neurological condition that effects both motor and non-motor functions. It is degenerative because the disease gradually worsens over time. It is also chronic because it persists over a long period of time.

The major motor symptoms are slowness of voluntary movements (called bradykinesia), continuous involuntary shaking of the body (called tremor), stiff muscles whereby muscles are tight and seem unable to relax (called muscle rigidity) and difficulty maintaining an upright position and steady balance (called postural instability).

These symptoms are believed to occur due to the loss of neurons from the substantia nigra, a structure located within the basal ganglia in the brain stem. Neurons in the substantia nigra are the only cells that produce the neurotransmitter dopamine, so when damaged by Parkinson's disease there is a reduced amount. This neurotransmitter has a direct role in movement, enabling neural messages that allow smooth, coordinated function of the body's skeletal muscles involved in voluntary movement. It is also

involved in the brain's ability to plan and initiate coordinated muscle movements. As the disease progresses, the motor cortex in the brain becomes affected because it receives insufficient information on how and when to move skeletal muscles. There are also non-motor symptoms associated with Parkinson's disease. These include difficulties with speech such as reduced fluency and clarity or speed of speech where speaking is too rapid resulting in words being crowded together. Other common non-motor symptoms include loss of sense of smell (called anosmia), disturbed ability to regulate body temperature, fatigue, constipation, problems with cognitive function such as slowness of thinking and memory loss, and mental health concerns such as anxiety and depression.

Current medications used to treat Parkinson's disease include drugs that either mimic the effects of dopamine or those which the brain can convert into dopamine.

ACTIVITY 2.9

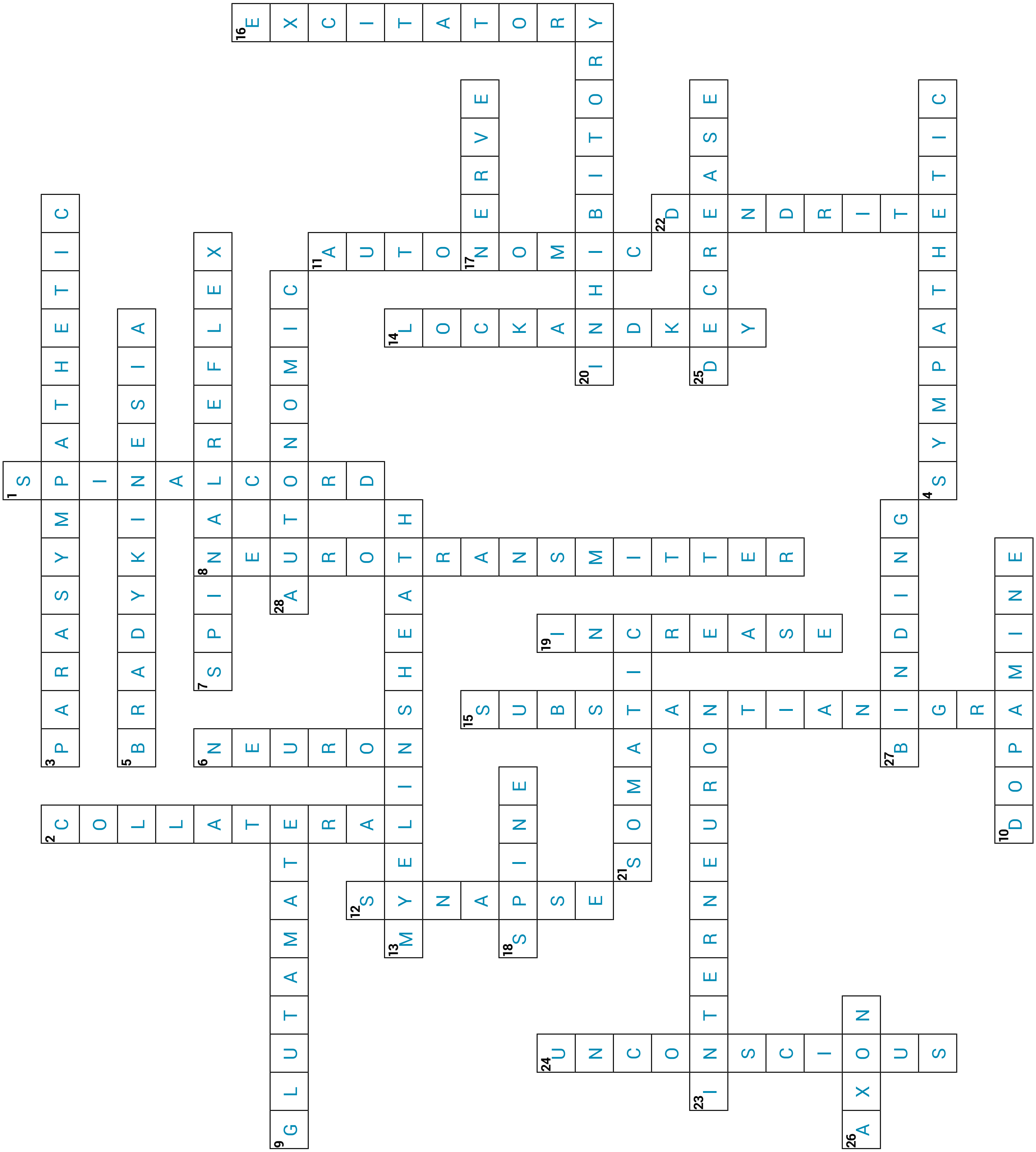
Crossword on concepts and terms in nervous system functioning

Across

3 Subdivision of the nervous system that is dominant during rest and digestion when we are not under any immediate threat.
4 Subdivision of the nervous system that prepares the body to respond quickly in an emergency.
5 The slowness of voluntary muscle movement associated with Parkinson's disease.
7 An involuntary action that cannot occur unless sensory and motor neurons communicate via interneurons in the spinal cord.
9 Neurotransmitter that produces an excitatory effect in the CNS.
10 Neurotransmitter implicated in motor symptoms of Parkinson's disease.
13 Insulates the neuron against interference from adjacent neurons.
17 A bundle of axons.
18 A tiny knob-like growth on the surface of a dendrite.
20 The effect of GABA on a postsynaptic neuron.
21 Subdivision of the nervous system that carries motor messages from the CNS to voluntary muscles and sensory signals to the CNS from the body.
23 A CNS nerve cell that is neither sensory nor motor.
25 The change in digestion when the sympathetic nervous system is activated.
26 An extension of a neuron that transmits an action potential away from the soma and to another neuron.
27 When neurotransmitter attaches at its receptor site.
28 Self-regulating subdivision of the nervous system.

Down

1 Connects the brain and the PNS and initiates some simple reflexes.
2 Small branch at the end of an axon.
6 The primary cell involved in the reception and transmission of information across the synapse.
8 A chemical that, when released into a synaptic gap, transmits a neural message from neuron to neuron.
11 Subdivision of the nervous system that regulates the activity of visceral muscles.
12 Where presynaptic and postsynaptic neurons communicate.
14 Model used to describe the neurotransmission process.
15 Degeneration and loss of neurons in this brain structure primarily accounts for Parkinson's disease motor symptoms.
16 The effect of neurotransmitter that makes a postsynaptic neuron more likely to fire.
19 The change in heart rate when the sympathetic nervous system is activated.
22 An extension of a neuron that receives an incoming message from another neuron.
24 A response to a sensory stimulus that does not involve awareness.


1 SPINAL CORD
2 COLLATERAL
3 PARASYMPATHETIC
4 SYMPATHETIC
5 BRADYKINESIA
6 NEURON
7 SPINAL REFLEX
8 NEUROTRANSMITTER
9 GLUTAMATE
10 DOPAMINE
11 AUTONOMIC
12 SYNAPSE
13 MYELIN SHEATH
14 LOCK AND KEY
15 SUBSTANTIA NIGRA
16 EXCITATORY
17 NERVE
18 SPINE
19 INCREASE
20 INHIBITORY
21 SOMATIC
22 DENDRITE
23 INTERNEURON
24 UNCONSCIOUS
25 DECREASE
26 AXON
27 BINDING
28 AUTONOMIC

ACTIVITY 2.10

True/False quiz on nervous system functioning

Indicate whether each statement is true or false by writing T or F in the column at the right.

Statement	T or F
1 A spinal reflex does not require participation of the brain.	T
2 The somatic nervous system is a subdivision of the autonomic nervous system.	F
3 Glutamate has an inhibitory effect, whereas GABA has an excitatory effect.	F
4 The autonomic nervous system regulates internal organs and systems performing functions that are vital for survival.	T
5 Involuntary responses to stimuli do not involve conscious awareness.	T
6 The peripheral nervous system connects the brain and spinal cord to the body's sense receptors, muscles and glands.	T
7 A reflex is a learned response to a specific stimulus.	F
8 Pupil dilation is a function of the sympathetic nervous system.	T
9 Parkinson's disease only affects people physically.	F
10 The central nervous system consists of the brain and spinal cord.	T
11 The space between neurons where neurotransmitter may be secreted is called the dendritic gap.	F
12 The intestines and bladder are relaxed when the sympathetic nervous system is dominant.	T
13 The role of dopamine in Parkinson's disease illustrates the effects of chronic changes to the nervous system due to interference to neurotransmitter function.	T
14 The parasympathetic nervous system 'counterbalances' the activity of the central nervous system.	F
15 The myelin sheath aids the conduction of neural impulses through the axon part of the neuron.	T
16 The somatic nervous system has sensory and motor functions.	T
17 A neurotransmitter molecule can bind with a receptor site when the site is already bound by another neurotransmitter.	F
18 The sympathetic nervous system takes longer to return the body to its normal state compared with the parasympathetic nervous system's immediate activation.	F
19 Bodily responses regulated by the autonomic nervous system occur automatically without conscious effort.	T
20 Skeletal muscles are voluntary muscles under the control of the somatic nervous system.	T

CHAPTER 3

Stress as a psychobiological process

	Activities												
Key knowledge	3.1	3.2	3.3	3.4	3.5	3.6	3.7	3.8	3.9	3.10	3.11	3.12	3.13
• sources of stress (eustress and distress) including daily pressures, life events, acculturative stress, major stress and catastrophes that disrupt whole communities	✔	✔								✔	✔	✔	✔
• models of stress as a biological process, with reference to Selye's General Adaptation Syndrome of alarm reaction (shock/counter shock), resistance and exhaustion, including the 'fight–flight–freeze' response and the role of cortisol			✔	✔	✔					✔	✔	✔	✔
• models of stress as a psychological process, with reference to Richard Lazarus and Susan Folkman's Transactional Model of Stress and Coping (stages of primary and secondary appraisal)						✔	✔				✔	✔	✔
• context-specific effectiveness, coping flexibility and use of particular strategies (exercise and approach and avoidance strategies) for coping with stress.								✔		✔	✔	✔	✔
Key science skills									✔				

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ACTIVITY 3.1

Eustress versus Distress

(a) Complete the table below by listing the different characteristics of eustress and distress.

Eustress ☺	Distress ☹
• positive	• negative
• short-term	• short- or long-term
• motivates, focuses energy	• feels unpleasant (e.g. upsetting, tension, anxiety)
• feels exciting	• decreases performance
• improves performance	• perceived as outside of our coping abilities
• perceived as within our coping abilities	• potentially harmful (e.g. can lead to mental
• not harmful	and physical problems)

(b) Because different people have different reactions to events and situations, it can be difficult to objectively categorise stressors into a list of those that can cause eustress and those that can cause distress. However, consider the list of 15 potential stressors in the table below and indicate whether you think each stressor is more likely to cause eustress or distress by placing a tick in the appropriate column.

Stressor	Eustress ☺	Distress ☹
1 Excessive homework		✔
2 Welcoming a baby into the family	✔	
3 Getting married	✔	
4 Experiencing persistent sleep problems		✔
5 Receiving a promotion at work	✔	
6 Competing in a sporting grand final	✔	
7 Being diagnosed with a chronic disease		✔

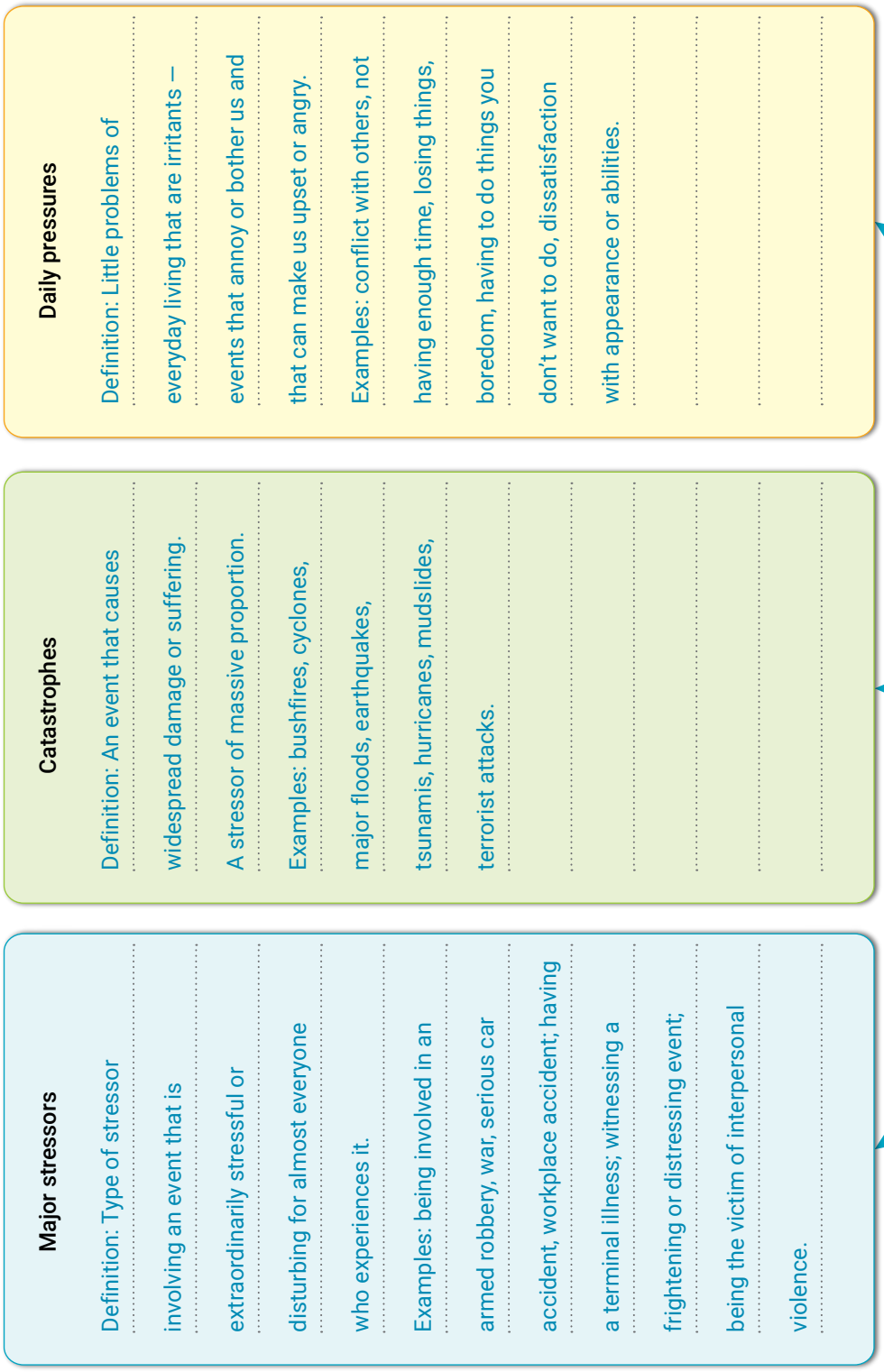
ACTIVITY 3.1 *continued*

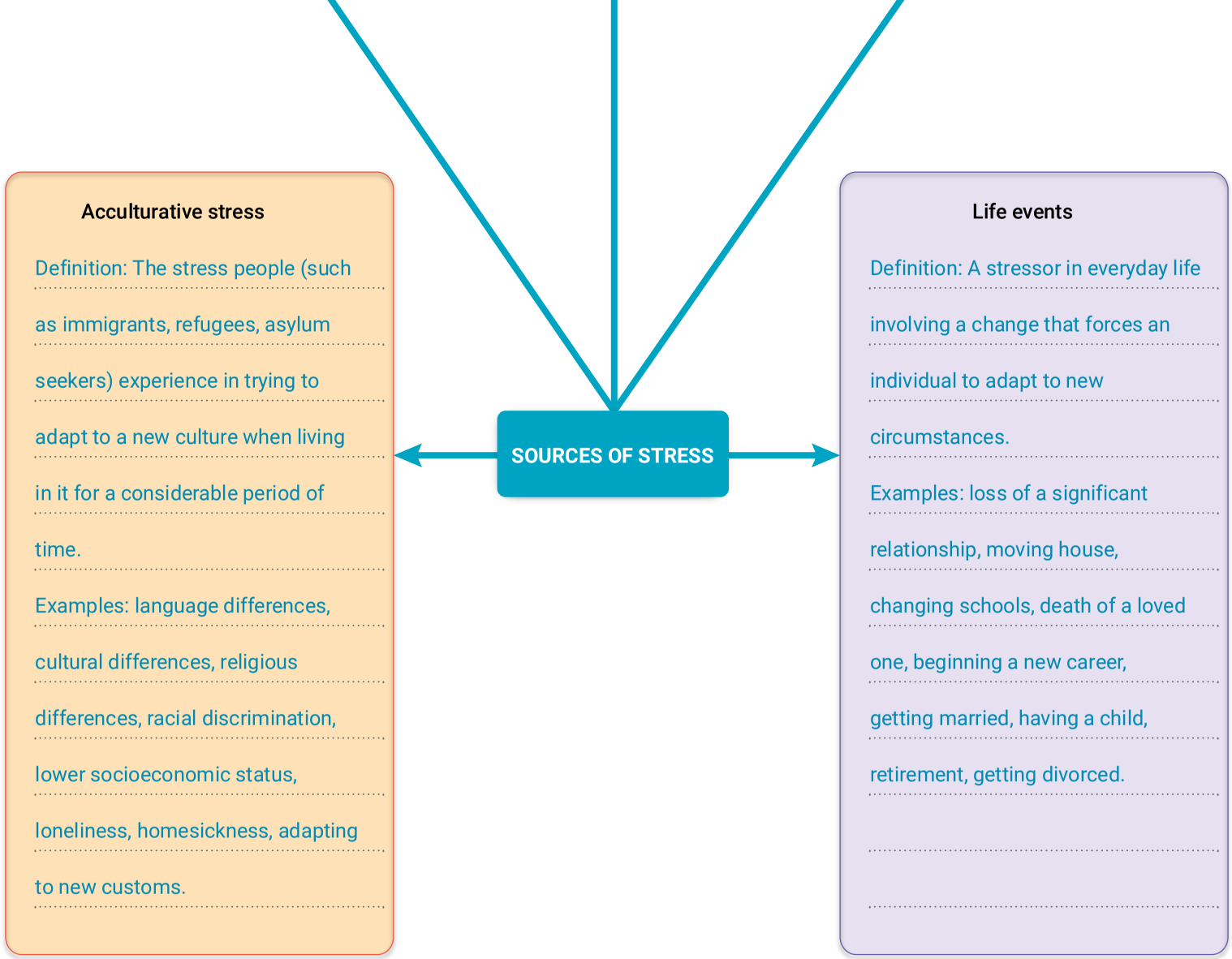
Stressor	Eustress ☺	Distress ☹
8 Breaking up with a boyfriend/girlfriend		✔
9 Having financial problems		✔
10 Starting university	✔	
11 Going overseas for the first time	✔	
12 Buying a house	✔	
13 Retiring from paid employment	✔	
14 Being admitted to hospital		✔
15 Not being invited to a party held by close friends		✔

ACTIVITY 3.2

Sources of stress

Complete the diagram to summarise five different sources of stress. Include a definition and two examples of each source in your answer.

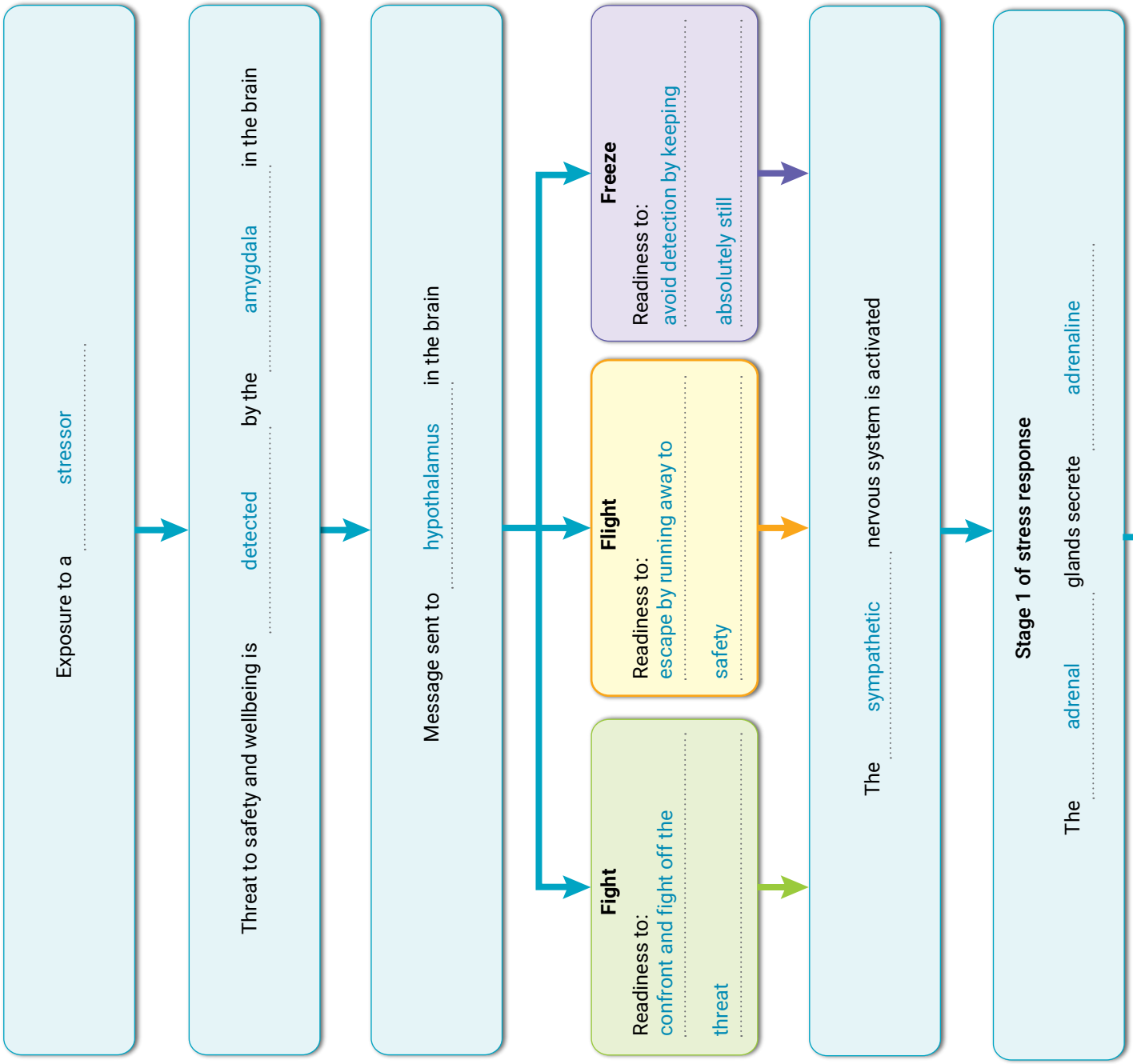


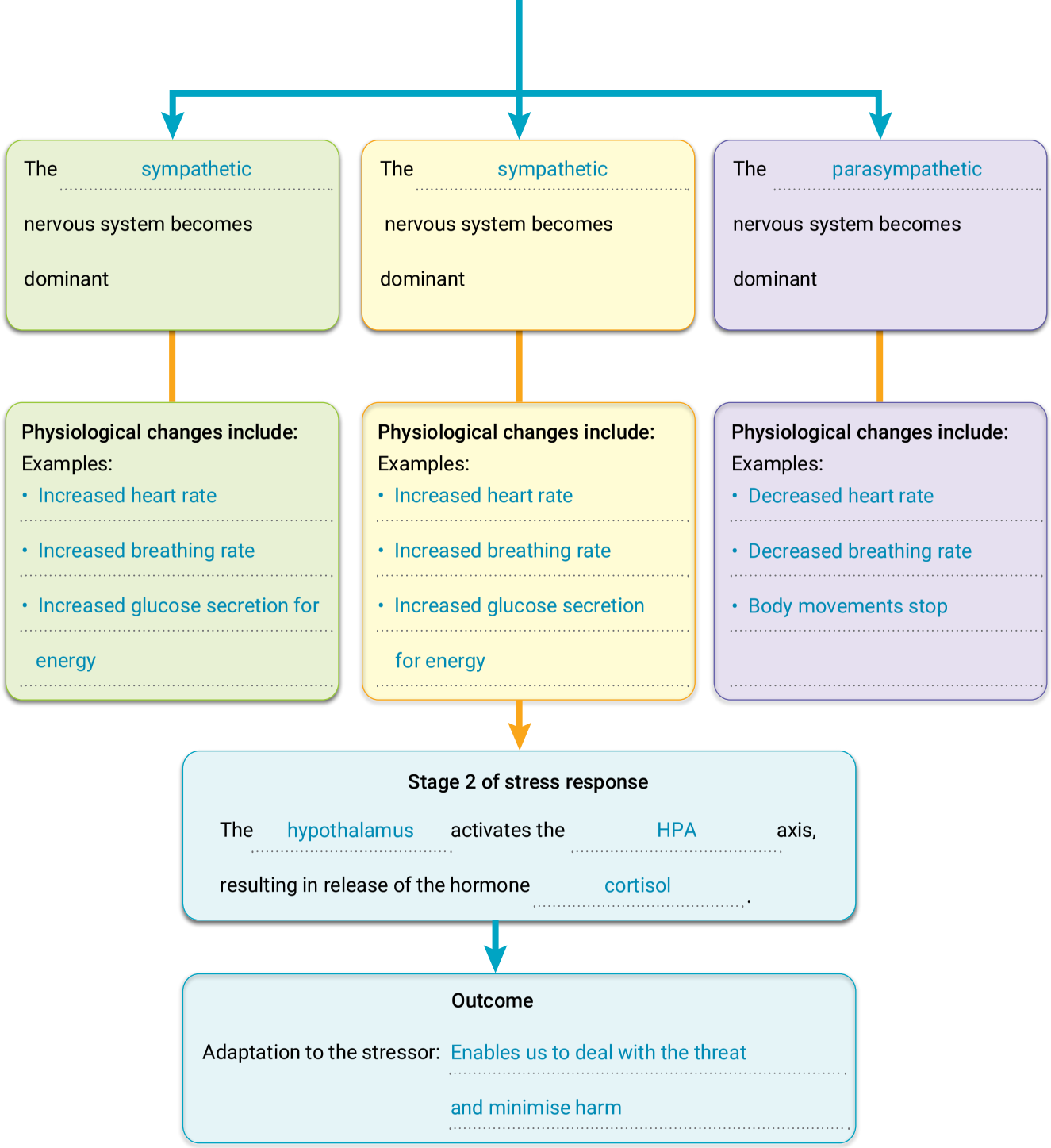

SOURCES OF STRESS
Acculturative stress
Definition: The stress people (such as immigrants, refugees, asylum seekers) experience in trying to adapt to a new culture when living in it for a considerable period of time.
Examples: language differences, cultural differences, religious differences, racial discrimination, lower socioeconomic status, loneliness, homesickness, adapting to new customs.
Life events
Definition: A stressor in everyday life involving a change that forces an individual to adapt to new circumstances.
Examples: loss of a significant relationship, moving house, changing schools, death of a loved one, beginning a new career, getting married, having a child, retirement, getting divorced.

ACTIVITY 3.3

Summarising fight–flight–freeze

Complete the flow chart to summarise the fight–flight–freeze response to a stressor.

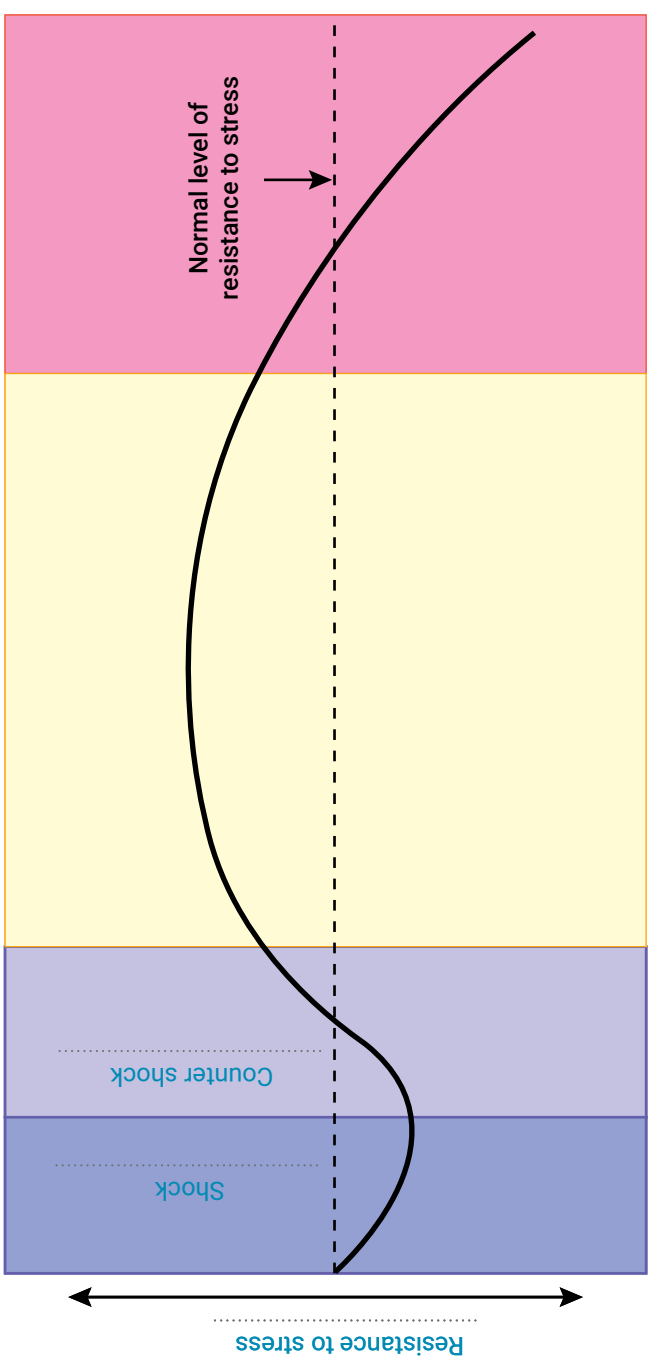



The sympathetic nervous system becomes dominant
The sympathetic nervous system becomes dominant
The parasympathetic nervous system becomes dominant
Physiological changes include:
Examples:
• Increased heart rate
• Increased breathing rate
• Increased glucose secretion for energy
Physiological changes include:
Examples:
• Increased heart rate
• Increased breathing rate
• Increased glucose secretion for energy
Physiological changes include:
Examples:
• Decreased heart rate
• Decreased breathing rate
• Body movements stop
Stage 2 of stress response
The hypothalamus activates the HPA axis, resulting in release of the hormone cortisol.
Outcome
Adaptation to the stressor: Enables us to deal with the threat and minimise harm

ACTIVITY 3.4

Summarising the General Adaptation Syndrome

Correctly label the graphical representation of Selye's General Adaptation Syndrome. Then, in the panels beneath, outline the physiological characteristics of each of the 3 stages. Also include the names of any chemicals or hormones that may be present and relevant nervous system involvement in your answers.



Stage 3

Exhaustion ..... (vulnerable and weak)

Stage 2

Resistance ..... (maximise resources to cope and adapt)

Stage 1

Alarm reaction ..... (immediate response)


Stage 1: Alarm reaction
• shock — blood pressure and body temperature drops, temporary loss of muscle tone.
• counter shock — sympathetic nervous system (fight–flight) response activated; adrenaline released; cortisol may be released; body is aroused and alert; heart and respiration rates increase; glucose and oxygen supplied to muscles.
Stage 2: Resistance
• Parasympathetic nervous system is activated but arousal level remains above normal.
• All unnecessary physiological processes shut down e.g. digestion, growth, menstruation, sex drive.
• Cortisol is released (or continues to be released).
• Immune system is weakened.
Stage 3: Exhaustion
Signs of 'physical wear and tear', which may include:
• extreme fatigue, high levels of anxiety, symptoms of depression, nightmares, hypertension, gastrointestinal problems and heart disease
• In extreme cases, if the stress persists, the organism may even die.

ACTIVITY 3.5

Media analysis/response

Read the media article about the fight–flight response and then answer the questions that follow.

Nervous stomach: Why you might get the runs when you're stressed

by Vincent Ho

So, you're going on a date and you're understandably a bit nervous. And then you feel it — a churning and cramping in your gut. Suddenly you're running to the toilet and wondering why your body reacts this way. How does a case of nerves translate to an upset stomach? What is actually happening in your body?

Feeling an upset tummy when we're nervous is normal. The broad term dyspepsia refers to any discomfort in the upper abdomen, or abdominal pain, and is very common when we're anxious and stressed. A systematic review pooling data from a number of studies found around one quarter of people have dyspepsia.

When we get nervous, a number of processes occur in the brain that are passed onto the stomach and affect the digestive process. This is a hangover from our hunter–gatherer days and part of the fight-or-flight response — a physiological reaction to a perceived harmful event, attack or threat to survival.

When we're in a relaxed state, there is more energy for digestion. The speedier movements of our stomach and small bowel (intestines) facilitate better absorption of nutrients. But during stress, digestion and the movements in our stomach and small intestines slow down, while movements in our large bowel (or colon) increase. It's the increased movement in our large bowel that in some cases has us running to the toilet. Here's how that happens.

Brief history of experiments

We can thank two patients, who had very rare accidents, for our early understanding of what happens to the stomach when we're anxious and stressed.

In 1822, 19-year-old Alexis St Martin suffered a gun-shot wound to the stomach. He survived, but developed a permanent hole in his stomach that refused to heal. This hole extended to the outside skin of his abdomen.

While undoubtedly awful for Alexis, army doctor William Beaumont saw a unique opportunity. Beaumont used the hole as a window into the process of digestion, conducting experiments to better understand the inner workings of the gut, which included the impact of Alexis' emotional response on the stomach. When Alexis became angry, for instance, Beaumont noticed his digestion was impaired.

Further observations were carried out by doctor Stewart Wolf on another patient, Tom Little. In 1894, when he was nine years old, Tom drank something that severely damaged his oesophagus. He had a hole created in his

stomach for feeding. As with Alexis, Wolf observed Tom's stomach under periods of emotional stress. He found fear would make Tom's stomach turn white and a period of depression could virtually stop digestion.

Fight or flight and the gut

In the early 20th century, scientist Walter Cannon coined the term 'fight-or-flight response' after observing the reaction of animals in response to stressful events. He saw that when cats were acutely stressed, movement in their upper guts, including the stomach and small intestine, was markedly reduced.

This process involved two parts of our nervous system, known as the sympathetic and the parasympathetic. The sympathetic nervous system is activated during times of stress and puts the body on a war-like footing. The parasympathetic nervous system, on the other hand, acts like a brake. It promotes the 'rest and digest' response that calms the body down after the stress has passed, and helps conserve energy.

When we feel stressed, a region of the brain called the hypothalamus (which helps regulate emotions) produces the corticotropin releasing hormone (CRH) — the key hormone that activates the sympathetic system.

CRH can stimulate the release of another hormone — the adrenocorticotropic hormone (ACTH) — which then releases cortisol from the adrenal gland (found above the kidneys). Cortisol is an important hormone in the fight-or-flight response. It helps us get ready to fight or escape danger and can lead to slowing down the movement in our stomach.

This is thought to be an evolutionary mechanism as blood is diverted away from the stomach and small intestine to the skeletal muscles and lungs, preparing the body for defence. The movements of the stomach and small intestine as well as digestion accelerate again once the parasympathetic system is activated.

But it's different in the colon (large bowel). During periods of stress and anxiety, movement in the large bowel actually increases, though this is not caused by the sympathetic nervous system. It is actually those same parasympathetic system fibres that carry a 'rest-and-digest' response that are thought to deliver the signals to the colon. CRH can be transmitted down those fibres directly to the wall of the colon where it stimulates receptors to produce fluid and increases colonic movements.

This doesn't ordinarily lead to more poo or diarrhoea during acute stress because defecation requires a more complex and coordinated set of functions. But in some stressful situations, the pelvic nerve can be activated and directly stimulates neurons in the wall of the rectum. This then triggers increased rectal activity and defecation.

Functional dyspepsia?

We now have a way to work out what areas of the brain become active when the stomach is under stress. This is done through imaging the brain. Neuroimaging techniques can measure changes in blood flow in the brain and correlate these changes (or activations) to brain activity.

When a balloon is inflated in the stomach, stretching the stomach wall in healthy people to test its sensitivity, some areas of the brain such as the amygdala and insula that are involved in the processing of emotions become very active. In people with functional dyspepsia — a condition with symptoms such as pain or discomfort localised to the upper part of the abdomen in the absence of a physical cause — these brain areas may fail to deactivate.

Research in functional dyspepsia patients has found negative emotional memory can affect their brain activity.

If symptoms become abnormally severe and chronic it may be worth seeing a doctor to consider whether further investigations and treatment are required. If investigations such as endoscopy do not show any abnormalities then functional dyspepsia is a possible diagnosis. These patients are the ones most likely to experience upper abdominal symptoms provoked by stress and anxiety.

Strategies tailored to help with negative emotions and thoughts such as cognitive behavioural therapy can be beneficial.

Source: *The Conversation* (https://theconversation.com/au). Vincent Ho is a senior lecturer and academic gastroenterologist at Western Sydney University.

ACTIVITY 3.5 *continued*

1 What name is given to the abdominal discomfort or pain people may experience when anxious and stressed and what percentage experience it?

dyspepsia; 25%

2 According to the article, what happens to digestion when we are in a stressed state compared with a relaxed state?

When we are *stressed*, digestion and the movements in our stomach and small intestines slows down, while movements in our large bowel (or colon) increase. When we're *relaxed*, there is more energy for digestion. The speedier movements of our stomach and small bowel (intestines) facilitate better absorption of nutrients.

3 (a) The article describes 'experiments' conducted by two doctors which found that emotions can impair digestion. Explain why these are not true experiments.

Explanation should refer to absence of key features of experimental research e.g. no manipulation of variables (i.e. no IV), no comparison/control group, no random allocation to either of two conditions.

(b) Suggest a more appropriate name for the research method.

case study (or case history or clinical observation)

4 (a) Outline the article's description of the fight–flight response and the roles of different nervous system divisions.

The fight–flight response involves two parts of our nervous system: the sympathetic and parasympathetic nervous systems. The sympathetic nervous system is activated during times of stress and puts the body on a 'war-like footing' (get the body ready for fight or flight). The parasympathetic nervous system on the other hand, acts like a brake. It promotes the 'rest and digest' response that calms the body down after the stress has passed and helps conserve energy.

(b) Comment on the accuracy of the article's description.

Comment should demonstrate understanding that the description of fight–flight and respective roles of the sympathetic and parasympathetic systems are accurate.

However, the article also includes the HPA axis as part of fight–flight without explaining the circumstances when HPA is activated i.e. our body cannot maintain the intensity of fight–flight reactions for a prolonged period so a longer-lasting chain of reactions involving the HPA interactions is initiated.

ACTIVITY 3.5 *continued*

5 The article explains how researchers identify areas of the brain that become active when the stomach is under stress.

(a) Name a neuroimaging technique that can measure blood flow in the brain.

Example: PET/positron emission tomography

(b) Name the research method used to 'work out what areas of the brain become active when the stomach is under stress'.

correlational study/method

(c) Explain whether researchers using this method can establish a cause–effect relationship between the variables of research interest i.e. active brain area and stress.

Correlational research is used to identify and describe the 'co-relationship' between two (or more) variables of interest. No attempt is made to manipulate any variable, as in experimental research. Nor is there any random allocation to conditions. The researcher merely assesses the type and strength of relationship between the variables.

6 According to the article, why might you 'get the runs when you are stressed'?

Corticotropin releasing hormone (CRH) enters the walls of the large bowel, which increases movement and fluid production. In some cases, the pelvic nerve can be activated and directly stimulates neurons in the wall of the rectum, which can trigger increased rectal activity and defecation.

ACTIVITY 3.6

Explaining stress as a psychological process using the Lazarus and Folkman model

Read the following post by Susie.B on an online forum.

The Teen Advice Forum

Got a question? Need to pour your heart out? Get chatting here about all the stuff that matters…

High school = freaking out

SO I'm starting high school next week and I'm really freaking out. Whenever I think about it my heart starts beating fast, I can't sit still and I start sweating and I just generally feel like I'm going to burst! The work will be too hard for me, I'll probably get lost and then be late to class and then I'll get in trouble on my first day. No one will probably want to talk to me either and I'll be by myself at recess and lunch. Everyone will think I'm such a loser. I know I won't be able to deal with it.

How can I stop freaking out about school? Please help!

SUSIE.B

1 With reference to Lazarus and Folkman's Transactional Model of Stress and Coping, explain why Susie is experiencing stress.

Susie is experiencing stress because of the way she is *appraising* the stressor (school). According to Lazarus and Folkman, Susie has made a *primary appraisal*, which has one of three possible outcomes — irrelevant, benign–positive or stressful. The outcome of her primary appraisal is that the situation is STRESSFUL. She has then decided that the school situation poses a potential THREAT. As a consequence of going to school she believes she will get lost, receive a detention, be lonely and the source of others' ridicule. The outcome of her *secondary appraisal* is that she believes her coping abilities are inadequate to deal with this situation, so she is consequently experiencing STRESS.

2 Write a response to Susie based on the Lazarus and Folkman model that would help her reduce her stress.

The advice should suggest that Susie either think differently *about the stressor* and/or think differently about what *coping resources* she has and can draw on to help her deal with it. For example, for Susie to be able to reduce her stress about school, she needs to appraise it differently. When she undertakes the primary appraisal (i.e. when she first thinks about starting school), she could think about it differently at this point so that the outcome is either 'irrelevant' or 'benign–positive' instead of stressful. Susie doesn't know for sure that she is going to get lost (that might not happen), she might meet some other lovely girls, the work might not be as hard as she thinks, etc. However, even if Susie does appraise it as stressful and a threat, when she makes the secondary appraisal, she could think about all of the coping resources she has available to help her deal with this situation. If she is able to believe her coping abilities are in fact adequate to deal with this situation, she will not experience stress.

ACTIVITY 3.7

Sentence completion on the Transactional Model of Stress and Coping

Select terms from the shaded panel below to correctly complete the passage about Lazarus and Folkman's Transactional Model of Stress and Coping. A term can be used more than once but not all terms need to be used.

adequate	appraisal	benign–positive
challenge	conscious	environment
experimental	external	harm/loss
inadequate	individual	internal
irrelevant	object	objective
primary	psychological	secondary
subjective	threat	unconscious

1 According to Lazarus and Folkman, stress involves a 'transaction' between an individual and their environment.

2 When we make a secondary appraisal, we evaluate our ability to control or overcome the situation in which we find ourselves.

3 A primary appraisal about harm/loss involves evaluating how much damage has already occurred.

4 Stress is largely a product of an individual's appraisal of a stressor.

5 A primary appraisal about challenge involves an assessment of the potential for personal gain or growth from the situation.

6 One of the strengths of the Lazarus and Folkman model is that it focuses on psychological determinants of the stress response over which we have control.

7 If a primary appraisal results in the stressor being judged as irrelevant, then it will not have any positive or negative effect on a person's wellbeing.

8 One of three possible outcomes of a primary appraisal is for the stressor to be considered irrelevant and it then does not have any effect on a person's wellbeing.

ACTIVITY 3.7 *continued*

9 A person is likely to experience stress if their coping resources are perceived as being inadequate.

10 In a primary appraisal, we evaluate the significance of the event and whether anything is at stake in this encounter.

11 A threat appraisal involves an assessment of harm/loss that may not yet have occurred but could occur in the future.

12 One of the weaknesses of the Lazarus and Folkman model is that individuals may not always be conscious of all the factors causing them to experience a stress response.

13 A person's appraisal of a stressor is highly personal and therefore subjective.

14 A judgment that a stressor has good implications and is potentially beneficial means that the stressor has been appraised as benign–positive.

15 A limitation of the Lazarus and Folkman model is that is difficult to test through experimental research.

ACTIVITY 3.8

True/False quiz on strategies for coping with stress

Indicate whether each statement is true or false by writing T or F in the column at the right.

Statement	T or F
1 Distracting yourself with other activities is an example of an approach coping strategy.	F
2 A person is considered to be 'coping flexibly' if they are able to discontinue an ineffective coping strategy and implement an alternative one when required.	T
3 In order for a coping strategy to have 'context-specific effectiveness', it is important to consistently use the same type of coping strategies across different stressful situations.	F
4 Sleeping more than usual is an example of an avoidance coping strategy.	T
5 Exercise can help reduce muscle tension associated with elevated sympathetic nervous system activity.	T
6 A person is considered to have 'low coping flexibility' if they readily adjust their coping strategies because a particular strategy they are using is proving to be ineffective.	F
7 Approach coping strategies are generally considered to be more adaptive and effective than avoidance coping strategies.	T
8 Moderate physical exercise on a regular basis can significantly increase the risk of serious disease such as hypertension, stroke, digestive disorders and kidney disease.	F
9 Trying to find out more information to better understand an encounter with a stressor is an example of an approach coping strategy.	T
10 Avoidance coping strategies focus activity towards the stressor, whereas approach strategies focus activity away from the stressor.	F
11 'Coping flexibility' is considered to be an adaptive personality attribute.	T
12 Avoidance coping strategies can be more effective in coping with stress in the short-term than approach coping strategies.	T
13 Physical exercise will not have stress coping benefits when it takes time and effort.	F
14 A person is considered to have 'high coping flexibility' if they persist in the use of the coping strategies they deploy, even in the face of ineffectiveness.	F
15 Long-term use of approach coping strategies is associated with an increased vulnerability to mental health problems.	F
16 Approach coping strategies attempt to deal directly with a stressor, whereas avoidance coping strategies attempt to deal indirectly with a stressor.	T
17 Coping can be defined as the ability to identify unhelpful thinking patterns that may be affecting mental health and wellbeing.	F
18 'Coping flexibility' includes the ability to select a coping strategy that suits the situational circumstances.	T
19 Physical exercise when experiencing stress tends to increase the levels of stress hormones present in the bloodstream.	F
20 Avoidance coping strategies tend to be less effective in the long term than approach coping strategies because they do not actually solve the problem that causes the stress.	T

ACTIVITY 3.9

Evaluation of research on the effectiveness of a stress management training program

Researcher Mohsen Yazdani and his colleagues (2010) conducted research to determine the effectiveness of a stress management training program on levels of depression, anxiety and stress among nursing students.

There were 72 participants, with a mean age of 20.9 years. All were nursing students enrolled in a nursing and midwifery course at the University of Medical Sciences in Iran. The students were randomly allocated to one of two groups: Group 1 who received a stress management training program, or Group 2 who did not receive a stress management training program. In Group 1, 54.3% and 45.7% of the participants were female and male respectively. In Group 2, 57.6% were females and 42.4% males.

The stress management training program undertaken by Group 1 consisted of 8 x two-hour sessions, twice per week. The program had the following content:

1st session	Introduction session and providing information about the stress
2nd session	Familiarity with gradual muscle relaxation and its implementation with mental imagery
3rd session	Familiarity with the consequences and physical symptoms of the stress
4th session	Relaxation and imagery and training and diaphragm breathing practices
5th session	Linking thoughts and emotions and familiarity with congnitive errors
6th session	Discussion about relaxation exercises
7th session	Replacement of logical thoughts and personal stress management program
8th session	End of the stress management training program, completing the questionnaire

The researchers asked all participants to complete the Depression, Anxiety and Stress Scale (DASS) at three time points: (i) *before*, (ii) *immediately after*, and (iii) *one month after* completion of the stress management training program. The results of the questionnaire for both groups at each of these three time points are shown in the table below. All scores reported are mean scores on the DASS.

	Group 1			Group 2		
	Before	***After***	***4 Weeks***	***Before***	***After***	***4 Weeks***
Depression	10.63	6.03	4.69	9.34	9.08	6.02
Anxiety	7.60	5.09	4.39	7.88	10	7.82
Stress	13.39	8.93	5.96	12.82	13.17	10.40

Source: Yazdani, M., Rezaei, S., & Pahlavanzadeh, S. (2010). The effectiveness of stress management training program on depression, anxiety and stress of the nursing students. *Iranian journal of nursing and midwifery research*, *15*(4), 208–215.

ACTIVITY 3.9 *continued*

1 Formulate a research hypothesis for this experiment.

Example: Participating in an 8-week stress management training program will be effective in reducing levels of depression, anxiety and stress in nursing students.

2 Identify the operationalised independent and dependent variables.

independent variable: stress management program

dependent variable: scores on Depression, Anxiety and Stress Scale (at 3 points in time)

3 Identify a random allocation procedure that could have been used by the researchers.

Any procedure which ensures every participant has an equal chance of being selected for either group e.g. use of a random number generator, lottery method, coin tossing.

4 Explain why random allocation was used in this particular experiment with reference to a relevant variable.

Explanation should demonstrate understanding that random allocation was used to control individual participant differences that could become confounding variables because it helps ensure uniform distribution of participant variables across both groups e.g. pre-existing levels of depression, anxiety and stress; prior or current experience with stress management programs; motivation; work or exam obligations that could impact on adherence to the program

5 Identify the experimental and control groups and give a reason for each choice.

experimental group: Group 1 — received the 8-week stress management training course and were therefore exposed to the IV

control group: Group 2 – did not receive the stress management training and therefore no IV exposure

6 Identify the type of experimental design used.

independent groups

7 Summarise the results of the study as shown in the table.

The summary should refer to group differences at each of the three time points e.g.

- *Before* the intervention in depression, anxiety and stress mean scores in the two groups were roughly the same.
- *After* the intervention, the mean scores for anxiety, depression and stress respectively in Group 1 were 6.03, 5.09 and 8.93 and in the control group were 9.08, 10 and 13.17. The mean scores for Group 2 were therefore higher on all three dependent variable measures than for Group 1, suggesting that the program was effective.
- *One-month after*, the depression, anxiety and stress scores were all still higher for the control group who did not receive the intervention than they were for Group 1, who did receive the intervention. This suggests that the effects of the program were maintained at least 4 weeks after completion of the program.

8 Briefly state a conclusion about participation in a stress management program by nursing students.

The conclusion should be based on the results obtained from the research. Examples:

- According to the results of the study, participation in a stress management training program for nursing students is beneficial and can reduce their depression, anxiety and stress levels.
- According to the results of the present study, participation in a stress management training program for nursing students is beneficial and can improve their mental health in a number of ways.

ACTIVITY 3.10

Media analysis/response

Consider the following cartoon about stress and then answer the questions that follow.

Source: CartoonStock

1 Of the five sources of stress, which is the most likely source of Clarckson's stress? Explain your choice.

Most likely to be the *daily pressures* associated with his job. Explanation should refer to cumulative effects of daily pressures such as those associated with travel to and from work; tight/short work deadlines; amount of work; continual interruption during work (e.g. phone calls, emails, people talking to him, etc.); experiencing conflict with colleagues; job insecurity; concerns about the physical working environment that affect performance (e.g. excessive heat, cold or noise, inadequate lighting, uncomfortable seating, malfunctioning equipment, etc.).

2 What are three signs the company manager may have noticed that could indicate Clarckson was finding his job stressful?

Examples should refer to changes in thoughts, feelings and/or behaviour such as disinterest or loss of motivation; drop in work performance (e.g. slowness of task completion, loss of creativity or initiative); difficulties concentrating; an increase in sick days and absenteeism; mood swings and irritability; aggression; anxiety; isolation or being withdrawn; tearful; fatigue/tiredness/low energy; impatience; problems with interpersonal relationships; health complaints (e.g. increased heart rate, increased breathing rate, nausea, headaches, muscle tension, tiredness).

3 Suppose that Clarckson recently completed an important project for his manager that involved long hours over a 12-day period. During his first weekend off, he developed the flu and could not enjoy his time away from work. Explain why Clarckson was vulnerable to the flu with reference to Selye's General Adaptation Syndrome.

Clarckson's vulnerability to the flu after completing the project is consistent with GAS theory. While completing the project, it is likely that Clarckson was in the GAS Stage 2: Resistance, so his body's resistance to the particular stressor was above normal. However, because cortisol also weakens the immune system, its continuing presence interfered with his body's ability to protect itself against other stressors, such as illness and disease. Consequently, soon after completing the project, it failed to respond effectively to the flu virus, a new stressor that entered the body.

4 How realistic is the manager's suggestion that Clarckson could die from work-related stress? Explain your answer with reference to Selye's General Adaptation Syndrome.

The suggestion is realistic. If Clarckson's stress persists at a very high level and he does not use any effective strategies for coping with his stress, he could enter 'Stage 3: Exhaustion' of the GAS. This stage is characterised by extreme fatigue, high levels of anxiety, and symptoms of depression, nightmares and physical disorders such as hypertension and heart disease. According to the GAS, in extreme cases, if stress continues further, it is possible for organisms to die.

5 Suggest two possible strategies Clarckson could use for coping with his work-related stress and state whether each strategy involves approach or avoidance.

Examples:

- engage in regular physical exercise (approach)
- complete stress management training (approach)
- learn/adopt effective time-management strategies (approach)
- seek social support from friends and family (approach)
- seek advice from a professional e.g. psychologist (approach strategy)
- arrange a meeting with the manager boss to discuss and address concerns about workload (approach)
- speak to the IT department (or other relevant departments) about issues with the working environment and equipment (approach)
- pretend everything is fine (avoidance)
- listen to music and/or practice meditation/relaxation techniques (avoidance)
- sleep more than usual (avoidance)
- resign and seek another job (approach strategy as it solves the problem but could introduce other stressors).

ACTIVITY 3.11

Matching exercise on stress concepts

Match each description with the most appropriate term on the right. Write the letter of the term you select to the left of each description.

(t)	**1** A brain structure that receives a message from the amygdala to activate fight–flight–freeze.	**(a)** distress
(j)	**2** The three-stage physiological response to stress that occurs regardless of the type of stressor that is encountered.	**(b)** life event
(a)	**3** A negative psychological response to a stressor.	**(c)** adrenaline
(f)	**4** Name of the initial appraisal made in the Lazarus and Folkman's Transactional model.	**(d)** fight–flight–freeze response
(k)	**5** A coping strategy that can reduce the level of stress hormones.	**(e)** secondary appraisal
(n)	**6** An everyday life irritant that can be a stressor.	**(f)** primary appraisal
(b)	**7** A type of stressor involving change that forces an individual to adapt to new circumstances.	**(g)** acculturative stress
(p)	**8** Making an effort to escape from having to deal with a stressor.	**(h)** eustress
(m)	**9** A hormone secreted from the adrenal cortex in response to a stressor.	**(i)** resistance
(l)	**10** A stimulus that causes or produces stress, or challenges our ability to cope.	**(j)** General Adaptation Syndrome
(o)	**11** The ability to effectively adjust one's coping strategies according to the demands of different stressful situations.	**(k)** physical exercise
(d)	**12** An involuntary physical reaction that prepares the body to deal with a sudden and immediate threat.	**(l)** stressor
(h)	**13** A positive psychological response to a stressor.	**(m)** cortisol
(s)	**14** The third stage of the General Adaptation Syndrome.	**(n)** daily pressure

ACTIVITY 3.11 *continued*

(q)	**15** An event that is extraordinarily stressful for almost everyone who experiences it.	**(o)** coping flexibility
(r)	**16** Making an effort to confront a stressor and deal directly with it and its effects.	**(p)** avoidance coping
(g)	**17** The stress people experience when trying to adapt to a new culture.	**(q)** major stressor
(e)	**18** Name of the second appraisal made in Lazarus and Folkman's Transactional model.	**(r)** approach coping
(c)	**19** A hormone secreted by the adrenal gland in response to a stressor.	**(s)** exhaustion
(i)	**20** The second stage of the General Adaptation Syndrome.	**(t)** hypothalamus

ACTIVITY 3.12

Crossword on concepts and terms in stress as a psychological process

Across

1 In Selye's GAS, rebound from the temporary state of shock following exposure to a stressor during the alarm reaction stage.
3 In the Transactional Model, this determines whether or not someone experiences stress.
5 Negative psychological response to a stressor.
7 In the Transactional Model, one of the three possible decisions about an event during a primary appraisal.
9 Second stage of Selye's GAS.
12 This network consists of the hypothalamus, the pituitary gland, and the adrenal glands.
14 People can do this to deal with the buildup of stress and help the body return to normal functioning.
15 A hormone that energises the body when stressed but also has an anti-inflammatory effect and can be an immune system suppressant.
16 This type of coping strategy involves an effort to confront a stressor and deal directly with it.
17 Explains stress from a psychological perspective.
19 A neurotransmitter that has the same effects as adrenaline.
20 Subdivision of the nervous system that calms the body after fight or flight reactions.
22 Third stage of Selye's GAS.

Down

2 When a threat is perceived, a signal is sent to this part of the brain via the amygdala.
4 Stress that is long lasting.
6 Positive psychological response to a stressor.
8 In the Transactional Model, the response likely to occur when the coping demands of the situation are perceived as being far greater than the coping resources that are available.
10 The ability to change a coping strategy to suit the demands of a specific stressful situation.
11 An automatic, involuntary, physical response to a threat which is characterised by minimal movement in order to avoid detection.
13 A hormone secreted from the adrenal medulla.
18 Subdivision of the nervous system that provides the body with a burst of energy so that it can respond to perceived dangers.
21 This type of coping strategy involves no attempt to actively confront the stressor.

1 COUNTERBLOCK
2 HYPOTHALAMUS
3 APPRAISAL
4 CHRONICSTRESS
5 DISTRESS
6 EUSTRESS
7 IRRELEVANT
8 STRESSORS
9 RESISTANCE
10 COPING
11 FREE
12 HIPPOCAMPUS
13 AXIS
14 EXERCISE
15 CORTISOL
16 APPROACH
17 TRANSACTIONAL MODEL
18 SYMPATHETIC
19 EPINEPHRINE
20 PARASYMPATHETIC
21 AVOIDANCE
22 EXHAUSTION

ACTIVITY 3.13

True/False quiz on stress as a psychobiological process

Indicate whether each item is true or false by writing T or F in the blank column.

Statement	T or F
1 Stressors are events that produce challenges.	T
2 Stressors tend to increase activity in the immune system, thereby making people more vulnerable to disease.	F
3 Stress may be defined as an unpleasant or unwanted experience that cannot be controlled.	F
4 The Transactional Model of Stress and Coping proposes that stress is a product of each individual's appraisal of a stressor and their ability to cope with it.	T
5 When a threat is perceived, the amygdala signals the sympathetic nervous system to activate the fight–flight–freeze response.	F
6 The fight–flight–freeze response is a pattern of involuntary biological processes that occur in much the same way in all individuals in response to certain types of stressors.	T
7 The General Adaptation Syndrome is a three-stage physiological response that occurs in much the same way in all individuals in response to certain types of stressors.	F
8 Coping involves efforts to deal with the source of stress or to control reactions to stress.	T
9 If stress continues for a long period of time, a person enters the third stage of the General Adaptation Syndrome called resistance.	F
10 Psychological factors determine whether a situation or event is experienced as eustress or distress.	T
11 Eustress is not considered to be harmful or damaging to the body.	T
12 A catastrophic event could be classified as a major stressor if it is extraordinarily stressful or disturbing for almost everyone who experiences it.	T
13 Adrenaline is secreted by the adrenal cortex in the adrenal glands, whereas cortisol is secreted by the adrenal medulla.	F
14 Hypervigilance is an initial behavioural response commonly associated with a stressor that causes fear and the person 'freezes' rather than 'fighting' or 'fleeing'.	T
15 One effect of an excessive amount of cortisol in the blood over a prolonged time is enhanced immune system functioning, resulting in increased ability to combat disease.	F
16 Acculturative stress involves the psychological impact of adaptation to a new culture.	T
17 A coping strategy will have context-specific effectiveness when the specific strategy that is used suits the stressful situation.	T
18 Avoidance coping strategies attempt to deal directly with a stressor, whereas approach coping strategies deal with it indirectly.	F
19 The Transactional Model of Stress and Coping proposes that stress is a product of each individual's appraisal of a stressor and their ability to cope with it.	T

ACTIVITY 3.13 *continued*

Statement	T or F
20 Any sustained physical exercise such as running, swimming or cycling may help alleviate stress-related symptoms.	T
21 The initial stage of the General Adaptation Syndrome involves a temporary state of counter shock followed by a rebound with a shock reaction that activates mobilisation of bodily resources to combat the stress.	F
22 Adrenaline is a neurohormone that also occurs as a neurotransmitter called epinepherine.	T
23 A life event that forces an individual to adapt to new circumstances may become a stressor.	T
24 According to the Transactional Model of Stress and Coping, a primary appraisal involves an evaluation of our ability to control or overcome the situation in which we find ourselves.	F
25 One effect of cortisol is to energise the body by increasing blood sugar and enhancing metabolism.	T

CHAPTER 4

Neural basis of learning and memory

	Activities								
Key knowledge	**4.1**	**4.2**	**4.3**	**4.4**	**4.5**	**4.6**	**4.7**	**4.8**	**4.9**
• neural plasticity and changes to connections between neurons (including long-term potentiation and long-term depression) as the fundamental mechanisms of memory formation that leads to learning	✔	✔	✔	✔				✔	✔
• the role of neurotransmitters and neurohormones in the neural basis of memory and learning (including the role of glutamate in synaptic plasticity and the role of adrenaline in the consolidation of emotionally arousing experiences).					✔	✔	✔	✔	✔
Key science skills				✔					

Source: VCE Psychology Study Design extracts © VCAA; reproduced by permission.

ACTIVITY 4.1

An overview of neural plasticity

Select terms from the shaded panel below to correctly complete the passage about neural plasticity and changes to connections between neurons. Each term can be used only once.

activated	adapt	adults	brain	changes
complex	connectivity	damage	development	elasticity
embryonic	experience	experiences	function	genetically
language	learn	learning	lifespan	memory
more	motor	networks	neural	physiological
plastic	plasticity	responsive	sensory	shape
simple	structural	think	tissue	younger

Neural plasticity is the ability of the brain's neural structure or function to be changed by experience throughout the lifespan. This may involve a single neuron, a pair of neighbouring neurons or entire networks of neurons. This property of the brain provides the physiological basis of learning and memory. It means the brain can continually respond to environmental input enabling us to adapt to life's ever-changing circumstances.

Neural plasticity is facilitated by the neuron's ability to change its shape, size, function and connectivity with other neurons. These changes are influenced by the interaction of biological processes that are genetically determined and also by everyday life experiences. Neural plasticity is a feature that persists from embryonic development through to old age. It accounts for our acquisition of language as a toddler, learning to play sport as a teenager, developing job skills as an adult and learning to use a new mobile phone in old age.

When we learn a new skill or form a new memory, brain tissue structurally alters to reflect that experience. The more we practice a skill or think about a concept, the more frequently neurons associated with that action will become activated, forming and strengthening relevant neural pathways. This is the fundamental neural mechanism of learning and memory.

Some parts of the brain like the sensory and motor cortices show higher levels of plasticity than others. Similarly, the brains of younger individuals appear to be more plastic than that of adults, particularly at specific times in development when the brain is more responsive to certain types of experiences. Acquisition of language as a toddler is a good example of this. Similarly, infants tend to recover more quickly from brain damage than adults due to greater plasticity of their brain.

Generally, the more complex an experience is in terms of the variety of sensory inputs, the more distinctive the structural changes that will occur in brain tissue involved in that experience.

ACTIVITY 4.2

Long-term potentiation (LTP) and long-term depression (LTD)

(a) Complete the table that follows by listing each of the following LTP and LTD features under the correct heading.

- Gradually strengthens a presynaptic and postsynaptic neural connection.
- The strengthening of a synaptic connection is long lasting.
- The weakening of a synaptic connection is long lasting.
- Decreases the efficiency of transfer of information along a neural pathway.
- Triggered by high intensity stimulation at the synapse.
- Increases the efficiency of transfer of information between a presynaptic and postsynaptic neuron.
- Increases the efficiency of transfer of information along a neural pathway.
- Makes the postsynaptic neuron less likely to fire following stimulation by the presynaptic neuron.
- Increased synaptic excitability.
- Heavy simultaneous activity occurs in adjacent presynaptic and postsynaptic neurons at the synapse.
- Gradually weakens a presynaptic and postsynaptic neural connection.
- Makes the postsynaptic neuron more likely to fire following stimulation by the presynaptic neuron.
- Decreased synaptic excitability.
- Communication across the synapse is silenced.
- Triggered by lack of stimulation at the synapse.
- Decreases the likelihood that what has been learnt will be forgotten.
- Increases the likelihood that what has been learnt will be forgotten.

Long-term potentiation (LTP)	Long-term depression (LTD)
• Gradually strengthens a presynaptic and postsynaptic neural connection. • The strengthening of a synaptic connection is long lasting. • Triggered by high intensity stimulation at the synapse. • Increases the efficiency of transfer of information between a presynaptic and postsynaptic neuron. • Increased synaptic excitability.	• The weakening of a synaptic connection is long lasting. • Decreases the efficiency of transfer of information along a neural pathway. • Makes the postsynaptic neuron less likely to fire following stimulation by the presynaptic neuron. • Gradually weakens a presynaptic and postsynaptic neural connection. • Decreased synaptic excitability.

Long-term potentiation (LTP)	Long-term depression (LTD)
• Heavy simultaneous activity occurs in adjacent presynaptic and postsynaptic neurons at the synapse. • Makes the postsynaptic neuron more likely to fire following stimulation by the presynaptic neuron. • Increases the likelihood that what has been learnt will be forgotten.	• Communication across the synapse is silenced. • Triggered by lack of stimulation at the synapse. • Decreases the likelihood that what has been learnt will be forgotten.

(b) Although they have opposite effects in terms of neural plasticity, LTP and LTD also have several features in common. List four of these in the box below.

Features common to LTP and LTD
• both are activity dependent (i.e. more or less activity) • both involve glutamate (but in different amounts) • both involve glutamate receptor sites • both lead to changes in excitability

Features common to LTP and LTD
• both are long-lasting effects
• both are forms of long-lasting neural plasticity
• both cause changes to the synapse
• both are involved in learning and memory (but the role of LTD is less clear)

(c) Paul is studying VCE Psychology and decides to rote learn some key definitions. One of the terms he decides to practise is the definition of 'reuptake'. This was a new word that he had never previously seen or heard. At first, Paul could not remember what the term meant even though he had checked the definition previously in his textbook. However, over time and with practice, Paul began to remember its meaning. Eventually, after a few days Paul could remember the full definition precisely.

Apply your understanding of **neural plasticity** to describe and explain the likely changes in Paul's brain at a **neuronal level** that enabled him to learn and remember the correct definition. In your response, ensure you refer to **long-term potentiation** and **changes in the synapse**.

- Initially, Paul has no neural circuit representing the definition of the word 'reuptake' because it is a new term with which he has no previous experience (i.e. not learnt).
- When Paul reads the definition in his textbook, neural circuits become activated as he thinks about the meaning of the word 'reuptake' and other words associated with its definition that are already stored in memory. At this stage the connections between pre- and postsynaptic neurons involving the new group of words to be associated, learned and remembered are very weak because they have only been activated a few times.

- As Paul continues to repeat the definition and practices writing it out, the neural circuit(s) associated with the concept of reuptake and its definition will be repeatedly and consistently activated at a high intensity. This repeated activation of pre- and post-synaptic neurons gradually strengthens synapses within the relevant neural circuit (and as levels of glutamate increase).
- The result is long-term potentiation and therefore change in the synapse through long-term strengthening of synaptic connections, including the ability of pre- and postsynaptic neurons within the circuit to communicate with one another, and increased sensitivity to any activation of the presynaptic neuron within the neural circuit associated with the word and its definition.
- This ability of the synapse to change over time by forming and strengthening new connections is referred to as synaptic plasticity. In Paul's case, the change is likely to be stable and long lasting, especially if the relevant neural circuit and synapses are re-activated through repeated study and therefore use.

ACTIVITY 4.3

Hebb's rule and long-term potentiation

Canadian psychologist Donald Hebb is credited with discovering that learning involves the establishment and strengthening of neural connections at the synapse. He suggested that as learning takes place, neural networks form by gradually strengthening communication between neurons through repeated activation. This explanation can be summarised as 'neurons that fire together, wire together', which is exactly the same kind of association mechanism as long-term potentiation.

Under the diagram on page 125, show how the process of long-term potentiation (LTP) can strengthen the synapse between neurons A and C (but not between B and C), by cutting out the following five panels with text and pasting them in the correct sequence.

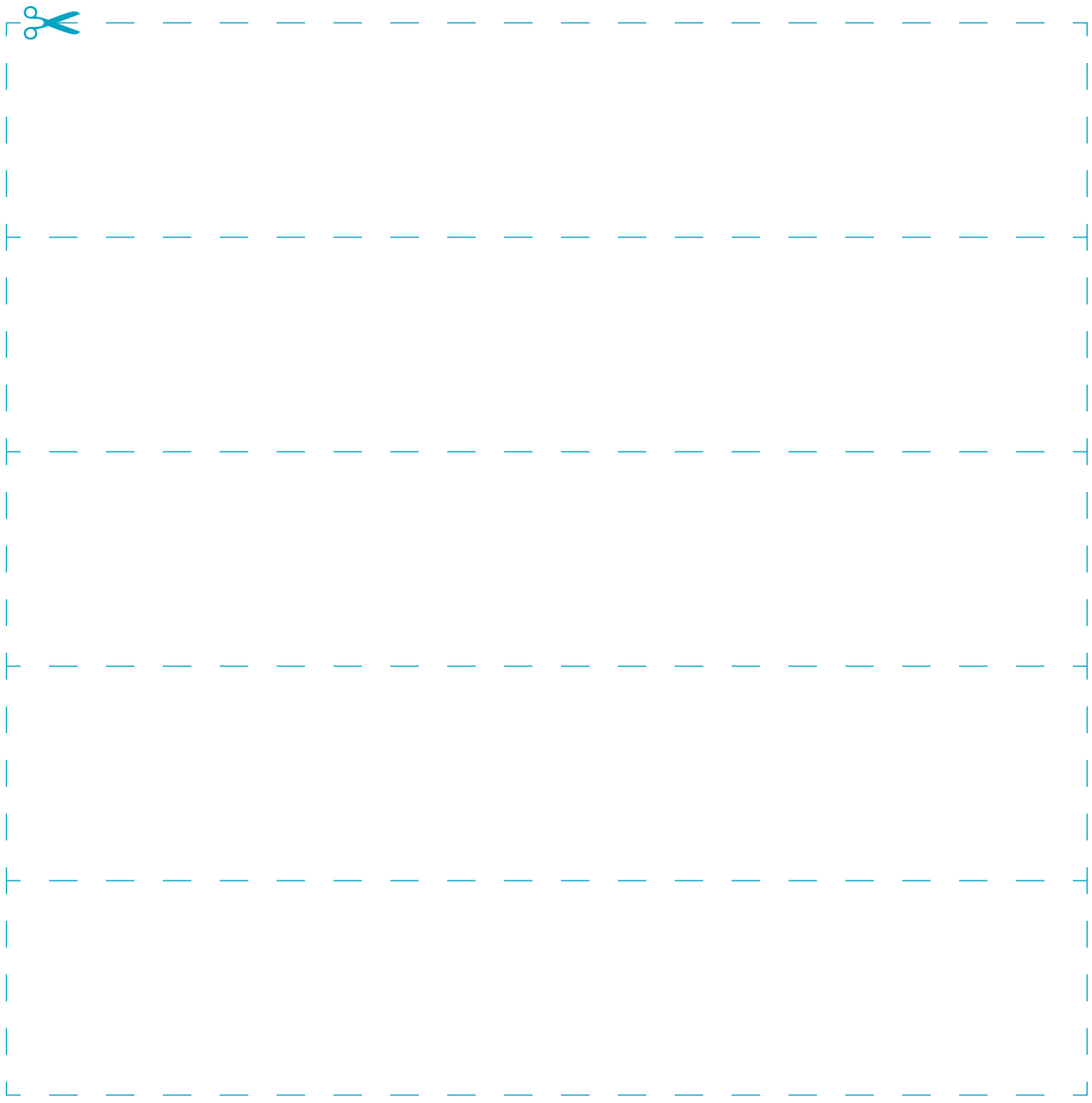
Repetition of the learning experience (e.g. through practice) is now more likely to reactivate neurons A and C by releasing excitatory neurotransmitter glutamate into the synaptic gap. Meanwhile, the synapse between B and C might only seldom activate or not activate at all.

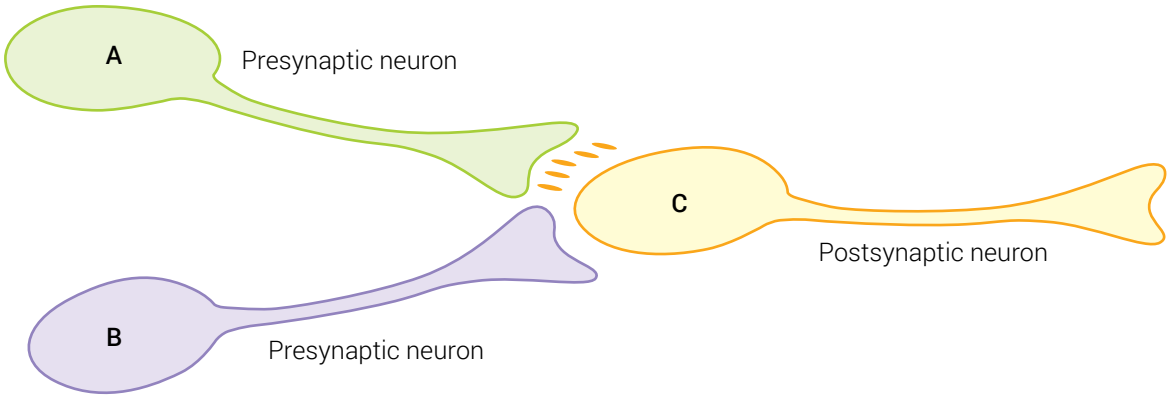
The increase in glutamate combined with repeated activation now makes the postsynaptic neuron C more responsive to any level of activation by presynaptic neuron A. The sensitivity of neuron C to neuron B, however, remains low due to lack of stimulation.

The new learning experience activates neurons A and C but not B. This initial activation of presynaptic neuron A and postsynaptic neuron C slightly increases the possibility that they will fire together next time when the same experience occurs.

Over an extended period of time and with repeated activation, the neural circuit containing synapse A to C becomes stable and long lasting. This circuit represents the learning as a memory and is now the one most likely to activate in the future when the memory of what was learnt is needed.

The synaptic connections between neurons A to C and B to C are equally as weak because neither synapse has been stimulated prior to the new learning experience.





1 The synaptic connections between neurons A to C and B to C are equally as weak because neither synapse has been stimulated prior to the new learning experience.

2 The new learning experience activates neurons A and C but not B. This initial activation of presynaptic neuron A and postsynaptic neuron C slightly increases the possibility that they will fire together next time when the same experience occurs.

3 Repetition of the learning experience (e.g. through practice) is now more likely to reactivate neurons A and C by releasing excitatory neurotransmitter glutamate into the synaptic gap. Meanwhile, the synapse between B and C might only seldom activate or not activate at all.

4 The increase in glutamate combined with repeated activation now makes the postsynaptic neuron C more responsive to any level of activation by presynaptic neuron A. The sensitivity of neuron C to neuron B, however, remains low due to lack of stimulation.

5 Over an extended period of time and with repeated activation, the neural circuit containing synapse A to C becomes stable and long lasting. This circuit represents the learning as a memory and is now the one most likely to activate in the future when the memory of what was learnt is needed.

ACTIVITY 4.4

Evaluation of research on long-term potentiation

Evidence for the roles of LTP and LTD in learning and memory initially came from animal studies. For example, both LTP and LTD were discovered in experiments using anaesthetised rabbits. Evidence has also come from studies using mice.

One well-known experiment with mice was influenced by research findings that drugs which enhance transmission of information across the synapse also tend to enhance learning and memory. NMDA (N-methyl-D-aspartate) is a neurotransmitter receptor found on the dendrites of neurons, particularly neurons in the hippocampal region. NMDA is specialised to receive glutamate and, together with glutamate, is believed to have an important role in LTP. Without NMDA at the glutamate receptor site, any message carried in glutamate cannot be 'accepted' by a postsynaptic neuron. Moreover, NMDA helps to strengthen the connection between two neurons that happen to be active at the same time. As theorised by Hebb, such strengthening is the basis for learning and memory.

Evidence that the NMDA glutamate receptors are involved in LTP led American psychologist Joseph Tsien to investigate whether he could influence learning and memory by manipulating the capability of NMDA in postsynaptic neurons during learning tasks. Tsien (2000) used genetic engineering to produce a strain of mice that had more efficient NMDA receptors. When tested on various learning and memory tasks, these mice performed better on all tasks than did normal unaltered mice. For example, they outperformed the normal mice in maze learning and object recognition tasks. They also showed significantly better memory when tested a day or more later.

Although LTP has been recorded in the brains of higher order animals and human research participants during learning and memory, the role of LTP in complex forms of learning in humans continues to be investigated. Generally, it is now widely accepted that LTP is necessary for learning and memory and that NMDA receptors are necessary for the changes at the synapse assumed to underlie learning and memory. However, this does not mean that other biological processes, as well as psychological processes, are of lesser importance in learning and memory. Tsien's results also highlight the importance of *both* the neurotransmitter and the receptor in the neurotransmission process. The effects of a neurotransmitter are not entirely caused by the chemical. Its effects are also due to the receptor to which the neurotransmitter binds.

In Tsien's experiment, the 'smart' (genetically altered) mice were exposed to two objects: one that they had explored previously and one that was new. Like other mammals, mice prefer to explore new objects more than familiar ones. The 'smart' mice explored the new object (red top) more than the original object (orange top), even when several days had passed since the first session. The unaltered mice explored the new object more than the familiar one only when a shorter period of time had elapsed. To Tsien, this was evidence that the 'smart' mice remembered the original object for longer than did the unaltered mice.

Source: Peter Murphy

ACTIVITY 4.4 *continued*

1 Formulate a research hypothesis for Tsien's experiment.

Example: Mice with more efficient NMDA receptors will perform better on maze learning and object recognition tasks than will normal unaltered mice.

2 Identify the operationalised independent and dependent variables.

independent variable: change in NMDA receptors i.e. genetically engineered/unaltered NMDA receptors

dependent variable: performance on maze learning and object recognition tasks

3 Identify the experimental and control groups.

experimental group: genetically engineered mice/mice with more efficient NMDA receptors

control group: normal unaltered mice

4 Explain whether the results support the hypothesis.

Explanation should demonstrate understanding that when tested on various learning and memory tasks, the genetically engineered mice in the experimental group performed better on all tasks than did mice in the control group. Therefore, the results support the hypothesis that mice with more efficient NMDA receptors will perform better on maze learning and object recognition tasks than will normal unaltered mice.

5 Explain how Tsien's results highlight the importance of *both* the neurotransmitter and the receptor in the neurotransmission process.

Tsien's independent variable involved manipulation of the NMDA receptors for glutamate in experimental group mice. The improved performance of these mice showed that the effects of glutamate are not entirely caused by the neurotransmitter. Its effects were also found to be due to the NMDA receptor to which the glutamate binds.

6 Explain two limitations in generalising the results of the experiment to non-human animals.

Limitations include:

- generalising about human learning and memory from the results of a mouse experiment (e.g. complexity of the human nervous system and its functioning compared to that of a mouse, especially in relation to a higher order mental function)
- the genetic engineering process may have caused another molecule(s) in addition to NMDA receptors to have exerted an unexpected and unwanted effect that occurred independently of glutamate and/or LTP
- other receptors at the glutamate receptor site are also known to influence glutamate binding in an important way (e.g. AMPA receptors) and their action may have been unintentionally altered to some extent by changing the action of NMDA receptors (e.g. they may have exerted more or less influence than normally occurs, but in a way that influenced the observed target behaviours)
- the maze learning and object-recognition tasks assess specific types of memory
- difficulties in establishing a cause–effect relationship in the learning and memory experiments as synaptic change at the neuronal level was not actually observed, instead inferred (assumed) to have occurred.

7 Explain two ethical considerations that would have prevented Tsien from conducting his experiments with human participants.

Relevant ethical considerations include:

- ensuring participant wellbeing is protected e.g. Safeguarding the wellbeing of human research participants before, during and following their involvement in the research is vital. Tsien's genetic engineering procedure and its potential consequences carried unacceptable welfare risks.
- ensuring beneficence e.g. potential benefits to participants or the wider community did not outweigh the risks to participant wellbeing.

8 Give two practical advantages, other than overcoming ethical constraints, of animal use in psychological research.

Advantages include:

- Some studies cannot be conducted with humans because suitable human participants are unavailable.
- Bodily systems and/or behaviours of some animals are similar to those of humans; therefore, using animals can be a 'starting point' for learning more about human behaviour.
- Animals have practical advantages over people for use as research participants e.g. can be kept for long periods of time in captivity in laboratories, making it easier to observe their behaviour under these conditions, rats produce a new generation every three months and can be used to study the development of certain behaviours over successive generations within a relatively short period of time.
- The behaviour of animals can usually be controlled to an extent not possible with human participants e.g. knowledge of prior experience in a controlled environment when raised from birth.
- When certain experiments require large numbers of participants who have, for example, the same genetic background, animals are more easily obtained than humans.
- No participant expectations to control.

ACTIVITY 4.4 *continued*

9 Explain the meaning of long-term potentiation and its relevance to learning and memory.

- long-term potentiation (LTP): long lasting strengthening of synaptic connections of neurons, resulting in enhanced or more effective functioning of the neurons whenever activated
- relevance: facilitates representation in memory of newly learnt information (i.e. the memory may actually be produced during the LTP process of strengthening synaptic connections) and enhanced functioning of neurons that form the memory circuit; these synaptic connections (and therefore memories) can be made stronger or weaker depending on when and how often they have been activated in the past; active connections tend to get stronger (and the memory longer lasting), whereas those that aren't used get weaker and can eventually disappear entirely (so that the memory is lost i.e. forgotten).

ACTIVITY 4.5

Comparing neurotransmitters and neurohormones

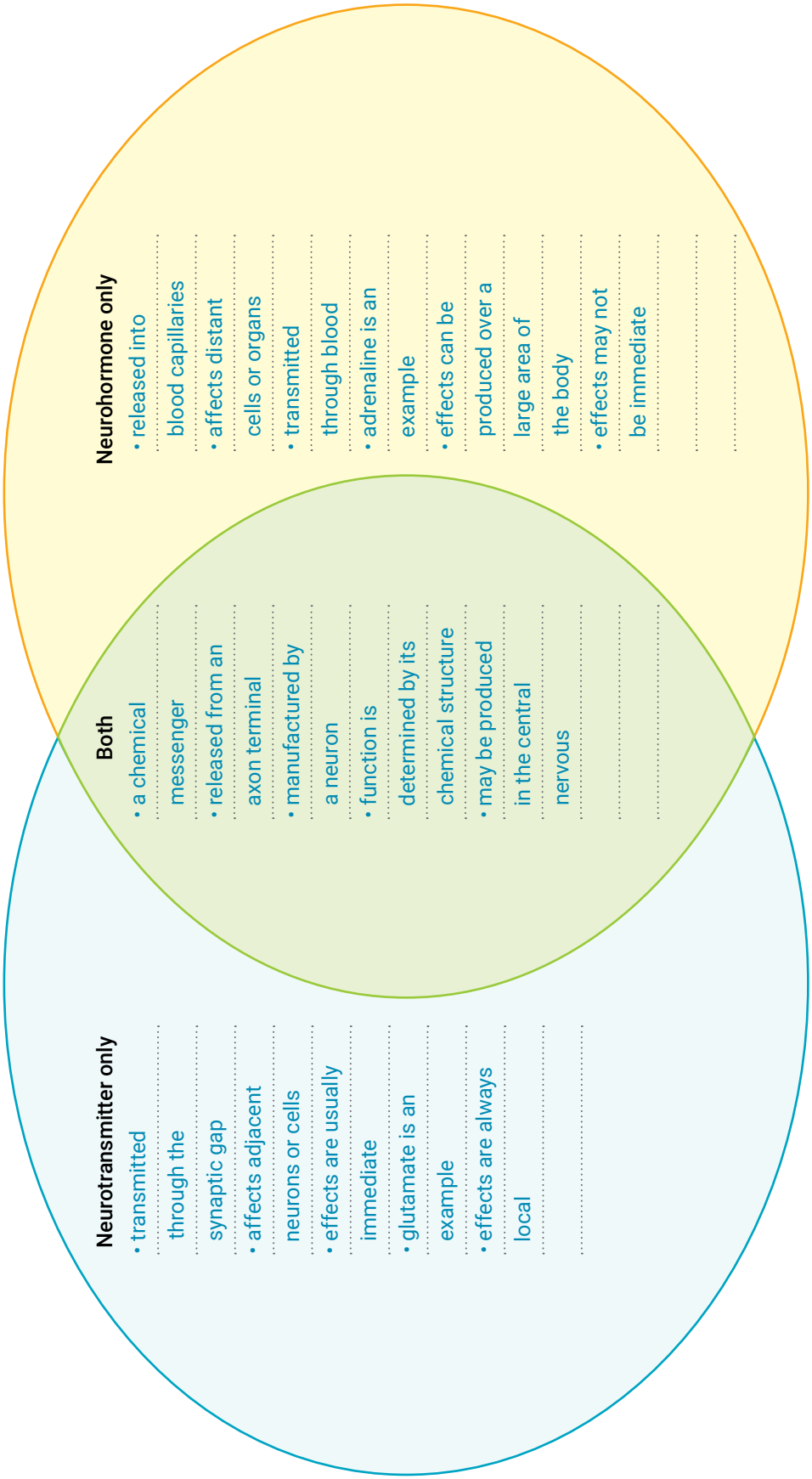
(a) Define the following terms.

neurotransmitter: a chemical substance manufactured by a neuron that carries a message to other neurons or cells in muscles, organs or other tissue

neurohormone: a chemical messenger manufactured by a neuron that is released into the bloodstream and carried to target neurons or cells

(b) Although neurotransmitters and neurohormones have distinct functional differences, they also have some features in common. Complete the Venn diagram on the next page by placing the following statements about neurotransmitters and neurohormones in the correct sections.

a chemical messenger	transmitted through the synaptic gap
released from an axon terminal	affects adjacent neurons or cells
released into blood capillaries	affects distant cells or organs
effects are usually immediate	manufactured by a neuron
transmitted through blood	adrenaline is an example
effects can be produced over a large area of the body	function is determined by its chemical structure
glutamate is an example	effects may not be immediate
effects are always local	may be produced in the central nervous


Neurohormone only
• released into blood capillaries
• affects distant cells or organs
• transmitted through blood
• adrenaline is an example
• effects can be produced over a large area of the body
• effects may not be immediate
Both
• a chemical messenger
• released from an axon terminal
• manufactured by a neuron
• function is determined by its chemical structure
• may be produced in the central nervous
Neurotransmitter only
• transmitted through the synaptic gap
• affects adjacent neurons or cells
• effects are usually immediate
• glutamate is an example
• effects are always local

ACTIVITY 4.6

Summarising the role of adrenaline in the consolidation of emotionally arousing experiences

Select terms from the shaded panel below to correctly complete the passage about the role of adrenaline in the consolidation of emotionally arousing experiences. A term should be used only once but not all terms need to be used.

adrenaline	amygdala	arousing	blood	consolidation
detail	disruption	durability	emotions	epinepherine
gradually	heightened	hippocampus	immediately	locally
long-lasting	long-term	more	neurons	neurotransmitters
noradrenaline	significant	stable	storage	strengthened
stress	temporarily	thirty	time	

Consolidation is the biological process of making a newly formed memory ..... stable ..... and enduring after learning. New information is ..... temporarily ..... stored in short-term memory before it is transferred to ..... long-term ..... memory for more permanent storage. The ..... hippocampus ....., which is located deep within the brain, plays a crucial role in the ..... consolidation ..... of most of our memories, helping ensure they are ..... long-lasting ..... memories (but it is not the long-term storage location).

The consolidation process occurs ..... gradually ..... and is vulnerable to ..... disruption ..... for at least ..... thirty ..... minutes following learning. Because consolidation is ..... time ..... dependent, the process is exposed to various factors that can influence the strength and ..... durability ..... of the memory being formed.

One such factor involves the ..... stress ..... hormones that are released during emotionally ..... arousing ..... experiences, including both pleasant and unpleasant events. Two of these hormones, called adrenaline and noradrenaline, may be produced and secreted by ..... neurons .....

When this occurs, they are called neurohormones and are released into circulation to reach target brain regions

via the blood. Both adrenaline and noradrenaline can also be secreted by neurons as neurotransmitters. When this occurs, they are called epinepherine and norepinephrine and are released locally within brain regions as a response to stress.

The amygdala, which is located near the hippocampus, has a crucial role in processing emotions, at least for their intensity. When adrenaline is released during heightened emotional arousal, it can induce the release of noradrenaline in the amygdala. The presence of noradrenaline during consolidation may then activate the amygdala to signal to the hippocampus that the explicit details of the experience are significant and its long-term storage should be strengthened. The more emotionally arousing the event is to the individual, the longer lasting its memory is likely to be and the more detail that is likely to be recalled later.

ACTIVITY 4.7

How adrenaline can enhance the consolidation of long-term memories of emotionally arousing experiences

Consider the image below showing a person skydiving for the first time.

Explain why this experience is more likely to be remembered in detail by this individual.
Your response must include key structures of the brain involved and the role of adrenaline as a neurohormone.

Explanation should demonstrate understanding that:

1. Skydiving/jumping out of the aeroplane for the first time is an emotionally arousing experience e.g. very frightening, anxiety-laden, stressful and/or exhilarating.

2. This type of event will initiate a high level of physiological arousal (as per fight–flight in response to a threat or stressor) that will include secretion of the neurohormone adrenaline into the bloodstream.

3. Adrenaline can induce the release of noradrenaline in the amygdala; the amygdala has a crucial role in processing emotions associated with the skydiving event and primary roles in the formation and storage of memories associated with emotional events e.g. greater emotional arousal associated with an event enhances a person's retention and recollection of the conscious explicit details of the emotional event.

ACTIVITY 4.7 *continued*

4. Noradrenaline within the amygdala following heightened emotional arousal activates the amygdala to signal the hippocampus that the explicit details of the experience are significant and long-term storage should be strengthened e.g. explicit details may include information about the weather that day, the name of the instructor, clothing colours, how long the experience lasted etc.; the hippocampus has a crucial role in the consolidation of the new memory so that it is stable and enduring.

5. The result of the interaction between the amygdala and hippocampus is that consolidation of the memory is enhanced and emotional details (via the amygdala) and explicit details (via the hippocampus) are stored as an enduring long-term memory.

ACTIVITY 4.8

Crossword on concepts and terms in the neural basis of learning and memory

Across

1 A chemical messenger secreted from an axon terminal into the bloodstream for carriage to a target neuron or cell.

3 The ability of a synapse to change over time through use or disuse.

9 The ability of the brain's neural structure or function to be changed by experience.

12 This person explained change to synaptic connections through repeated activation that is sometimes stated as 'neurons that fire together wire together'.

13 When inadequate stimulation results in the weakening of a synaptic connection or information transmission.

15 Its presence during consolidation may activate the amygdala to signal the hippocampus that the emotional details of an event are significant and their long-term storage should be strengthened.

16 A neurohormone that can enhance memory consolidation of emotionally arousing experiences.

17 Cannot occur without experience.

18 The site of communication between adjacent synapses.

Down

2 A brain structure with a crucial role in the consolidation of most types of memories.

4 The biological process of making a newly formed memory stable and enduring after learning.

5 From a biological perspective, a neurological representation of an event that has been learnt.

6 Results in a long-lasting strengthening of neural connections and interactivity at a synapse.

7 A hormone or neurotransmitter that has the same effect as adrenaline.

8 An excitatory neurotransmitter within the brain that plays an important role in synaptic plasticity.

10 A brain structure with a crucial role in the acquisition of emotional memories.

11 A description of the type of observable changes that happen to the brain as a result of learning and experience.

14 A chemical messenger released and exerting its effects locally at a synapse.

1 NEUROTRANSMITTER
2 HORMONE
3 SYNAPTIC PLASTICITY
4 CONSOLIDATION
5 MEMORY
6 LOBE
7 EPINEPHRINE
8 GLUTAMATE
9 NEURON
10 ALPHA MOTOR UNIT
11 STRUCTURAL PLASTICITY
12 HEBBIAN THEORY
13 LONG TERM POTENTIATION
14 NEUROTRANSMITTER
15 NORADRENALINE
16 ADRENALINE
17 LEARNING
18 SYNAPSE

ACTIVITY 4.9

True/False quiz on the neural basis of learning and memory

Indicate whether each item is true or false by writing T or F in the column at the right.

Statement	T or F
1 Learning and memory involve some type of neurological change within the brain.	T
2 Learning and memory depend on groups of neurons that work together.	T
3 There is little or no relationship between the level of emotional significance of a personal experience and the likelihood it will be recalled later.	F
4 The essential role of consolidation is to ensure memories are emotionally arousing.	F
5 Learning involves the establishment and strengthening of synaptic connections.	T
6 Long-term potentiation and long-term depression produce the same long-lasting effect at the synapse.	F
7 The strength of a connection between two neurons is determined by the neural activity of pre- and postsynaptic neurons.	T
8 It is practically impossible for older individuals to learn a new language due to the loss of neural plasticity in the brain.	F
9 Function rather than structure best differentiates neurotransmitters from neurohormones.	T
10 Long-term depression results in enhanced or more effective neurotransmission at the synapse.	F
11 Adrenaline may influence consolidation of emotionally arousing experiences by activating noradrenaline secretion within the amygdala.	T
12 Adrenaline helps ensure emotionally arousing experiences are accurately recalled.	F
13 Studies of people with concussion show that the consolidation process does not involve any short-term memory storage.	F
14 Long-term potentiation and long-term depression are forms of synaptic plasticity.	T
15 Neurohormones and neurotransmitters are made and secreted by neurons.	T
16 Long-term potentiation may weaken or eliminate unused synaptic connections.	F
17 Neurons cannot change their specific connections to other neurons due to biological processes that are genetically determined.	F
18 Adrenaline may also occur as the neurotransmitter called epinepherine and therefore have the same effect in the nervous system as epinepherine.	T
19 Neurons can change in size and shape but not function.	F
20 Long-term potentiation decreases the likelihood that what has been learnt will be forgotten.	T
21 Neurohormones typically travel faster than neurotransmitters.	F
22 Glutamate is a neurohormone that has an excitatory effect at a synapse.	F
23 Adrenaline can enhance the consolidation of emotionally arousing experiences.	T
24 Memory consolidation is an outcome rather than a process.	F
25 The amygdala interacts with the hippocampus in processing the emotional details of a memory for long-term storage.	T

CHAPTER 5

Models to explain learning

	Activities																	
Key knowledge	5.1	5.2	5.3	5.4	5.5	5.6	5.7	5.8	5.9	5.10	5.11	5.12	5.13	5.14	5.15	5.16	5.17	5.18
• classical conditioning as a three-phase process (before conditioning, during conditioning and after conditioning) that results in the involuntary association between a neutral stimulus and unconditioned stimulus to produce a conditioned response, including stimulus generalisation, stimulus discrimination, extinction and spontaneous recovery	✔	✔	✔	✔	✔	✔	✔	✔					✔	✔			✔	✔
• operant conditioning as a three-phase model (antecedent, behaviour, consequence) involving reinforcers (positive and negative) and punishment (including response cost) that can be used to change voluntary behaviours, including stimulus generalisation, stimulus discrimination and spontaneous recovery (excluding schedules of reinforcement)									✔	✔	✔	✔	✔	✔			✔	✔
• observational learning as a method of social learning, particularly in children, involving attention, retention, reproduction, motivation and reinforcement															✔	✔	✔	✔
• the 'Little Albert' experiment as illustrating how classical conditioning can be used to condition an emotional response, including ethical implications of the experiment.							✔										✔	✔
Key science skills								✔										

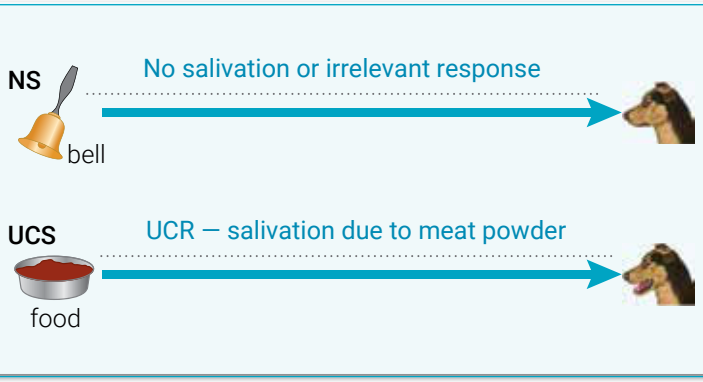
Source: VCE Psychology Study Design extracts © VCAA; reproduced by permission.

ACTIVITY 5.1

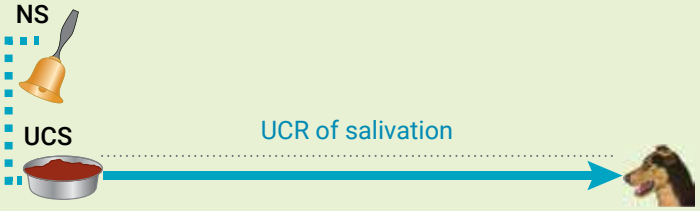
Classical conditioning as a three-phase process

(a) Complete the following diagram illustrating the three-phase process of classical conditioning in Pavlov's experiments. Describe what is occurring in each phase on the left and add labels to the panels on the right.

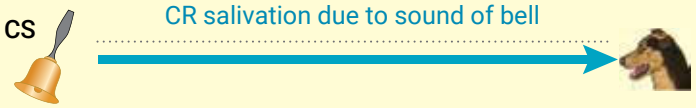
Before conditioning
Neutral stimulus of sound of bell produces no relevant response. Unconditioned stimulus of meat powder produces reflexive unconditioned response of salivation.



During conditioning
The neutral stimulus of sound of bell is repeatedly presented just before the unconditioned stimulus of the meat powder to produce the conditioned response. Response at this stage is to the unconditioned stimulus.



After conditioning
The neutral stimulus of the sound of the bell has now become the conditioned stimulus which produces the conditioned response of salivation.



(b) Describe how Pavlov's dogs might demonstrate **stimulus generalisation** during the experiment.

By salivating to other sounds/stimuli similar to the bell

(c) Describe how Pavlov's dogs might demonstrate **stimulus discrimination** during the experiment.

By only salivating to the specific sound of the bell used during conditioning

ACTIVITY 5.2

Summarising the classical conditioning process

Complete the following diagram to show how the classical conditioning process could be used to condition an organism to blink to the tap of a pencil. Use the following terms or their abbreviations: conditioned response (CR), unconditioned response (UCR), irrelevant response, conditioned stimulus (CS), unconditioned stimulus (UCS), neutral stimulus (NS).

Before conditioning

A tap of a pencil: neutral stimulus (NS) — **elicits** → **No eye blink or** irrelevant response

A puff of air to the eye unconditioned stimulus (UCS) — **elicits** → **An eye blink:** unconditioned response (UCR)

During conditioning

A tap of a pencil: neutral stimulus (NS)

paired with

A puff of air to the eye: unconditioned stimulus (UCS) — **elicits** → **An eye blink:** unconditioned response (UCR)

This is the acquisition **phase of classical conditioning.**

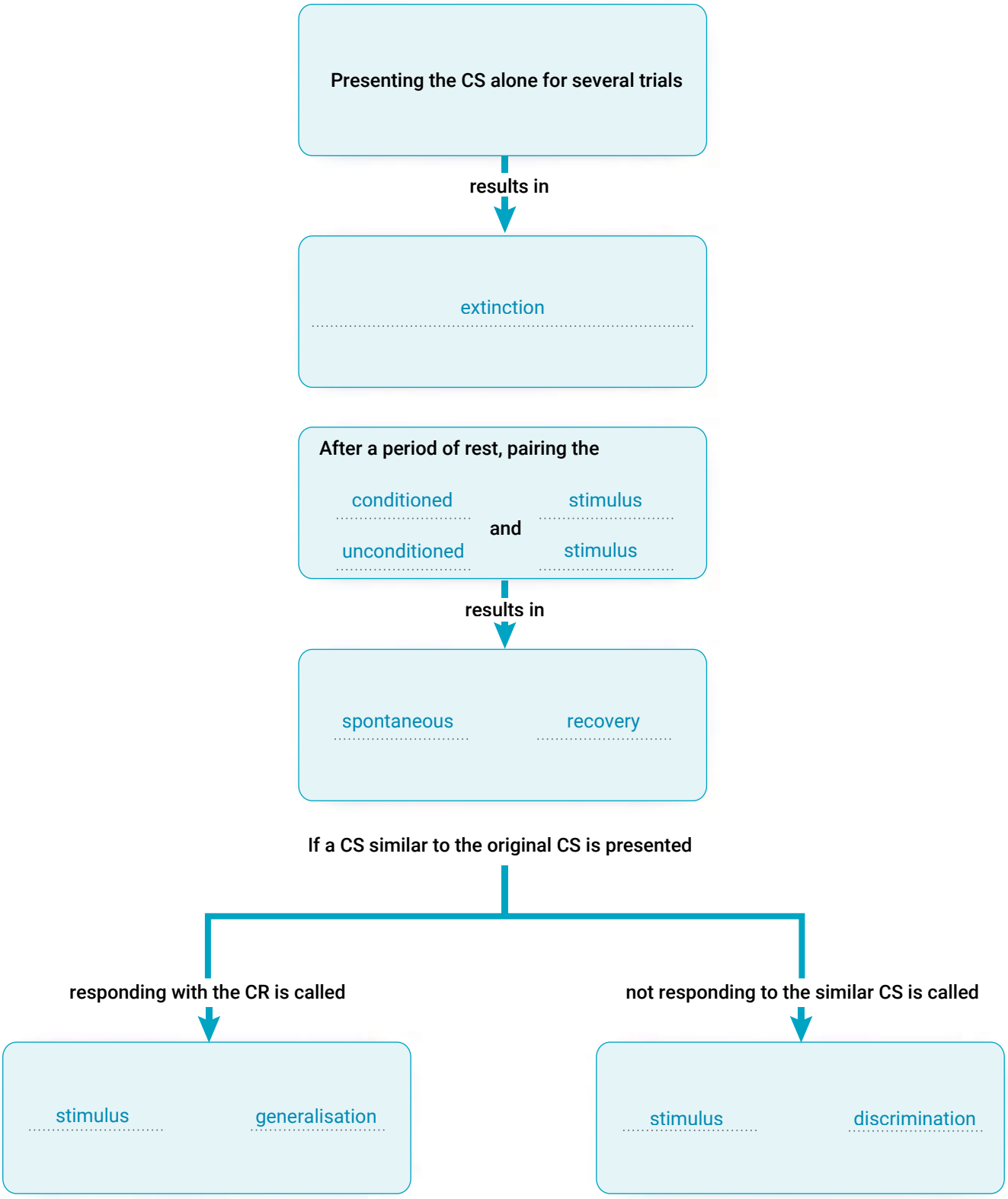
After conditioning

A tap of a pencil: conditioned stimulus (CS) — **elicits** → **An eye blink:** conditioned response (CR)

ACTIVITY 5.3

Summarising post-classical conditioning concepts

Complete the following diagram to show how the conditioned stimulus-response relationship may vary after acquisition of a conditioned response has occurred.



ACTIVITY 5.4

Matching exercise on classical conditioning terms

Match each description with the most appropriate term on the right. Write the letter of the term you select to the left of each description.

(e)	**1** The learned behaviour that is produced when the conditioned stimulus is presented.	**(a)** stimulus discrimination
(g)	**2** When the neutral stimulus is repeatedly presented with the unconditioned stimulus during the acquisition phase.	**(b)** extinction
(k)	**3** The period when the organism learns to associate the neutral stimulus with the unconditioned stimulus until the neutral stimulus alone produces the learned response.	**(c)** stimulus generalisation
(i)	**4** An object or event that consistently produces an unlearned, naturally occurring automatic response.	**(d)** neutral stimulus
(f)	**5** The term used by Pavlov to describe a conditioned response.	**(e)** conditioned response
(j)	**6** The unlearned behaviour that occurs automatically when the unconditioned stimulus is presented.	**(f)** conditioned reflex
(a)	**7** When the organism responds only to the conditioned stimulus and not to any other similar stimuli.	**(g)** trial
(b)	**8** The gradual decrease in the rate or strength of the conditioned response when the conditioned stimulus is repeatedly presented alone.	**(h)** spontaneous recovery
(d)	**9** An object or event that initially does not produce any predictable response but later can become a conditioned stimulus through repeated associations with an unconditioned stimulus.	**(i)** unconditioned stimulus
(c)	**10** When the organism responds in a similar but not necessarily identical way to other stimuli that are similar to the conditioned stimulus.	**(j)** unconditioned response
(h)	**11** The reappearance of a conditioned response following a rest period and after extinction is believed to have occurred.	**(k)** acquisition

ACTIVITY 5.5

Describing the classical conditioning process

Select terms from the shaded panel below to correctly complete the passage about classical conditioning. Each term should be used only once and all terms must be used.

acquisition	associate	conditioned response	conditioned stimulus	discrimination
extinction	involuntary	irrelevant	learning	neutral stimulus
Pavlov	predictable	reflexive	repeated	salivate
spontaneous recovery	stimuli	stimulus generalisation	unconditioned response	unconditioned stimulus

A relatively permanent change in an organism's behaviour due to experience is called learning. The type of learning in which an organism learns to associate two different stimuli is called classical conditioning. The scientific study of classical conditioning started with an accidental discovery made by a Russian physiologist named Ivan Pavlov in the late 19th century.

While studying the digestive system of dogs, Pavlov observed that his laboratory dogs began to salivate even before his assistant placed food in their mouths. The sight or sound of the assistant had produced the same reflexive response to food.

In Pavlov's classic experiment, a tone is sounded just before food is placed in a dog's mouth. At this time, the tone is called a/an neutral stimulus because it does not produce a predictable response. The dog's response is irrelevant to what is being learnt. In contrast, the food is called a/an unconditioned stimulus because it produces the unconditioned response of salivation when food is placed in the dog's mouth. This type of response is a reflexive, involuntary response that is predictably caused by the unconditioned stimulus. Through repeated pairing of the tone and food, trial by trial, the two stimuli were associated. Eventually, the dogs in Pavlov's experiment would salivate

on hearing the tone. Salivation is now called the conditioned response and the tone is now called a/an conditioned stimulus.

The initial learning of a conditioned response is called acquisition. But a conditioned stimulus–response association is not necessarily permanent. When the strength of an association fades over time and disappears, then extinction is said to have occurred. Nor is this permanent. If a conditioned response reappears when the conditioned stimulus is presented following a rest period, then spontaneous recovery is said to have occurred.

Pavlov also experimented with different tones. If a dog salivates only to the sound of the bell but not to any other sound, then stimulus discrimination is said to have occurred. If a dog salivates in response to a sound like the bell, then stimulus generalisation is said to have occurred.

ACTIVITY 5.6

Using classical conditioning terms to analyse scenarios

Part A

Getting used to classical conditioning abbreviations

Use the following abbreviations relating to classical conditioning to complete the passage summarising learning through classical conditioning.

neutral stimulus	unconditioned stimulus	unconditioned response	conditioned stimulus	conditioned response
NS	UCS	UCR	CS	CR

Before classical conditioning, the NS will elicit an irrelevant response and the UCS will elicit a/an UCR.

During classical conditioning, the NS is repeatedly paired with the UCS which continues to elicit the UCR.

When classical conditioning has occurred, the NS has becomes a/an CS and elicits the CR which is similar but not necessarily identical to the UCR.

Part B

Analysing classical conditioning scenarios using classical conditioning terms

The following scenarios describe behaviours acquired ('learnt') through classical conditioning. Identify the NS, UCS, CS, UCS and CR in each scenario.

Scenario 1: Arun

As a child, Arun was playing on the kitchen floor while his mother washed the dishes. She dropped a glass next to Arun then immediately screamed at him to not touch the glass as she snatched him into her arms. Her behaviour caused Arun to cry. He now has a fear of broken glass.

NS broken glass

UCS mother's behaviour

UCR crying

CS broken glass

CR fear of broken glass

Scenario 2: Paula

Paula was walking happily alongside a busy road listening to a newly released techno song on her smartphone. She mindlessly stepped off the kerb on to the road and was narrowly missed by a taxi that blasted its horn as it sped past. Paula was traumatised by the incident and during the next couple of days she burst into tears whenever it came to mind. A few weeks later, after this emotional reaction had subsided, Paula was listening to the radio while lying on her bed. The techno song was played without introduction and she became upset and tearful. She is now always upset and tearful for no apparent reason whenever she hears the song.

NS techno song

UCS nearly being hit by the taxi

UCR traumatised and tearful

CS techno song

CR upset and tearful

Scenario 3: Ted

Yui has a 3-year-old son Ted who always accompanies her to the local shopping centre. When there, they always walk past a small, coin-operated merry-go-round. Until recently, Ted showed little interest in the merry-go-round. Last week Yui decided to give Ted a ride and he thoroughly enjoyed it. Now, whenever Yui takes Ted to the shopping centre, he gets excited when he sees the merry-go-round and tries to break from her hand to run up to it for another ride.

NS sight of the merry-go-round

UCS riding the merry-go-round

UCR enjoyment when riding the merry-go-round

CS sight of the merry-go-round

CR excitement

Scenario 4: Simba

Lachlan lives in a second floor apartment with his cat named Simba. When Lachlan goes to work, Simba is left in the apartment with a water bowl but no food in case she overeats. When he returns home after work, Lachlan unlocks the door by pressing a security code that makes loud beeps. He will then feed Simba before making his own dinner. On opening the door, Lachlan always finds Simba waiting just inside the entrance ready to purr and rub against his legs. When Lachlan first moved into the apartment, the beeping sound merely got Simba's momentary attention before she resumed napping.

NS beep sound

UCS food/dinner

UCR purring and rubbing against Lachlan's legs

CS beep sound

CR purring and rubbing against Lachlan's legs

Scenario 5: Kristy

Kristy, who is five years old, was excited to test out the new bodyboard that she got for Christmas. When using the board during the family's first beach holiday, Kristy was continually swamped by the big waves and knocked off the board. When a very big wave dumped her, Kristy ran out of the surf distressed and crying. Now, Kristy refuses to use the bodyboard and will no longer go near the surf when at the beach.

NS using the bodyboard

UCS swamped by big waves and knocked off the board

UCR feeling distressed and crying

CS using the bodyboard

CR not using the bodyboard or going near the surf (avoidance behaviour)

Scenario 6: Harry

Harry recently qualified as a lawyer and is now working for a big city law firm. He is finding the job very stressful and often has to answer work-related emails well into the evening. Many of these emails trigger stress symptoms because they relate to complex issues he must deal with. While studying at university, Harry checked his phone each night to see if there were any email messages from friends or from his sister who had moved overseas. Now, Harry is reluctant to check his personal emails and experiences a fight–flight type response every time his smartphone pings to alert him that a new email has arrived.

NS smartphone ping/email alert

UCS work-related email

UCR stress symptoms

CS smartphone ping/email alert

CR fight–flight type response

Scenario 7: Bo

Bo went out with her friends to try Indian food at a new restaurant. The next morning, Bo woke up feeling very ill and then vomited on several occasions. She visited her doctor who diagnosed a virus that was going around at the time. Bo's doctor reassured her that the illness she was experiencing had nothing to do with the Indian food she had eaten the night before. Despite this knowledge, Bo has found that she no longer desires Indian food and will never eat it again.

NS Indian food

UCS virus

UCR vomiting

CS Indian food

CR avoiding/not eating Indian food

Scenario 8: An example of something you have learnt through the classical conditioning process
Example:

Exchange scenarios with a classmate and correct each other's.

Analysis:

NS

UCS

UCR

CS

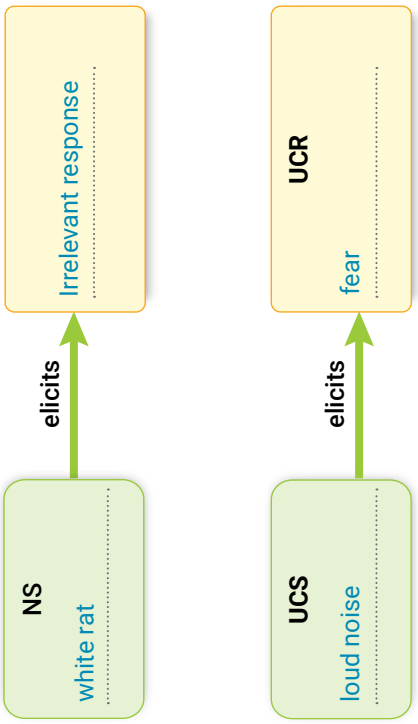
CR

ACTIVITY 5.7

The 'Little Albert' experiment — using classical conditioning to condition an emotional response

Part A

Complete the flow chart to illustrate the classical conditioning of Albert's conditioned fear response to the white rat. In the panels at the left, describe what is done in each phase and the purpose of the procedure.



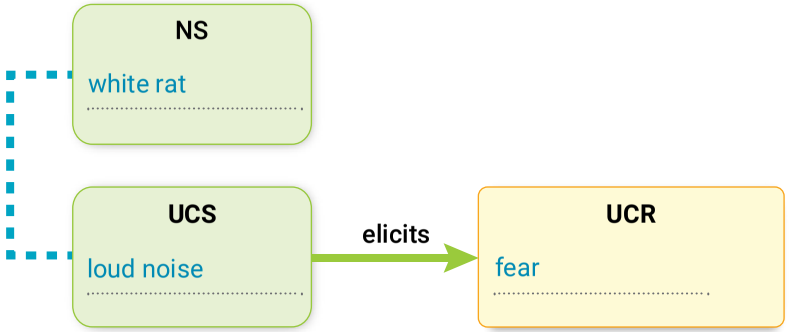
Phase 1. Before conditioning

The white rat is a NS in this initial phase and produces an irrelevant response by Albert i.e. reaches for the rat with no fear.

A loud noise (UCS) is used to elicit a fear response (UCR). Whenever Albert touches the rat, a steel bar is struck and is observed to produce an emotional response of fear with crying induced by the fear.

Phase 2. During conditioning

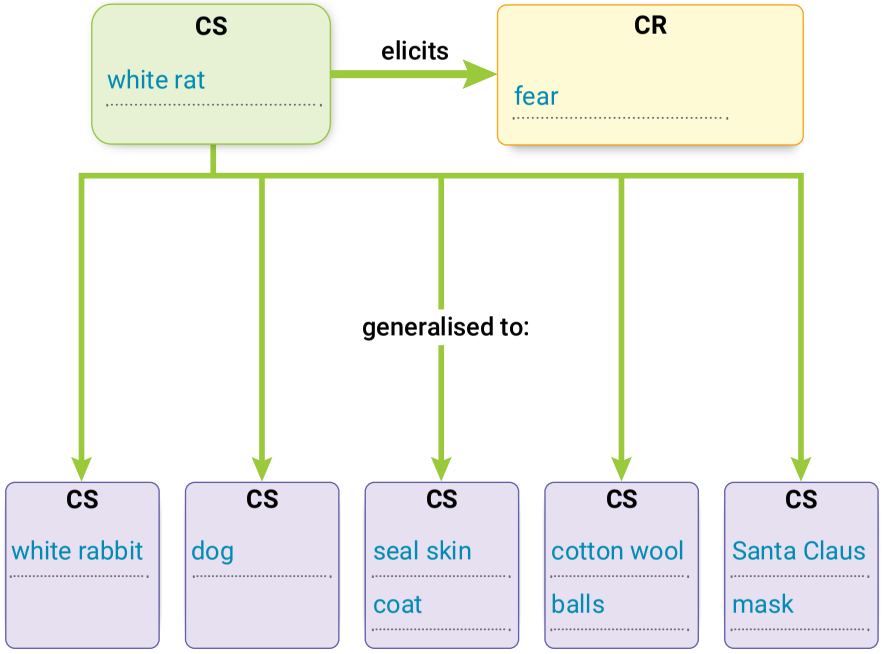
Repeated pairing of the NS and UCS over a 17-day period and again 1 week later is used until the UCS alone becomes a CS that elicits the CR (and the UCR becomes a CR).



Phase 3. After conditioning

Fear has now become a CR to the presence of the rat (the CS), which was initially a NS. The CS consistently elicits fear. The classical conditioning procedure has established a conditioned emotional fear response whenever the rat is presented.

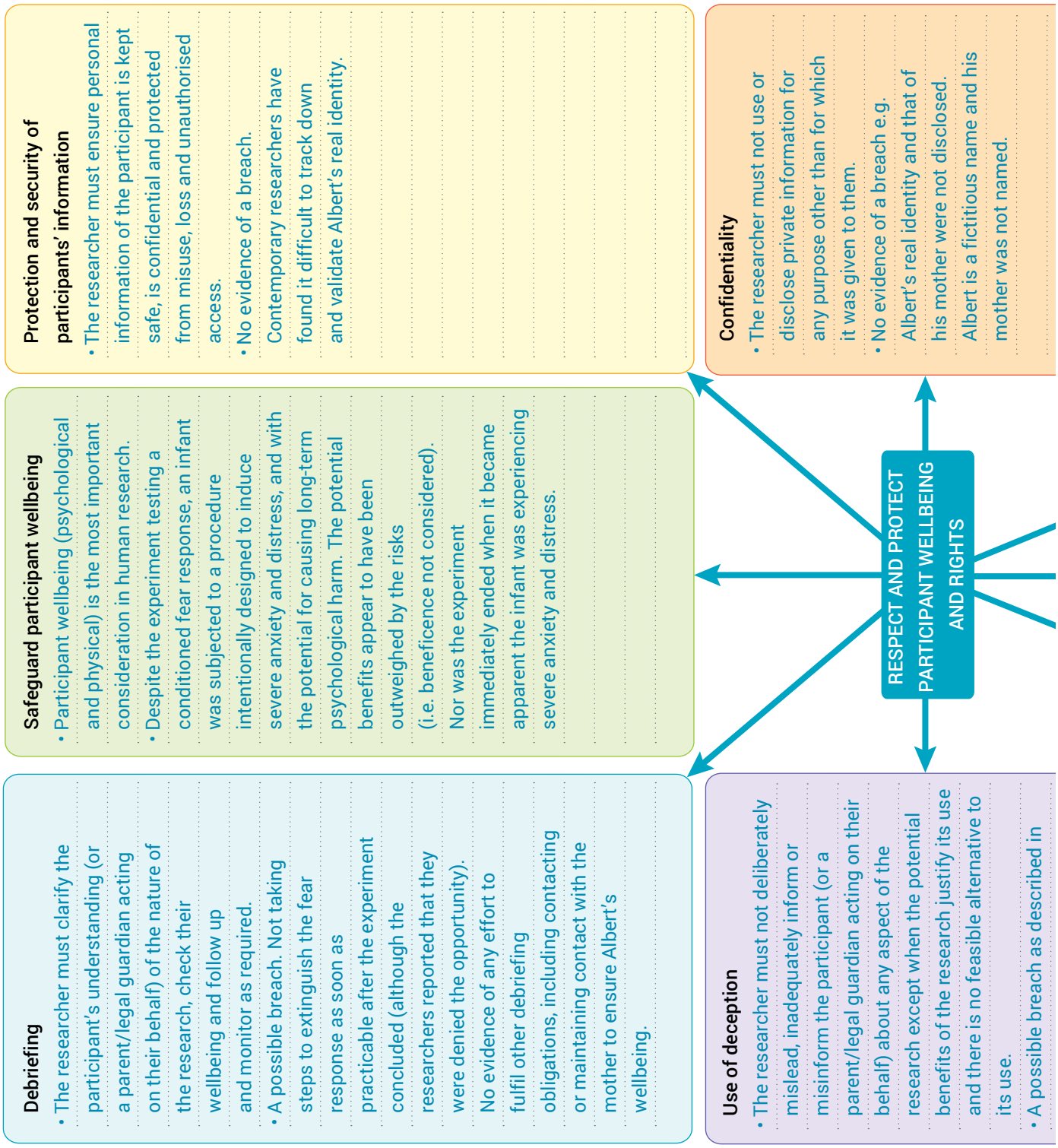
(Albert also demonstrates stimulus generalisation by showing a similar CR to other similar stimuli.)



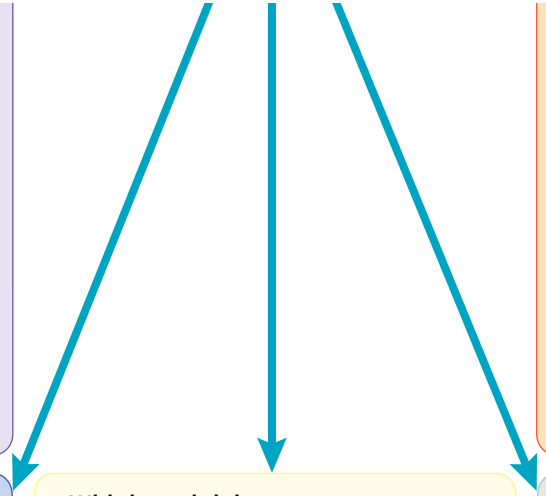
Part B

Summarising ethical implications of the experiment

Consider the ethical responsibilities of contemporary researchers shown in the chart below. Explain whether each responsibility was followed, ensuring you consider what should have been done and what was possibly done by Watson and Rayner.



relation to informed consent. Not fully or truly informing the parent would not be justifiable in relation to this particular experiment. However, there is no evidence of either so this is conjecture.



Informed consent

- Participants (or a parent/legal guardian acting on their behalf) must be fully informed of the purpose, methods, demands, risks and potential benefits of a study to ensure they make an informed decision to participate.
- A possible breach. Watson may have not provided a detailed account to Albert's mother about the true nature and purpose of the experiment, including intentional and prolonged exposure to severe anxiety and distress, and the real risk of psychological harm to her child. However, there is no evidence of either so this is conjecture.

Withdrawal rights

- The researcher must respect the participant's (or a parent/legal guardian acting on their behalf) unconditional right to opt out of a study at any time without giving a reason.
- A possible breach. Watson may have not informed the mother of her right to withdraw her infant prior to or during the experiment (e.g. when Albert experienced distress), but unclear whether or not this occurred.

Voluntary participation

- The researcher must ensure the participant voluntarily consents to be involved in the study (or a parent or legal guardian must do so on their behalf) and no coercion or negative consequences if participation is declined.
- A possible breach. Because Albert's mother knew Watson and was an employee of 'the clinic' where the experiments were conducted, she may have felt obliged and/or been pressured to permit Albert's participation. However, there is no evidence of either so this is conjecture.

ACTIVITY 5.8

Evaluation of research on the use of classical conditioning to treat persistent bedwetting

Some children continue to wet their beds long after they are toilet trained and out of nappies. Persistent involuntary discharge of urine, when in bed or dressed, after the age when bladder control should have been achieved is called enuresis. This condition is more common in males and may occur only at night or both at night and during the day. Most children with enuresis have no significant underlying physical or psychological problems. Nor is treatment sought or necessary in most cases.

For those who seek enuresis treatment, a classical conditioning procedure has been successfully applied in many cases. One of the early studies on this treatment was conducted by researcher Ian Wickes (1958) using 100 'persistently enuretic children' aged between five and 17+ years. Age and gender of participants at the start of treatment are shown in Table 1. All were selected from outpatients at one of Wickes' clinics. For the purpose of the study, 'enuresis was regarded as having been present if bedwetting had occurred above the age of 5 years'.

Table 1

Age in years	Total	5–7	8–9	10–11	12–13	14–15	16–17	17+
Male	81	12	18	19	22	7	2	1
Female	19	2	4	8	3	2	-	-
Total	100	14	22	27	25	9	2	1

Source: Wickes, I.G. (1958). Treatment of persistent enuresis with the electric buzzer. *Archives of disease in childhood, 33,* 160–164.

Wickes believed that, in many cases of enuresis, the individual had simply failed to learn to wake up in response to the stimuli arising from a full bladder and that this necessary bit of learning could be brought about by classical conditioning. For instance, if a person were to awaken when there was bladder tension which precedes urination, then bedwetting could be prevented.

Wickes decided to use a 'conditioning apparatus' consisting of an alarm unit which sounded a buzzer that would reliably awaken the sleeper. The sound of the buzzer would follow the stimulation from a full bladder. He reasoned that after a series of such paired presentations, the response of waking up — at first made only to the buzzer — should begin to occur in response to stimulation from a full bladder. Then, the child would go to the toilet instead of wetting the bed while asleep.

Wickes' main problem was to arrange for a buzzer to sound shortly after the child's bladder was full. His solution was to have the child sleep with a gauze pad appropriately positioned so that the first drop of urine closed a circuit that set off the buzzer. This ensured that soon after the sleeper was stimulated by a full bladder, he or she was awakened by the buzzer.

Wickes found that his treatment proved to be an effective method for curing enuresis as many participants began to wake up in response to the stimulation from a full bladder — before wetting the bed. The results are shown in Table 2 on the following page.

Table 2

Total no. wet nights during third month	Total	Severity of enuresis before treatment (approximate proportion of wet nights)		
		<50%	50%–75%	75%–100%
Nil	44	5	15	24
1–3	10	2	1	7
4–6	14	2	3	9
7+	17	1	3	13
Abandoned	7	1	3	3
Not known	8	2	2	4
Total	100	13	27	60

Source: Wickes, I.G. (1958). Treatment of persistent enuresis with the electric buzzer. *Archives of disease in childhood, 33,* 160–164.

1 Identify the research method used by Wickes.

cross-sectional study

2 Identify the sampling procedure

convenience sampling

3 Identify the sample and population used for the study.

sample: 100 participants selected for the study (as shown in Table 1)

population: all children diagnosed with enuresis at one of Wickes' clinics

4 How many young adolescents aged 13 or older participated in the study?

12

5 What is a crucial informed consent procedure of relevance to this particular study?

A parent or legal guardian of each participant must give the consent (based on appropriate information about the study) because of the young age of the participants.

6 Identify the operationalised independent and dependent variables.

independent variable: classical conditioning procedure for treatment of enuresis

dependent variable: total number of wet nights during the first three months of treatment

7 How was bedwetting operationally defined?

For the purpose of the study, 'enuresis was regarded as having been present if bedwetting had occurred above the age of 5 years'.

8 Identify each of the following in the classical conditioning procedure used to treat enuresis.

neutral stimulus: stimulation by full bladder

unconditioned stimulus: sound of buzzer/alarm sound

conditioned stimulus: stimulation by full bladder

unconditioned response: wake up (and go to toilet)

conditioned response: wake up (and go to toilet)

9 Suggest a suitable title for Table 2.

Example: Response to treatment in relation to severity of enuresis

10 Describe the results shown in Table 2.

Example: Prior to treatment, 60 of the participants wet their beds on more than 75% of the nights, 27 wet their beds 50–75% of the nights, and 13 wet their beds on less than 50% of the nights. During three months of treatment, 44 never wet the bed on any night, 10 wet the bed on less than 3 nights, 14 between 4–6 nights, and 17 wet the bed on 7+ nights.

ACTIVITY 5.8 *continued*

11 Explain whether Wickes' conclusion is valid.

Explanation should demonstrate understanding that:

- validity refers to the accuracy of the conclusion i.e. that it is justifiable on the basis of the results obtained for the study, particularly the results relating to the specific variables that were investigated
- the results show that the treatment was successful for the great majority of participants e.g. 44% never wet the bed on any night during 3 months of treatment and 24% on 6 or less nights
- the results also show that the treatment was not particularly successful for 32% of the participants (i.e. the '7+', 'Abandoned' and 'Not known' categories')
- there are no details on the medical conditions, family histories, mental health states etc. of children for whom the treatment was successful or not successful, therefore variables other than the treatment that could impact on the success of the treatment cannot be identified
- there is no evidence of follow-up, therefore the long-term effectiveness of the treatment cannot be determined e.g.the number of participants who experienced relapse was not measured, so the research has a significant limitation — the treatment may not be considered a relatively permanent cure if there is a high relapse rate.

ACTIVITY 5.9

Operant conditioning as a three-phase model

(a) Complete the following diagram illustrating the three-phase model of operant conditioning. Beneath the diagram, write one sentence that summarises the three-way relationship between the phases.

Phase 1	Phase 2	Phase 3
Antecedent	**B**ehaviour	**C**onsequence
Description	**Description**	**Description**
The stimulus that precedes a specific behaviour and signals its probable consequence to the learner. ('What happened before')	The voluntary action performed by the learner in the presence of, or following, the antecedent stimulus. ('What happens')	The environmental event that occurs immediately after the behaviour and has an effect on the occurrence of the behaviour. ('What happens after')
Example	**Example**	**Example**
e.g. Seeing the red figure flashing at a pedestrian crossing	e.g. Not walking across the road and waiting until the signal changes to green	e.g. Safety when walking across the road

Relationship between A, B and C:

A specific **a**ntecedent prompts relevant **b**ehaviour that is followed by a specific **c**onsequence.

(b) Summarise potential consequences that can be used to change voluntary behaviours.

REINFORCEMENT **Effect on behaviour:** strengthens	**PUNISHMENT** **Effect on behaviour:** weakens
Positive reinforcer + **This is:** A pleasant or desirable stimulus that strengthens or increases the frequency or likelihood of a desired response (by providing a satisfying consequence) Example of its use: e.g. giving verbal praise for good/desirable behavior	**Positive punishment** – **This is:** Presentation of an unpleasant and undesirable stimulus to weaken a response or decrease the likelihood of it occurring again Example of its use: e.g. verbally scolding a child for reckless/undesirable behaviour
Negative reinforcer + **This is:** An unpleasant or aversive stimulus that, when removed or avoided, strengthens or increases the likelihood of a desired response (by providing a satisfying consequence) Example of its use: e.g. nagging until a sibling returns a borrowed item.	**Negative punishment (including response cost)** – **This is:** Removal of a pleasant or desirable stimulus to weaken a response or decrease the likelihood of it occurring again Example of its use: e.g. taking away a toy that is causing two siblings to fight over it.

ACTIVITY 5.10

Matching exercise on operant conditioning

Match each description with the most appropriate term on the right. Write the letter of the term you select to the left of each description.

(d)	**1** The process of giving a positive reinforcer after a desired response has been made in order to strengthen that response.	**(a)** negative punishment
(e)	**2** A response by a learner that acts on the environment to produce some kind of consequence.	**(b)** behaviour
(g)	**3** The name of the researcher who first described operant conditioning.	**(c)** negative reinforcer
(l)	**4** Introducing an unpleasant stimulus to weaken or eliminate target behaviour.	**(d)** positive reinforcement
(h)	**5** A stimulus that precedes a specific response and indicates the likely outcome of that response, thereby influencing its occurrence.	**(e)** operant
(b)	**6** A voluntary action performed by an organism in the presence of, or following, the antecedent stimulus.	**(f)** positive reinforcer
(c)	**7** An unpleasant stimulus that, when removed or avoided, increases the likelihood of a desired response occurring.	**(g)** Skinner
(a)	**8** Taking away a desirable stimulus to weaken or eliminate target behaviour.	**(h)** antecedent
(j)	**9** An event that occurs immediately after a response and influences the reoccurrence of the response.	**(i)** negative reinforcement
(f)	**10** A pleasant stimulus that increases the likelihood of a desired response occurring.	**(j)** consequence
(i)	**11** The process of taking away an unpleasant stimulus after a response has been made in order to strengthen that response.	**(k)** response cost
(k)	**12** Loss of a valued stimulus for undesirable behaviour, regardless of whether or not it causes that behaviour.	**(l)** positive punishment

Describing the operant conditioning process

Select terms from the shaded panel below to correctly complete the passage about operant conditioning. A term may be used more than once and all terms are used.

antecedent	associating	behaviour	consequence	desirable
discrimination	essential	increasing	influences	likely
recovery	repeated	responses	same	sequence
stimulus	three	three-phase	undesirable	voluntary

Learning through operant conditioning involves associating stimuli with responses (behaviours) which are in turn influenced by consequences. Essentially, operant conditioning theory proposes that an organism will tend to perform a behaviour (an operant) that has desirable consequences or to not perform a behaviour that has undesirable consequences.

The three-phase model of operant conditioning describes this learning process as having three parts that always occur in a specific sequence. The parts and their order of occurrence are the antecedent (which is a stimulus in the environment), a behaviour (which is a voluntary response or set of responses) and a consequence (which is an event that has an effect on the occurrence of the response that preceded it). All are essential in the operant conditioning process. The antecedent will signal the most likely consequence for a specific behaviour, which in turn influences whether or not that response will occur (and the strength of the response if made).

For example, suppose you are on a long walk under a hot sun, feeling very tired and see a public bench. The bench could be an environmental stimulus (i.e. the antecedent) that signals rest and physical relief (i.e. the consequence) if you sit down (i.e. the behaviour). Had you not seen the bench or if there was no bench, then you could not sit to rest and get physical relief. This highlights that the antecedent must

ACTIVITY 5.11 *continued*

always be present for the relevant behaviour to occur. If sitting down actually provides the anticipated rest and relief, then the consequence is desirable and that specific behaviour will be strengthened, thereby increasing the likelihood that it will be repeated in future. If on sitting down the bench immediately collapses, then the consequence is undesirable. Therefore, the behaviour of sitting on that bench, and possibly another public bench, is weakened and also less likely to be repeated in future.

As with classical conditioning, the processes of stimulus generalisation, stimulus discrimination, extinction and spontaneous recovery may also occur with operant conditioning. All of these processes have the same effect in both types of conditioning.

ACTIVITY 5.12

Analysing operant conditioning consequences in different events

For each of the following events, indicate the type of consequence involved, the behaviour that is influenced and whether the consequence is likely to strengthen or weaken the response in the future. The first event has been completed as an example.

Event	Type of consequence	Behaviour affected	Behaviour likely to be weakened or strengthened?
1 A laboratory rat receives a food pellet each time it presses a lever.	*positive reinforcement*	*lever pressing*	*strengthened*
2 Olivia finally takes out the garbage to get her father to stop pestering her.	negative reinforcement	take out the garbage	strengthened
3 Jack is grounded for a month for coming home late from a party at 3.00 am despite agreeing to be home by midnight.	negative punishment/ response cost	staying out later than agreed	weakened
4 Sirihn is given time off for finishing important data entry work earlier than expected.	positive reinforcement	data entry work	strengthened
5 Oliver fails to meet a reasonable productivity standard and is given a pay cut.	response cost/negative punishment	poor work performance	weakened

ACTIVITY 5.12 *continued*

Event	Type of consequence	Behaviour affected	Behaviour likely to be weakened or strengthened?
6 A puppy is scolded for urinating on the carpet and is then taken outside as part of its house training.	positive punishment	urinating on the carpet	weakened
7 Toula accidently burns her hand while playing with matches despite being told by her parents it was not allowed.	positive punishment	playing with matches	weakened
8 A taxi driver is penalised with 3 demerit points for disobeying a traffic signal.	response cost/negative punishment	disobeying a traffic signal	weakened
9 A disruptive secondary student is reprimanded by his teacher for distracting other students in class.	positive punishment	distracting other students	weakened
10 Arun uploads a YouTube video of himself dancing which receives 10 000 likes and 1000 dislikes.	positive punishment	uploading dancing video to YouTube	strengthened
11 Claire begins exercising by going running after work several nights a week. She soon notices that she feels healthier and has increased her energy level at work.	positive reinforcement	exercising/running after work	strengthened

ACTIVITY 5.12 *continued*

Event	Type of consequence	Behaviour affected	Behaviour likely to be weakened or strengthened?
12 William left his lunchbox on a playground bench while he played a game with some friends. When he returned his lunch had been taken which left him sad and hungry for the rest of the day.	negative punishment	leaving lunch unattended	weakened
13 A dog is conditioned to bark only when a red light comes on by giving it a food pellet when it barks on presentation of the red light.	positive reinforcement	bark when red light comes on	strengthened
14 Mia's headache disappears soon after she takes two paracetamol tablets.	negative reinforcement	taking paracetamol tablets when experiencing a headache	strengthened
15 A laboratory rat is conditioned to turn right in a maze by giving it an electric shock for turning left rather than right when in the maze.	negative reinforcement	turning right in maze	strengthened

ACTIVITY 5.13

Matching exercise on classical and operant conditioning terms

Match each description with the most appropriate term on the right. Write the letter of the term you select to the left of each description.

(f)	**1** Presentation of a desired stimulus to promote or strengthen a response.	**(a)** positive punishment
(j)	**2** When an organism responds in a similar way to similar stimuli.	**(b)** negative punishment
(e)	**3** An object or event that consistently produces an unlearned, naturally occurring, automatic response.	**(c)** neutral stimulus
(o)	**4** The name of the researcher most commonly associated with operant conditioning.	**(d)** spontaneous recovery
(h)	**5** The learned response that is elicited when the conditioned stimulus is presented.	**(e)** unconditioned stimulus
(a)	**6** Presentation of an unpleasant stimulus to weaken or eliminate target behaviour.	**(f)** positive reinforcement
(k)	**7** A stimulus that precedes behaviour and indicates the likely outcome of that behaviour.	**(g)** response cost
(d)	**8** The reappearance of a weakened conditioned response.	**(h)** conditioned response
(n)	**9** The unlearned behaviour that occurs automatically when the unconditioned stimulus is presented.	**(i)** Pavlov
(b)	**10** Removal of a pleasant stimulus to weaken or eliminate target behaviour.	**(j)** stimulus generalisation
(m)	**11** Removal of an unpleasant stimulus to strengthen target behaviour.	**(k)** antecedent
(i)	**12** The name of the researcher most commonly associated with classical conditioning.	**(l)** stimulus discrimination
(g)	**13** Loss of a valued stimulus for undesirable behaviour, regardless of whether or not it causes that behaviour.	**(m)** negative reinforcement
(l)	**14** Telling the difference between stimuli.	**(n)** unconditioned response
(c)	**15** An object or event that initially does not produce any predictable response but later can become a conditioned stimulus through repeated associations with an unconditioned stimulus.	**(o)** Skinner

ACTIVITY 5.14

Comparing classical and operant conditioning

Carefully cut out each statement relating to the differences and similarities between classical and operant conditioning and then paste them into the correct cell in the table.

	Classical conditioning	Operant conditioning
Theorist	Ivan Pavlov (1849–1936)	B.F. Skinner (1904–1990)
Nature of learning process	A three-phase learning process (before conditioning, during conditioning and after conditioning) that results through the repeated association of two stimuli.	A three-phase learning model (antecedent, behaviour, consequence) through which a response is associated with consequences (i.e. reinforcement or punishment) that influences its occurrence in the future.
Role of the learner	The learner has a passive role because responses are primarily involuntary regardless of the type of stimulus; there is no requirement for conscious engagement in the learning process.	The learner has an active role because responses are primarily voluntary and the learner must operate on its environment in some way.
Nature of the response	The response is usually involuntary (e.g. reflexive, unconscious), involving the ANS.	The response is usually voluntary, (e.g. intentional, conscious) involving the CNS
Timing of the stimulus and the response	The response (whether conditioned or unconditioned) occurs after the stimulus (whether conditioned or unconditioned).	The response may occur before the stimulus that acts as the consequence or after the antecedent stimulus.
Stimulus discrimination	The learner responds only to the CS and not to any other stimulus.	The learner responds only to the relevant antecedent stimulus and not to any other stimulus.
Stimulus generalisation	The learner responds to other stimuli that are similar to the CS but not necessarily in an identical way as they usually do.	The learner responds to other stimuli that are similar to the antecedent stimulus but not necessarily in an identical way as they usually do.

	Classical conditioning	Operant conditioning
Extinction	Observed as a gradual decrease in the strength or rate of the CR over time when the UCS is no longer presented. Said to have occurred when the CR is no longer present.	Observed as a gradual decrease in the strength or rate of a CR over time following repeated non-reinforcement of the CR. Said to have occurred when the CR is no longer present.
Spontaneous recovery	May occur after a rest period and apparent extinction when the CS is reintroduced.	May occur after a rest period without reinforcement and apparent extinction.

ACTIVITY 5.14 *continued*

Ivan Pavlov (1849–1936)

The learner responds to other stimuli that are similar to the CS but not necessarily in an identical way as they usually do.

A three-phase learning process (before conditioning, during conditioning and after conditioning) that results through the repeated association of two stimuli.

The response is usually involuntary (e.g. reflexive, unconscious), involving the autonomic nervous system.

The response may occur before the stimulus that acts as the consequence or after the antecedent stimulus.

The learner has an active role because responses are primarily voluntary and the learner must operate on its environment in some way.

Observed as a gradual decrease in the strength or rate of a CR over time following repeated non-reinforcement of the CR. Said to have occurred when the CR is no longer present.

The response is usually voluntary, (e.g. intentional, conscious) involving the central nervous system.

The response (whether conditioned or unconditioned) occurs after the stimulus (whether conditioned or unconditioned).

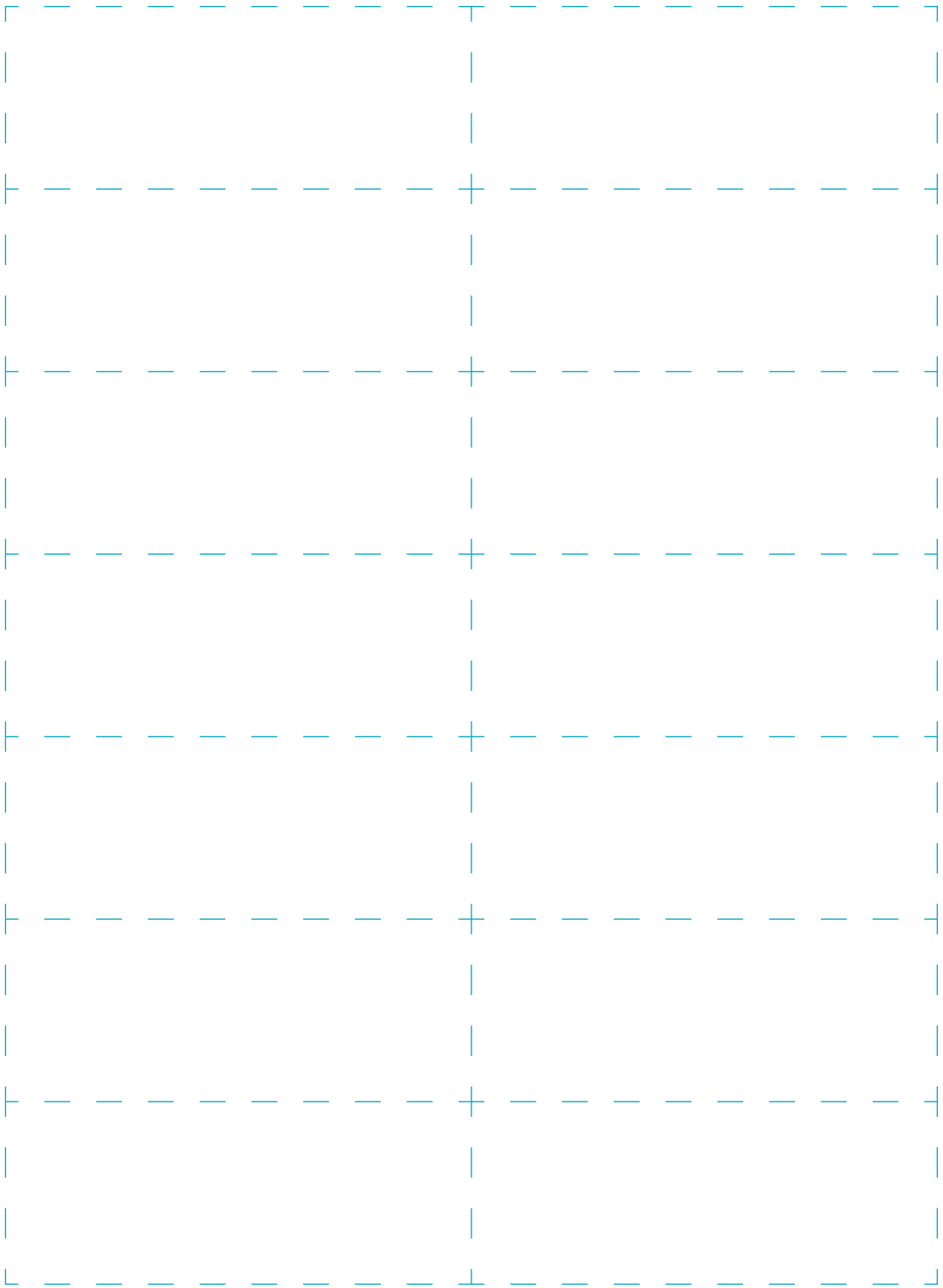
The learner responds to other stimuli that are similar to the antecedent stimulus but not necessarily in an identical way as they usually do.

May occur after a rest period without reinforcement and apparent extinction.

The learner responds only to the relevant antecedent stimulus and not to any other stimulus.

The learner has a passive role because responses are primarily involuntary regardless of the type of stimulus; there is no requirement for conscious engagement in the learning process.

A three-phase learning model (antecedent, behaviour, consequence) through which a response is associated with consequences (i.e. reinforcement or punishment) that influences its occurrence in the future.



ACTIVITY 5.14 *continued*

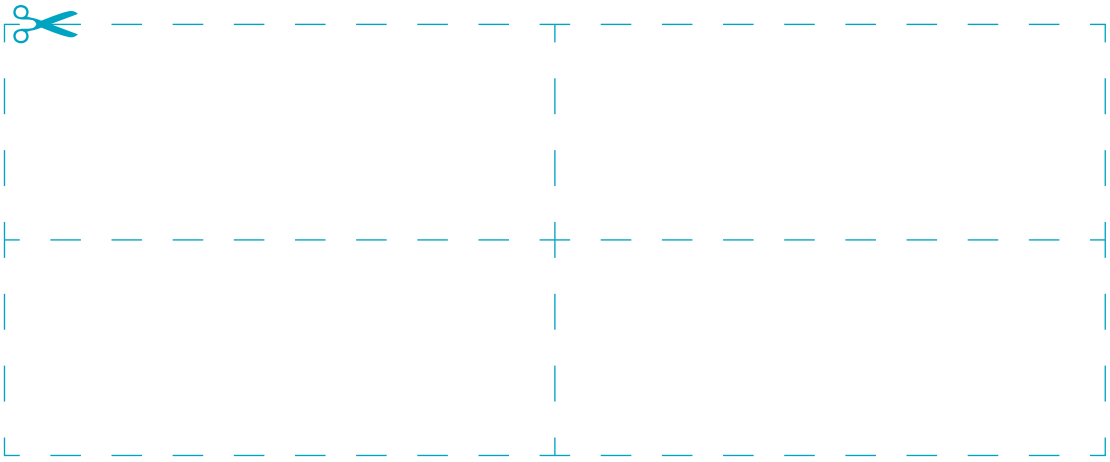
Observed as a gradual decrease in the strength or rate of the CR over time when the UCS is no longer presented. Said to have occurred when the CR is no longer present.

The learner responds only to the CS and not to any other stimulus.

May occur after a rest period and apparent extinction when the CS is reintroduced

B.F. Skinner (1904–1990)

ACTIVITY 5.14 *continued*



ACTIVITY 5.15

Summarising and applying observational learning theory

Complete the following flow diagram to summarise the observational learning processes in the sequence described by Albert Bandura, ensuring you describe each process and then apply to the example pictured.

Attention The learner pays attention in order to observe the modelled behaviour

Applied to this example Charlotte must watch and pay close attention to her grandmother, ensuring she recognises the distinctive features of what needs to be done to successfully make the jam.

Retention The learner mentally represents and retains what has been observed.

Applied to this example Charlotte must be able to remember (encode) and accurately recall the food/ingredient handling, cooking procedures, jam preparation etc. in the correct sequence.

Mary who is a grandmother carefully teaches her granddaughter Charlotte how to make strawberry jam.

Reproduction The learner must be able to convert the mental representation into action.

Applied to this example Charlotte must be mentally and physically capable of doing everything her grandmother showed her in order to successfully (and safely) make the jam e.g. preparing the ingredients, correctly selecting and using the cooking utensils, lighting the stove etc.

Reinforcement Reinforcement influences motivation to perform the observed behaviour

Applied to this example If Charlotte's attempt to make jam is associated with positive consequences such as praise from her grandmother and others who taste it, then she will be more likely to persist with her jam making and to make strawberry jam again in the future.

Motivation The learner must be motivated to reproduce the observed behaviour.

Applied to this example Charlotte must have the desire to make the strawberry jam and do everything that is required to do so without giving up e.g. she may simply want to make the jam perhaps because she likes to eat it or because she enjoys cooking.

ACTIVITY 5.16

Influences on observational learning processes

Write each of the following influences next to the correct process in the following table.

- The learner's ability (physical and/or psychological) to actually perform (reproduce/imitate) the observed behaviour
- The learner's ability to accurately recall key details of the observed behaviour
- The learner's perceptual capabilities e.g. ability to pay attention and detect key details of the observed behaviour
- The learner's level of motivation and interest in the model and the observed behaviour
- How useful the observed behaviour is to the learner
- Punishment for reproducing decreases likelihood of reproducing and sustaining the observed behaviour
- Self-efficacy — the learner's belief in their ability to reproduce the observed behaviour
- External reinforcement i.e. rewards sourced within the environment
- The learner's level of desire and want to reproduce the observed behaviour
- Type of memory strategy or rehearsal used to learn and remember the observed behaviour e.g. use of visual imagery; maintenance rehearsal (rote learning) vs elaborative rehearsal (meaningful learning)
- Vicarious reinforcement i.e. seeing the model being rewarded for the observed behaviour without personally experiencing the reinforcement
- The social context in which the observed behaviour occurs
- Characteristics of the model e.g. their status, likeability, attractiveness, similarities to the learner, familiarity to the learner, visibility of their behaviour, perceived reproducibility of their behaviour
- Self-reinforcement i.e. rewards sourced within the individual e.g. sense of pride or positive self-regard for achievement
- Strength and accuracy of the mental representation of the observed behaviour
- Kinds of distractors or competing stimuli present during the observation
- Reinforcement — reward is an incentive that increases likelihood of reproducing and sustaining the observed behaviour

Observational learning process	Influences
Attention	• The learner's perceptual capabilities e.g. ability to pay attention and detect key details of the observed behaviour • The learner's level of motivation and interest in the model and the observed behaviour • The social context in which the observed behaviour occurs • Kinds of distractors or competing stimuli present during the observation

Observational learning process	Influences
	• Characteristics of the model e.g. their status, likeability, attractiveness, similarities to the learner, familiarity to the learner, visibility of their behaviour, perceived reproducibility of their behaviour
Retention	• Type of memory strategy or rehearsal used to learn and remember the observed behaviour e.g. use of visual imagery; maintenance rehearsal (rote learning) vs elaborative rehearsal (meaningful learning) • Strength and accuracy of the mental representation of the observed behaviour • The learner's ability to accurately recall key details of the observed behaviour

Observational learning process	Influences
Reproduction	• The learner's ability (physical and/or psychological) to actually perform (reproduce/imitate) the observed behaviour
Motivation	• The learner's level of desire and want to reproduce the observed behaviour • Reinforcement — reward is an incentive that increases likelihood of reproducing and sustaining the observed behaviour • Punishment for reproducing decreases likelihood of reproducing and sustaining the observed behaviour • Self-efficacy — the learner's belief in their ability to reproduce the observed behaviour • How useful the observed behaviour is to the learner

Observational learning process	Influences
Reinforcement	• External reinforcement i.e. rewards sourced within the environment • Vicarious reinforcement i.e. seeing the model being rewarded for the observed behaviour without personally experiencing the reinforcement • Self-reinforcement i.e. rewards sourced within the individual e.g. sense of pride or positive self-regard for achievement

ACTIVITY 5.17

Crossword on concepts and terms in models to explain learning

Across

1 In classical conditioning, the response that occurs automatically when the unconditioned stimulus is presented.

4 The stimulus in classical conditioning that does not normally produce a predictable response but will become a conditioned stimulus.

7 When similar stimuli produce the same, but not necessarily identical, responses by an organism.

13 Strengthening or increasing the likelihood of a response using a pleasant stimulus.

17 The gradual weakening of a response and its eventual cessation when the unconditioned stimulus is no longer presented or reinforcement stops.

20 The response to the conditioned stimulus acquired through classical conditioning.

21 Delivery of an unpleasant consequence or removal of a pleasant consequence following an undesired response in order to reduce the likelihood of it reoccurring.

22 The reappearance of a conditioned response following a rest period and after its apparent extinction.

23 The nature of a classically conditioned response.

25 Strengthening or increasing the likelihood of a response by removing an unpleasant stimulus.

26 The first step in the observational learning process.

27 In operant conditioning, a stimulus that precedes a behaviour and signals its consequence.

Down

2 The type of conditioning that occurs through observation alone, without direct and personal experience of the consequences.

3 The unconditioned stimulus in the 'Little Albert' experiment.

5 Influences acquisition of both classically and operantly conditioned responses.

6 A method of social learning.

8 An emotional reaction acquired through classical conditioning.

9 The stimulus that is initially neutral but will elicit the conditioned response through classical conditioning.

10 Any response or set of responses that acts on the environment to produce some kind of consequence.

11 When a stimulus that is valued by a learner is removed in order to reduce the likelihood of a response reoccurring.

12 When an organism can tell the difference between two similar stimuli.

14 In classical conditioning, any stimulus that consistently produces a particular naturally occurring, automatic response.

15 In observational learning, the process that follows attention and precedes reproduction.

16 A type of conditioning involving learning through the repeated association of two or more different stimuli.

18 In observational learning, the imitation of a behaviour that has been observed and retained in memory.

19 The theorist who described and explained observational learning.

24 In operant conditioning, any voluntary activity that a person or animal performs that has an effect on the environment.

1 UNCONDITIONED RESPONSE
2 VICARIOUS
3 LOUDNOISE
4 NEUTRAL
5 ASSOCIATION
6 OBSERVATIONAL
7 STIMULUSGENERALISATION
8 CONDITIONED RESPONSE
9 CONDITIONED STIMULUS
10 OPERANT
11 RESPONSE
12 STIMULUS
13 POSITIVEREINFORCEMENT
14 UNCONDITIONED RESPONSE
15 REINFORCEMENT
16 CLASSICAL
17 EXTINCTION
18 RESPONDENT
19 BANDURA
20 CONSOLIDATION
21 PUNISHMENT
22 SPONTANEOUSRECOVERY
23 INVOLUNTARY
24 BEHAVIOUR
25 NEGATIVEREINFORCEMENT
26 ATTENTION
27 ANTECEDENT

ACTIVITY 5.18

True/False quiz on models to explain learning

Indicate whether each item is true or false by writing T or F in the blank column.

Statement	T or F
1 Conditioning and learning have the same outcome.	T
2 Classical conditioning is considered to be an active form of learning because it primarily involves behavioural activity based on reflexive responses.	F
3 Operant conditioning is a form of learning involving reinforcers and punishers that can be used to change voluntary behaviours.	T
4 Bandura's experiments with children demonstrate that we are more likely to imitate a model whose behaviour we see reinforced than one whose behaviour is punished.	T
5 The 'Little Albert' experiment demonstrates how operant conditioning can be used to condition an emotional response involving fear.	F
6 If someone observes a model's behaviour and does not reproduce the behaviour, it does not mean that the behaviour was not learned.	T
7 Negative reinforcement decreases the likelihood that a response will occur	F
8 A fly landing on your nose could be considered to be an antecedent.	T
9 Classical and operant conditioning demonstrate that learning is best defined as a temporary change in behaviour due to experience.	F
10 We are more likely to want to imitate the behaviour of someone we perceive as similar to ourselves.	T
11 In the Watson and Rayner experiment, the loud noise was the unconditioned stimulus and the white rat was the conditioned stimulus.	T
12 Modelling involves learning based on observing the behaviour of others.	T
13 In observational learning, vicarious reinforcement refers to when the learner is rewarded by watching the model perform a behaviour that is interesting.	F
14 Classical conditioning is a form of learning that results in the involuntary association between a neutral stimulus and unconditioned stimulus to produce a conditioned response.	T
15 Observational learning is a method of social learning involving attention, retention, reproduction, motivation and reinforcement.	T
16 A reinforcer is a stimulus that precedes a response and subsequently increases the probability of that response.	F
17 Observational learning does not involve conditioning.	F
18 In classical conditioning, the neutral stimulus must be presented before the unconditioned stimulus, ideally within about half a second.	T
19 The process of extinction involves removal of a stimulus following a response to increase the probability of that response.	F
20 According to observational learning theory, we can learn not only through direct experience but also through watching or listening to the experience of others.	T
21 A sniffer dog that detects drugs in a bag at the airport is demonstrating stimulus discrimination.	T

ACTIVITY 5.18 *continued*

Statement	T or F
22 Observational learning is used by children but not adults.	F
23 A child who is burned while playing with matches and subsequently is afraid to go near the kitchen stove, is demonstrating stimulus generalisation.	T
24 The three-phase model of operant conditioning means that the probability of a particular behaviour occurring in response to an antecedent stimulus depends on the consequences that have followed the behaviour in the past.	T
25 Both operant and classical conditioning can occur vicariously through observational learning.	T
26 Extinction and spontaneous recovery occur in operant conditioning but not classical conditioning.	F
27 A conditioned stimulus is a stimulus that is learned, whereas a neutral stimulus is a stimulus that is not learned.	T
28 A child doing his homework because he receives the teacher's approval is demonstrating behaviour learnt through classical conditioning.	F
29 Response cost removes a reinforcer and is a form of negative punishment aiming to weaken a response.	T
30 Observational learning includes imitating, modelling and social learning.	T

CHAPTER 6

Process of memory

	Activities											
Key knowledge	6.1	6.2	6.3	6.4	6.5	6.6	6.7	6.8	6.9	6.10	6.11	6.12
• the multi-store model of memory (Atkinson–Shiffrin) with reference to the function, capacity and duration of sensory, short-term and long-term memory	✔	✔	✔	✔	✔	✔	✔		✔	✔	✔	✔
• interactions between specific regions of the brain (cerebral cortex, hippocampus, amygdala and cerebellum) in the storage of long-term memories, including implicit and explicit memories.							✔	✔	✔	✔	✔	✔

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ACTIVITY 6.1

Comparing different memory stores

Complete the following table to summarise and compare key features of the three memory stores in the multi-store model.

Store	Function	Capacity	Duration
sensory memory	• Receives sensory information from the environment • Enables perceptual continuity for the world around us	Vast, potentially unlimited	Momentary — about 0.2–4 seconds
short-term memory (STM)	• Receives information from sensory memory and transfers information to and from LTM • Maintains information in conscious awareness for immediate use	7 ± 2 pieces of information	• Temporary — 18–20 seconds, possibly up to 30 seconds • Longer if renewed (e.g. maintenance rehearsal; using for 'working memory')

ACTIVITY 6.1 *continued*

Store	Function	Capacity	Duration
long-term memory (LTM)	Information storage for re-access and use at a later time	Vast, potentially unlimited	• Potentially permanent • Some information may be lost or inaccessible over time • Indefinite

ACTIVITY 6.2

Memory store function, capacity and duration

Tick which memory store is most involved in relation to each statement. A statement may be selected more than one once.

Statement	sensory memory	short-term memory	long-term memory
1 Information about Olivia's fifteenth birthday party is stored here.			✔
2 Information from body receptors is initially received in this store.	✔		
3 Information in this store is believed to be organised semantically (based on meaning).			✔
4 This store has unlimited capacity and duration.			✔
5 Sam is afraid of dogs after a scary incident when a ferocious dog lunged towards him.			✔
6 Information is this store is not encoded.	✔		
7 A structural feature.	✔	✔	✔
8 This store holds new information just long enough to enable the person to decide if it is required or not.	✔		
9 This store can receive, transfer and retain new incoming information.	✔	✔	✔
10 This store is where information in conscious awareness is held.		✔	
11 James can recall how to multiply by six when asked to solve a mathematical equation.		✔	✔
12 Kate can skip along the footpath without falling over.			✔
13 Imran becomes increasingly anxious when hearing a threatening musical score while watching a scene unfold during a horror movie.		✔	✔
14 Information in this store is lost quickest if unattended.	✔		
15 It is difficult to remember more than one new phone number at a time if the digits are not grouped.		✔	
16 Maria knows that the population of Australia exceeded 24 million in the year 2018.			✔
17 The duration of this store enables us to watch a movie without perceiving the individual picture frames.	✔		
18 Spiros can work out the change from ten dollars when selling oranges to a customer.		✔	✔
19 Numerous explicit and implicit memories are stored here.			✔
20 Information transferred to this store can be held there indefinitely using a rehearsal technique.		✔	

ACTIVITY 6.3

An overview of the Atkinson–Shiffrin model

Select terms from the shaded panel below to correctly complete the passage about memory. A term should be used only once but not all terms need to be used.

actively	attend	conscious	consolidation	decay
displaced	encoding	flow charts	long-term	lost
minutes	models	multi-store	neurologically	recovery
rehearsal	retrieval	seconds	sensory	short-term
storage	transferred	unconscious	7 ± 2	18–20

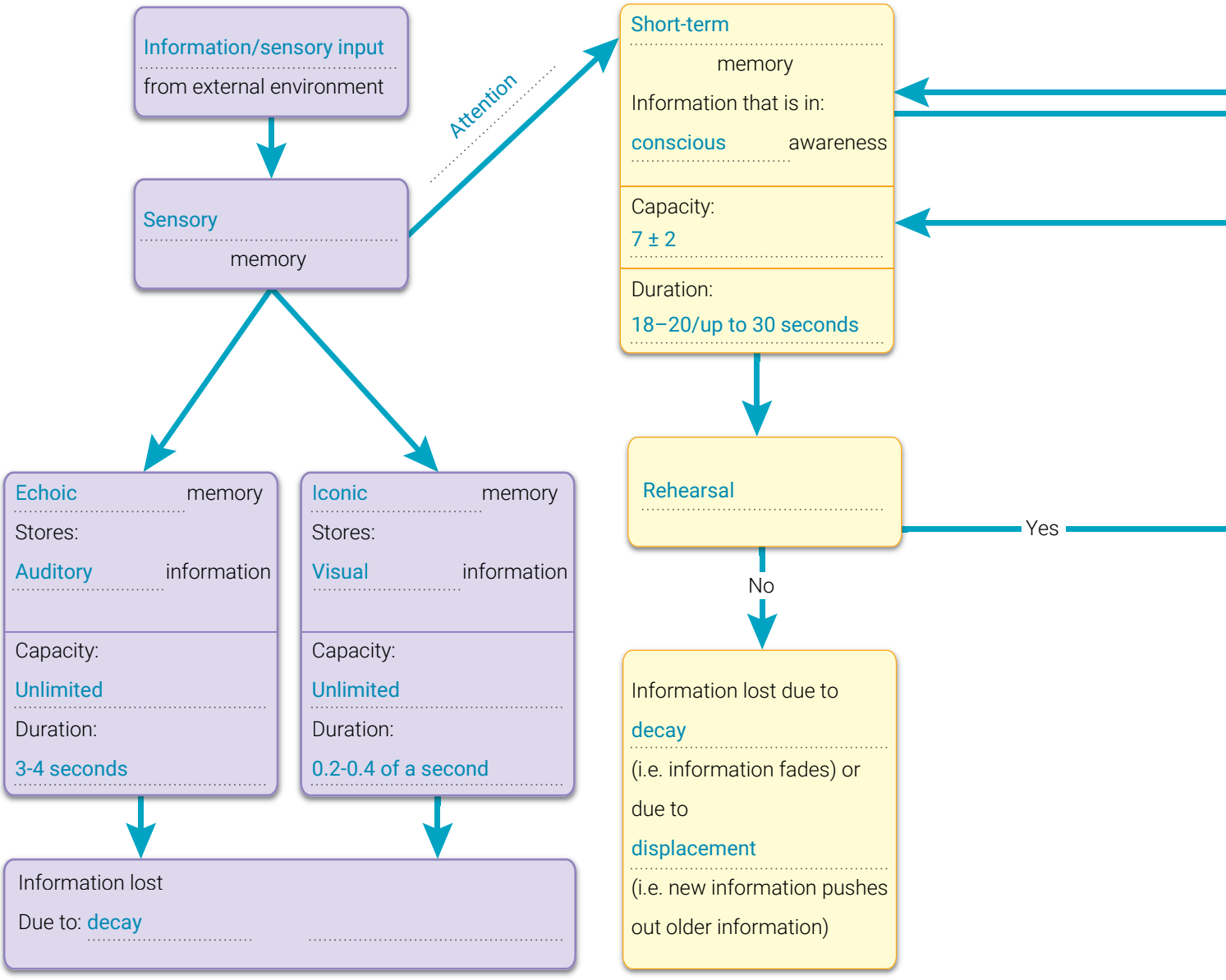
Psychologists have developed several models of memory that typically involve three vital processes. These are called encoding whereby information is changed into a usable form that can be neurologically represented and retained, storage whereby the changed information is retained over time and retrieval whereby the information may be brought back into conscious awareness when required.

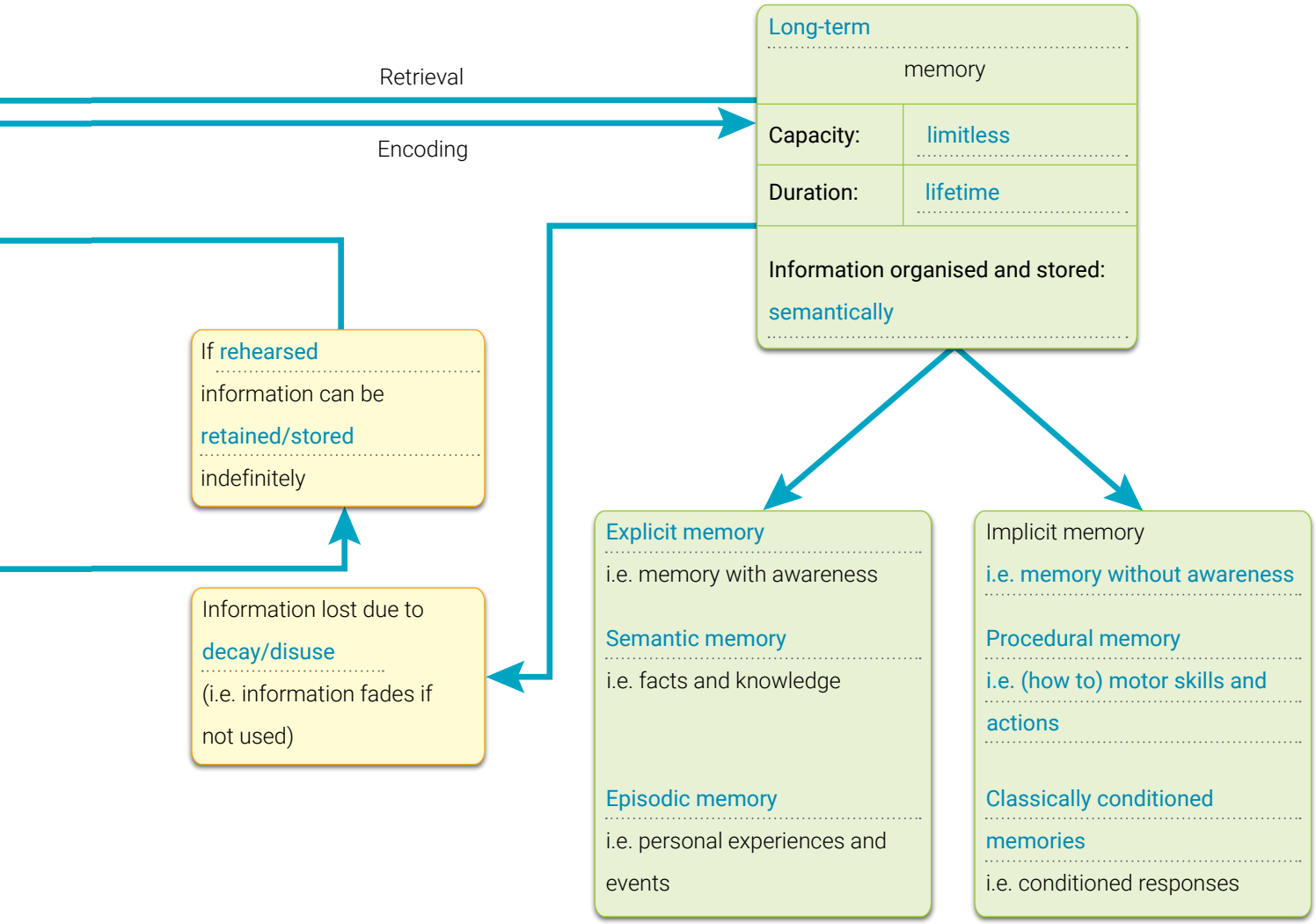
According to the Atkinson–Shiffrin multi-store model, sensory memory is the gateway for new information and can store vast quantities of this information for up to several seconds, depending on the type of information. If we attend to this information it will be transferred to short-term memory. If ignored, this information will decay and consequently be lost. In contrast, information received in short-term memory is typically stored there for about 18–20 seconds, depending on the type of information and the level of conscious effort being made. Furthermore, if information is effectively encoded in long-term memory, it may be stored there for a lifetime.

ACTIVITY 6.4

Information flow through the Atkinson–Shiffrin multi-store model of memory

Complete this flow chart to summarise the different memory stores and transfer of information through the Atkinson–Shiffrin multi-store model of memory.




Retrieval
Encoding
Long-term
memory
Capacity:
limitless
Duration:
lifetime
Information organised and stored:
semantically
If rehearsed
information can be
retained/stored
indefinitely
Information lost due to
decay/disuse
(i.e. information fades if
not used)
Explicit memory
i.e. memory with awareness
Semantic memory
i.e. facts and knowledge
Episodic memory
i.e. personal experiences and
events
Implicit memory
i.e. memory without awareness
Procedural memory
i.e. (how to) motor skills and
actions
Classically conditioned
memories
i.e. conditioned responses

ACTIVITY 6.5

Matching exercise on the human memory systems

Match each description with the most appropriate term on the right. Write the letter of the term you select to the left of each description. Each term can be used only once.

(m)	**1** Continually repeating a definition to yourself until you can write it down before you forget it.	**(a)** iconic memory
(j)	**2** Being introduced to a person by name but then forgetting it shortly afterwards as they tell you about their other family members.	**(b)** decay
(d)	**3** To represent memory in some neurological form in the memory system.	**(c)** short-term memory
(k)	**4** Remembering how excited you felt when you saw the superhero cake your grandmother made you for your 4th birthday.	**(d)** encode
(a)	**5** A sensory register that stores information for up to about one-third of a second.	**(e)** semantic memory
(l)	**6** The process by which a memory stabilises and 'sets' after its initial acquisition.	**(f)** procedural memory
(b)	**7** Forgetting due to not attending to the information over time.	**(g)** explicit memory
(e)	**8** Knowing that Tokyo is in Japan.	**(h)** echoic memory
(o)	**9** Entry point of human memory where new incoming information is briefly stored.	**(i)** long-term memory
(c)	**10** A memory system that maintains information in conscious awareness for immediate use.	**(j)** displacement
(h)	**11** Stores incoming auditory information in its raw form.	**(k)** episodic memory
(g)	**12** Information in long-term memory that can be verbally communicated.	**(l)** consolidation
(n)	**13** A contemporary term for short-term memory emphasising its active nature.	**(m)** maintenance rehearsal
(i)	**14** Retention of information over an indefinite period of time.	**(n)** working memory
(f)	**15** Walking up a staircase without falling over.	**(o)** sensory memory

ACTIVITY 6.6

Summarising long-term memory types

Complete the diagram to summarise the different long-term memory types and sub-types.

Long-term memory

Description: Stores a potentially unlimited amount of information for a very long time, possibly permanently. LTM is not considered to be a single store for all kinds of information. Different types of LTM are associated with different kinds of information and memory processes.

Name: Explicit memory

Description: Memory with awareness

Name: Implicit memory

Description: Memory without awareness

Name: Semantic memory

Description: Facts and knowledge

Examples: A maths formula, name of a movie, capital city locations, hair colour of a friend

Name: Episodic memory

Description: Personal experiences and events

Examples: First time on a bike during childhood, when a taste aversion was acquired, celebration of last New Year's Eve

Name: Procedural memory

Description: Motor skills and actions

Examples: Cooking an omelette, breaststroke swimming, writing with a pencil

Name: Classically conditioned memory

Description: Conditioned responses to conditioned stimuli

Examples: A classically conditioned reflex or a fear response, feeling ill at the thought of eating an oyster

ACTIVITY 6.7

Matching exercise on brain regions, memory time frames and memory storage

Match each description with the most appropriate term on the right. Write the letter of the term you select to the left of each description. Each term can be used only once.

(f)	**1** Stores various simple reflexes acquired through classical conditioning.	**(a)** echoic memory
(a)	**2** Stores auditory sensory information for about 3–4 seconds.	**(b)** cerebral cortex
(h)	**3** Has a crucial role in encoding memories of emotionally arousing experiences but does not permanently store emotional memories.	**(c)** hippocampus
(e)	**4** May store information for up to about 30 seconds without renewal.	**(d)** neural pathway
(c)	**5** Has a crucial role in readying short-term memories for long-term storage but does not permanently store any memories.	**(e)** short-term memory
(d)	**6** Anatomically links different bits of information that are associated with a memory but stored in multiple brain regions.	**(f)** cerebellum
(b)	**7** Stores explicit memories.	**(g)** iconic memory
(g)	**8** Stores visual sensory information for about 0.2–0.4 seconds.	**(h)** amygdala

ACTIVITY 6.8

Brain regions involved in LTM storage

Name each brain region and summarise the types of long-term memory stored there, if any.

Name: Cerebral cortex

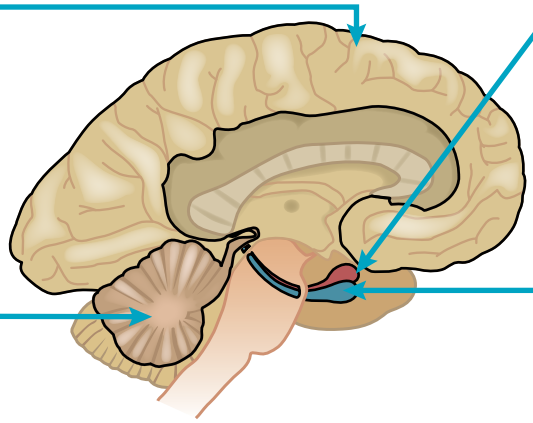
Description:

- stores explicit memories (semantic and episodic), most likely where first processed; an entire explicit memory not necessarily stored in one location e.g. parts may be stored where first processed
- stores procedural memories i.e. well-learned motor responses/sequences
- stores more complex classically conditioned responses/memories e.g. not conditioned reflexes

Name: Amygdala

Description:

- crucial role in the formation of emotional memories but does not permanently store semantic or episodic content of explicit emotional memories (or any details)
- does not store implicit memories (procedural or classically conditioned)



Name: Cerebellum

Description:

- involved in temporary storage of procedural (implicit) memories (but well-learned motor responses are believed to be stored in the cerebral cortex)
- stores simple conditioned reflexes e.g. eye blink to a sound associated with a puff of air
- does not store explicit memories

Name: Hippocampus

Description:

- processes new memories for long-term storage then transfers to cerebral cortex for more permanent storage
- temporarily stores explicit memories (semantic and episodic) during consolidation (but does not permanently store)

ACTIVITY 6.9

Analysis of a scenario involving LTM formation and storage

Identify the long-term memory types and brain regions involved in different parts of the scenario, focusing on the storage role/s of the brain regions. The first one has been completed as an example.

Xanthe is a primary school student in Year 6. She has begun walking home by herself now that her parents consider her old enough to cross roads safely. Her journey home is not very direct but her parents walked the route with her many times when she was younger and she now knows all of the turns she must make and which paths to walk. Her parents have also warned her about potential dangers when crossing certain roads and roads in general.

Along the way Xanthe must cross two busy roads and walk past a house where a large ferocious dog is kept. The dog is held securely behind a tall locked gate but it always barks ferociously at people walking by. Xanthe feels quite confident walking home but walking past the house with the dog always brings back memories of an episode earlier in her life where a dog had lunged at her when on a neighbourhood stroll with her family. Fortunately, she wasn't injured at the time, but the incident has left her feeling very wary of all dogs.

Xanthe's behaviour	Long-term memory type and brain region involved in storage
As Xanthe walks home by herself she knows the next turn to make or street to take	**Example:** **long-term memory type(s):** *episodic, semantic* **explicit or implicit:** *explicit* **brain region(s) involved in storage and explanation of choice:** *cerebral cortex — storage throughout, including street names and locations, navigational landmarks, prior experiences in the neighbourhood and sequential order of the streets Xanthe must walk; contributes to reconstruction of integrated memories using different elements of the route and the route in general* *hippocampus — does not permanently store information but may support retrieval from LTM into STM of relevant semantic and episodic memory information about the desired route as Xanthe walks home*
Xanthe practices the route with her parents	**long-term memory type(s):** episodic, semantic **explicit or implicit:** explicit **brain region(s) involved in storage and explanation of choice:** cerebral cortex – storage throughout of explicit details and key features of the route e.g. street names and locations, navigational landmarks, dangers hippocampus – consolidation of relevant route information from STM to LTM when rehearsing with parents, thereby enhancing long-term storage (does not permanently store information about the route)

Xanthe's behaviour	Long-term memory type and brain region involved in storage
Xanthe's fear of dogs	**long-term memory type(s):** classically conditioned memory **explicit or implicit:** implicit **brain region(s) involved in storage and explanation of choice:** amygdala — contributed to acquisition of the classically conditioned fear response earlier in life and its expression when walking past the relevant house hippocampus — consolidation of explicit components of the episode, such as place and time, thereby enhancing long-term storage (but not directly involved in the formation or storage of the conditioned emotional memory)

Xanthe's behaviour	Long-term memory type and brain region involved in storage
Xanthe is physically able to walk home	**long-term memory type(s):** procedural **explicit or implicit:** implicit **brain region(s) involved in storage and explanation of choice:** cerebral cortex — storage of well learned motor responses required for walking cerebellum — although involved in the initial encoding and temporary storage of relevant motor skills, not directly involved in long-term storage; may store simple conditioned reflexes that could be initiated when walking home (unconscious coordination of muscles when walking, including correct muscle tension and response, fine-tuning of movements etc.)
Xanthe knows how to cross busy roads safely	**long-term memory type(s):** semantic, episodic **explicit or implicit:** explicit **brain region(s) involved in storage and explanation of choice:** cerebral cortex — storage of semantic memory information such as crossing point locations, road signs, dangers, vehicle types and how to judge the traffic; storage of episodic memory experiences that may also be retrieved to inform safe crossing amygdala — contributed to formation of conscious, explicit memories of potential dangers (e.g. episodic memories of past road-crossing experiences involving heightened emotional arousal) which also support recognition of danger if too much traffic, a speeding car etc. hippocampus — consolidation of all memory information relevant to the situation, thereby enhancing long-term storage and better ensuring availability to support safe road crossing

ACTIVITY 6.10

Summarising memory stores and processes

Cross out the incorrect term in the bracketed pairs to correctly summarise the passage about human memory.

Human memory involves three fundamental processes called encoding, storage and retrieval that occur in a sequence, interact and are **(~~unrelated~~/interdependent)**. Encoding is the conversion of information into a **(usable/~~flexible~~)** form so that it can be represented in the brain within neural networks and stored so that it can be retrieved when needed.

The Atkinson–Shiffrin multi-store model of represents human memory as consisting of **(~~two~~/three)** separate stores. These stores differ in their function, in the amount of information they can hold (called storage **~~duration~~/capacity**) and the length of time they can hold information (called storage **duration/~~capacity~~**).

Sensory memory receives information detected by sensory receptors. It stores information in a/an **(raw/~~encoded~~)** form for very brief periods but long enough for information that is **(selected/~~ignored~~)** to be transferred to **(short-term/~~long-term~~)** memory. Iconic sensory memory stores **(~~auditory~~/visual)** information and echoic sensory memory stores **(auditory/~~visual~~)** information.

Short-term memory is also called working memory because it holds the information we are **(consciously/~~unconsciously~~)** aware of and use at any given moment to undertake many of our everyday life activities. Short-term memory typically holds 7±2 items of information for up to **(~~ten~~/thirty)** seconds. Information in short-term memory can be retained indefinitely through **(~~displacement~~/rehearsal)**.

Long-term memory is believed to have a/an **(~~limited~~/unlimited)** storage capacity and possibly a storage **(~~capacity~~/duration)** of up to a lifetime. New information transferred from sensory memory to short-term memory requires additional **(encoding/~~attention~~)** for its transfer to long-term memory storage. When the information reaches long-term memory, it is likely to be organised **(~~linguistically~~/semantically)** to enhance its retrieval.

Long-term memory is considered to be a **(~~single~~/multiple)** store for all kinds of information as different types of long-term memory are associated with different kinds of information and memory processes. The two main types

are explicit and implicit memories. Explicit memories are those that can be **(consciously/~~unconsciously~~)** retrieved and **(~~remembered~~/stated)**. These include **(semantic/~~episodic~~)** memories involving facts and general knowledge and **(~~semantic~~/episodic)** memories involving personal experiences. In contrast, implicit memories are those that do not require conscious or intentional retrieval. These include **(~~motor~~/procedural)** memories of how to perform actions, especially those that involve well-rehearsed motor skills. **(Implicit/~~Explicit~~)** memories also include classically conditioned associations such as reflexive or emotional responses to stimuli.

Most long-term memories are stored throughout the **(cerebral cortex/~~brain~~)**. The specific storage area tends to be where the relevant information was first **(~~learnt~~/processed)**. Different pieces of information that form a complex memory may be stored at **(~~identical~~/different)** sites), but are likely to be linked as a neural network so that they do not remain a collection of **(separate/~~boring~~)** memories.

The hippocampus located in the medial **(~~frontal~~/temporal)** lobe area is critical for the formation of new **(~~implicit~~/explicit)** memories and their **(~~combination~~/consolidation)** to help ensure their stability and durability. It does not permanently store these memories, but is believed to be involved in their transfer to long-term storage sites and their **(~~renewal~~/retrieval)** when needed.

The hippocampus is connected to and interacts with the **(~~cerebellum~~/amygdala)** in a number of memory processes, especially those involving emotional memories. The **(~~cerebellum~~/amygdala)** is crucial to the formation of **(implicit/~~explicit~~)** memories involving classically conditioned fear responses. The (**~~cerebellum~~/amygdala**) also activates in all other emotionally arousing experiences and helps ensure the emotional component of the memory is encoded with the (**~~implicit~~/explicit**) details. The amygdala does not permanently store semantic or episodic content (or any details) of **(~~implicit~~/explicit)** emotional memories, nor does it store procedural or classically conditioned **(implicit/~~explicit~~)** memories.

The **(cerebellum/~~cerebral cortex~~)** is involved in the encoding and temporary storage of the more complex procedural **(implicit/~~explicit~~)** memories. It has also been found to be a **(~~temporary~~/permanent)** storage site for **(simple/~~complex~~)** conditioned reflexes, but does not store **(~~implicit~~/explicit)** memories of any type.

ACTIVITY 6.11

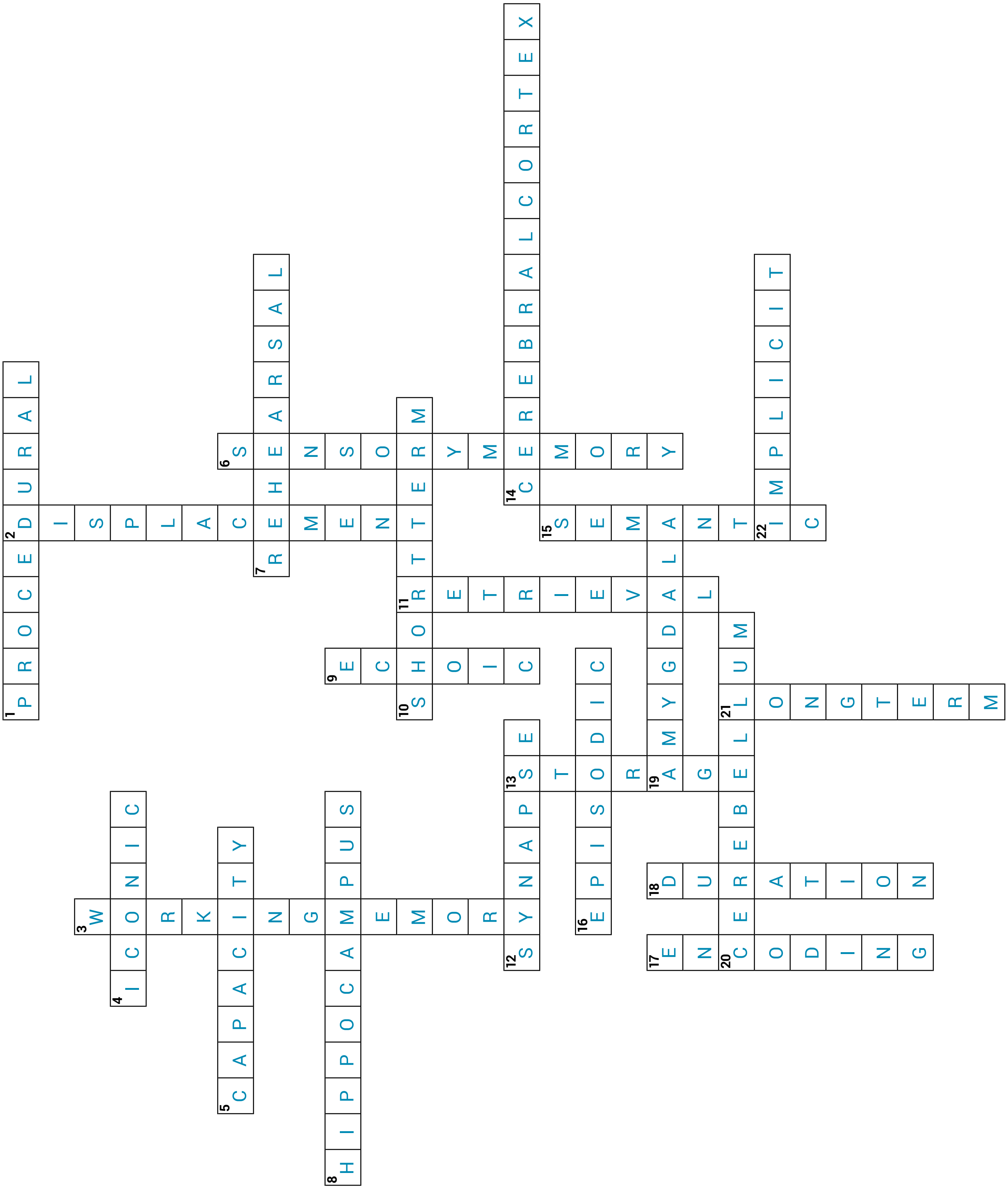
Crossword on concepts and terms in memory

Across

1 Long-term memory of well-learnt motor skills and actions.
4 A type of memory store for incoming visual information.
5 Describes the amount of information that can be stored in a memory system or sub-system.
7 Activity that prolongs retention in short-term memory beyond the usual storage period.
8 Brain structure with a crucial role in the consolidation of new explicit memories.
10 A memory store with limited capacity and duration unless information is renewed in some way.
12 Memories are formed here.
14 Long-term explicit, semantic and episodic memories are stored throughout this brain region.
16 Long-term explicit memory of personally experienced events.
19 Brain structure involved in the encoding of the emotional component of a memory.
20 Brain structure involved in the formation of long-term motor skill memories and implicit memories of simple conditioned responses.
22 Memory that does not require conscious or intentional retrieval.

Down

2 When new information shifts older information out of a memory store.
3 A more active term for short-term memory.
6 Entry point of memory in the Atkinson–Shiffrin model.
9 Stores incoming auditory information in raw form for a few seconds.
11 Recovery of a long-term memory into conscious awareness.
13 Retention of encoded information over time.
15 Long-term explicit memory of facts and knowledge.
17 Conversion of information into a form that can be neurologically stored in the brain.
18 A term that describes the length of time that information can be stored in a memory system or sub-system.
21 A memory store believed to have a potentially unlimited capacity and duration.



1 PROCEDURAL
2 DISPLACEMENT
3 WORKING MEMORY
4 ICONIC
5 CAPACITY
6 SENSORY MEMORY
7 REHEARSAL
8 HIPPOCAMPUS
9 ECHOIC
10 SHORT TERM
11 RETRIEVAL
12 SYNAPSE
13 STORAGE
14 CEREBRAL CORTEX
15 SEMANTIC
16 EPISODIC
17 ENCODING
18 DURATION
19 AMYGDALA
20 CEREBELLUM
21 LONG TERM
22 IMPLICIT

ACTIVITY 6.12

True/False quiz on the process of memory

Indicate whether each item is true or false by writing T or F in the column at the right.

Statement	T or F
1 Memories are stored everywhere in the brain.	F
2 Sensory memory encodes and stores incoming raw sensory information.	F
3 Explicit memories are declarative memories.	T
4 We are consciously aware of all information retrieved from long-term memory.	F
5 A heightened level of noradrenaline in the amygdala during arousal may enhance consolidation and storage of emotional memories.	T
6 Procedural memories are difficult or impossible to communicate verbally.	T
7 The cerebral cortex converts short-term memories into long-term memories.	F
8 The Atkinson–Shiffrin (1968) model proposes the following sequence for processing new incoming information: sensory register, short-term memory, long-term memory.	T
9 Sensory memory has a longer storage duration than short-term memory.	F
10 Some implicit memories require conscious or intentional retrieval.	F
11 Encoding determines how well information is stored in long-term memory.	T
12 Both sensory memory and short-term memory are temporary stores.	T
13 Maintenance rehearsal ensures short-term memory can have a virtually limitless storage capacity.	F
14 All explicit memories are semantic memories.	F
15 The cerebellum stores simple conditioned reflexes.	T
16 Iconic memory is considered the centre of consciousness.	F
17 A long-term memory can have a duration of minutes.	T
18 Information in short-term memory can only be lost through displacement.	F
19 The cerebral cortex is a long-term storage site for well-learnt motor skills.	T
20 The amygdala may contribute to the formation of both implicit and explicit memories.	T
21 Short-term memory capacity can be improved by grouping or 'chunking' bits of information.	T
22 Iconic memories decay more slowly than echoic memories.	F
23 The hippocampus may store long-term memories for up to a lifetime.	F
24 Storage capacity and duration are considered structural features of human memory.	T
25 Procedural memories typically require little or no conscious effort to retrieve.	T

CHAPTER 7

Reliability of memory

	Activities															
Key knowledge	7.1	7.2	7.3	7.4	7.5	7.6	7.7	7.8	7.9	7.10	7.11	7.12	7.13	7.14	7.15	7.16
• methods to retrieve information from memory or demonstrate the existence of information in memory, including recall, recognition, relearning and reconstruction	✔	✔	✔									✔			✔	✔
• the effects of brain trauma on areas of the brain associated with memory and neurodegenerative diseases, including brain surgery, anterograde amnesia and Alzheimer's disease								✔	✔	✔					✔	✔
• the factors influencing a person's ability and inability to remember information, including context and state dependent cues, maintenance and elaborative rehearsal and serial position effect											✔	✔	✔	✔	✔	✔
• the reconstruction of memories as evidence for the fallibility of memory, with reference to Loftus' research into the effect of leading questions on eyewitness testimonies.				✔	✔	✔	✔								✔	✔
Key science skills												✔				

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ACTIVITY 7.1

Methods to retrieve information from memory or demonstrate the existence of information in memory

Part A

Define each retrieval method and give an example that refers to our solar system. Recall has been completed as an example.

Retrieval method	Definition	Example
Recall	*Reproducing information stored in memory*	*Stating that Earth is the name of our planet*
Free recall	Reproducing information from memory in any order, without the assistance of any cue	Stating the names of the planets in our solar system in any order
Serial recall	Reproducing information from memory in the order in which it was learned	Stating the names of the planets in our solar system in the order from nearest to furthest from the sun
Cued recall	Reproducing information from memory by using a prompt to assist retrieval	Stating the names of the planets in our solar system when given the first letter of each one

Retrieval method	Definition	Example
Recognition	Identification of information previously experienced or learnt	Identifying the correct answer for the name of a planet from among alternatives that include incorrect names
Relearning	Learning information again that has been previously learned and therefore stored in long-term memory; also called *savings*	Requiring less time to relearn the names of the planets than when previously learned

Part B

Indicate the order of sensitivity of recall, recognition and relearning by writing them in the correct spaces under the continuum.

recall — recognition — relearning

Least sensitive → **Most sensitive**

ACTIVITY 7.2

Distinguishing between recall, recognition and relearning

Place a tick in the column that best describes the retrieval method used for each example.

Examples	free recall	serial recall	cued recall	recognition	relearning
1 Writing a detailed response to a section B short answer question in a VCE psychology exam.	✔				
2 Realising you have already seen a movie after you started watching it.				✔	
3 Naming all the Australian states and territories in alphabetical order.		✔			
4 Naming the Australian states and territories that start with the letter N.			✔		
5 Reciting the alphabet while teaching it to your niece.		✔			
6 Giving the correct answer to a history question when playing a board game with friends.	✔				
7 Finding it much easier to learn a ballet movement that you could perform in childhood than an equally complex new one.					✔
8 Knowing you studied ballet when asked if you have studied dance or ballet.				✔	
9 Remembering that QANTAS stands for Queensland and Northern Territory Aerial Services when asked by a tourist.			✔		
10 Knowing that wombats and rabbits are mammals when asked if they are.	✔				
11 Remembering the location of your keys at home because you always place them in the same spot.			✔		
12 Telling a friend the directions to your house because they have never visited you before.		✔			
13 Realising you have taken the wrong turn when distracted while travelling to the house of friend you have visited many times.				✔	
14 Knowing when to perform your role in a school play based on which scenes you are in.			✔		
15 Taking up guitar playing in retirement and learning a chord faster than when much younger.					✔
16 Visiting an interstate holiday destination as an adult and suddenly realising that you had holidayed there as a child.				✔	
17 Remembering all the lines of a favourite poem.		✔			
18 Remembering a forgotten line of a favourite poem after being told the first word.			✔		
19 Completing a difficult mathematics problem by remembering the correct sequence of steps in the formula.		✔			
20 Telling your favourite joke once again.	✔				

ACTIVITY 7.3

Measuring relearning by calculating a savings score

Part A

Select terms from the shaded panel below to correctly complete the passage about relearning. A term may be used more than once. Not all terms are used.

aware	easier	harder	implicit	last
learned	long-term	percentage	quickly	retained
retention	savings	second	time	trials

Most people report that learning something for the **second** time is much **easier** than learning it the first time. Relearning involves learning information again that was **learned** at some time in the past (and was therefore stored in **long-term** memory). If the information is learned more **quickly** the second time, then it is assumed that some information must have been **retained** (or 'saved') from the first learning experience, even though the learner may not be **aware** of it.

This measure of **retention** is also known as the method of savings (or simply savings) because the **percentage** of information retained can be measured by calculating a **savings** score. This score can be calculated based on the number of **trials** required to learn and then relearn information, or it can be calculated based on the amount of **time** taken to learn and then relearn information.

Part B

Complete each the following savings formulas.

Calculating a savings score based on ***number of trials***

$$\text{Savings score} = \frac{(\text{no. of trials for original learning}) - (\text{no. of trials for relearning})}{(\text{no. of trials for original learning})} \times \frac{100}{1}$$

Calculating a savings score based on ***time***

$$\text{Savings score} = \frac{(\text{time for original learning}) - (\text{time for original relearning})}{(\text{time for original learning})} \times \frac{100}{1}$$

Part C

Use the correct formula to calculate the savings score for each of the following examples.

1 Jennifer is teaching her 5-year-old daughter Megan how to tie her shoelaces. The first time Megan attempted to tie them it took her 15 attempts. A week later Megan watches her daughter closely and notices it only took her 10 attempts.

$$\text{Savings score} = \frac{(15) - (10)}{(15)} \times \frac{100}{1}$$

$$= \frac{5}{15} \times 100 = 33\%$$

2 Roger is teaching his son Vanh how to balance and ride a bicycle without training wheels. He decided to take him to a local park where there is a safe path. After one hour of learning and practice time, Vanh almost managed to ride by himself unassisted. Two weeks later, Roger returned with his son to the same location. On this occasion, he noticed that Vanh was able to successfully balance and ride unassisted after only 30 minutes.

$$\text{Savings score} = \frac{(60) - (30)}{(60)} \times \frac{100}{1}$$

$$= \frac{30}{60} \times 100 = 50\%$$

3 A trainee surgeon is practicing the medical procedure for appendix removal under the watchful eye of their supervisor. It takes the trainee 12 attempts to successfully complete the procedure. One week later, the trainee attempts the same procedure. On this occasion, the trainee manages to perform the procedure flawlessly in just 3 attempts.

$$\text{Savings score} = \frac{(12) - (3)}{(12)} \times \frac{100}{1}$$

$$= \frac{9}{12} \times 100 = 75\%$$

ACTIVITY 7.3 *continued*

4 Quinn is correcting his golf swing. The first time he practices it takes him 20 attempts to perform the action as shown by his coach. The next day he practises again and surprises his coach by swinging the club perfectly the first time.

$$\text{Savings score} = \frac{(20) - (0)}{(20)} \times \frac{100}{1}$$

$$= \frac{20}{20} \times 100 = 100\%$$

ACTIVITY 7.4

Memory reconstruction concept chart

Select terms from the following shaded panel below to complete the chart on memory reconstruction. Each term can be used only once. All terms are used.

accurate	add	believed
combining	complete	details
encoding	environment	experiences
knowledge	logical	might
plausible	recall	reconsolidation
state	uncertain	values

Memory reconstruction

involves: combining stored information with other available information to form what is believed to be a more coherent, complete or accurate memory. Each time we retrieve a memory, we may make up and add missing bits to complete the memory in a logical or plausible way.

When memory reconstruction is most evident:

- when we cannot fully recall an event
- when we are uncertain about some of the details of an event.

When memory error and distortions can occur:

- during initial encoding
- during retrieval
- during reconsolidation back into LTM following recall.

Influences on memory reconstruction include:

- pre-existing knowledge
- personal experiences
- personal values
- psychological state
- context or cues in the environment
- expectations
- motivations
- assumptions about what might have happened.

ACTIVITY 7.5

Summarising how errors and distortions creep into reconstructed memories

Select terms from the shaded panel below to correctly complete the passage about how errors and distortions creep into reconstructed memories. Each term can be used only once and all terms are used.

accurate	actively	add	believe	bits
brain	conscious	different	distortion	encoded
existing	experiments	eye-witness	integrated	leading questions
learning	long-term	neural	new	part
plausible	reconstruct	reproduction	store	uncertain

A reconstructed memory is often accurate, but may also contain errors and distortions. This means that a retrieved memory is not necessarily an exact reproduction of the original experience at the time of learning.

How do errors and distortions creep into memories? When we form an explicit, long-term memory, we encode and then store the elements and details throughout different regions of the brain. These are linked together within neural pathways. When we later attempt to access the memory, we retrieve the encoded elements and actively reconstruct the memory. In the process of doing so, various factors can contribute to errors and distortions.

During recall, we reconstruct the memory, drawing on our personal values, beliefs and expectations to make up and add missing bits in ways that complete the memory in a logical or plausible way. This is usually done without conscious awareness that it is happening. For example, conversations and interactions with other people or information related to an event can become integrated into a memory to such an extent that later recall is confused. We can even become uncertain as to

whether bits of the memory genuinely occurred or were added later. Sometimes, we can believe something is true and was part of an experience when it actually was not.

With repeated retrieval, the memory is subject to further distortion and it becomes harder to distinguish the details of what actually happened when originally encoded from what was added later.

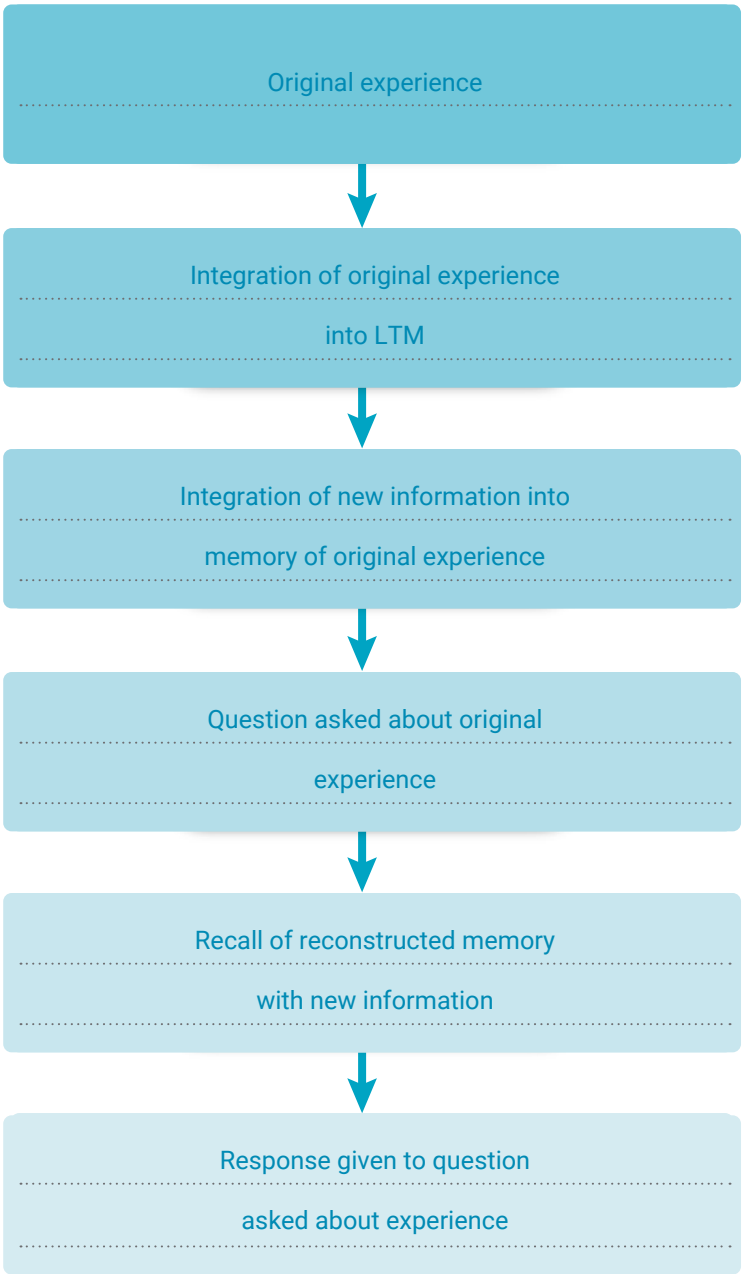
Elizabeth Loftus has shown that eye-witness testimonies are reconstructions and therefore not necessarily as accurate as previously thought. She has demonstrated this through her research using leading questions. Her leading questions have new bits of information and are phrased in such a way as to suggest the content was part of the original experience. The new piece of information in the leading question can then become integrated with an existing memory, as demonstrated by the 'eye-witness' participants in her car accident experiments.

ACTIVITY 7.6

Elizabeth Loftus' revised model of recall from LTM

(a) Complete the flow chart of Elizabeth Loftus' revised model of recall from LTM by writing the phrases into the spaces provided in the correct sequence.

Integration of new information into memory of original experience	Original experience	Recall of reconstructed memory with new information
Integration of original experience into LTM	Response given to question asked about experience	Question asked about original experience



(b) How does this model explain the effect of leading questions on eye-witness testimony?

Loftus's model includes an extra step of integrating new information acquired after the original experience, which may be used in a reconstructed memory that does not accurately reflect the original experience. A leading question can be used to add or 'plant' new, false information to or in an eye-witness's memory of a critical event, thereby increasing the likelihood of that information being integrated in their reconstructed memory when prompted to recall that memory by a closely related question asked at a later time during the trial.

ACTIVITY 7.7

Summarising effects of brain trauma on memory

Complete the following chart to summarise effects of brain trauma through neurodegenerative disease and brain surgery (lesioning) on memory.

Brain trauma

Definition: Any brain injury acquired after birth that impairs normal functioning

Neurodegenerative disease

Definition: Progressive decline in the structure, activity and function of brain tissue

Alzheimer's disease

Definition: A dementia characterised by gradual, widespread degeneration of brain neurons, progressively causing memory decline, deterioration of cognitive and social skills and personality changes

Amyloid plaques

These are: beta amyloid proteins that build up around neurons and form clumps

Effect: impair synapse function and neural communication

Neurofibrillary tangles

These are: twisted fibres of tau protein that build up inside neurons

Effect: impair ability of neurons to transport nutrients, leading to cell death

Symptoms

Early:

- STM dysfunction, moderate LTM loss for recent events, irritability, impaired decision making, reduced interest in social activities and capacity for self-care

Later:

- more severe decline in memory and other cognitive abilities
- difficulty recognising family members
- personality change

Anterograde amnesia

Definition: Loss of memory for information or events occurring *after* the amnesia-causing trauma

Brain surgery

May involve lesioning which is:

surgical cutting or removal of brain tissue

Henry Molaison (1957) case study

Treatment:

- brain surgery (lesioning) treat epileptic seizures
- medial temporal lobe area removed from each hemisphere, including most of each hippocampus and amygdala

Summary of findings:

- evidence for role of the hippocampus in the formation of new explicit memories
- suffered severe anterograde amnesia (and some retrograde amnesia)
- could no longer form any new explicit episodic or semantic memories
- STM unaffected
- could learn and retain new implicit procedural memories such as new motor skills, but could not recall having ever learned them (i.e. complete loss of episodic memory formation for the event)
- personality and many cognitive functions remained unchanged

Damage to hippocampus

- loss of ability to form new long-term explicit semantic and episodic memories and their transfer to the cerebral cortex for storage
- no significant effect on STM or formation, storage or retrieval of procedural memories or simple classically conditioned reflexes

Damage to amygdala

- primarily affects emotional memories e.g. may remember the semantic (and episodic) details, but not the emotional qualities of an event
- impaired ability to recognise facial expressions of emotions, especially fear
- may be unable to acquire a conditioned fear response
- no significant effect on STM or formation, storage or retrieval of procedural memories

Damage to cerebral cortex

- memory effects depend on site and amount of damage
- may disrupt long-term storage and retrieval of semantic and episodic memories as these are stored throughout the cortex
- may impair transfer of information into and out of STM, especially if damage to regions involved in attention e.g. prefrontal cortex, prefrontal cortex, parietal lobe

Damage to cerebellum

- loss of ability to acquire, store or retrieve conditioned responses involving very specific reflexive movements e.g. conditioned eye blink
- possible impairment to procedural component of complex movements
- possible impairment to spatial learning and memory e.g. procedural component of navigation
- no effect on STM or formation, storage or retrieval of long-term explicit memories

ACTIVITY 7.8

True/False quiz on Alzheimer's disease

Indicate whether each item is true or false by writing T or F in the column at the right.

Statement	T or F
1 Alzheimer's disease is a type of dementia.	T
2 Autopsies show that the brain region most affected by Alzheimer's disease tends to be the medial parietal lobe.	F
3 The risk of Alzheimer's disease tends to increase if a moderate or severe brain injury is experienced.	T
4 Alzheimer's disease tends to affect the deeper structures of the brain before it affects the outer layers of the brain.	F
5 Alzheimer's disease is easy to diagnose, especially in the early stages.	F
6 Impaired procedural memory contributes to difficulties in performing day-to-day tasks such as dressing, cooking and housekeeping activities.	T
7 The symptoms of Alzheimer's disease are a normal part of ageing.	F
8 Treatments are available to stop the progression of Alzheimer's disease.	F
9 The symptoms of Alzheimer's disease tend to be the same for all people diagnosed with the disorder.	F
10 Alzheimer's disease is a neurodegenerative disorder.	T
11 Impaired episodic memory is a prominent symptom of many people with Alzheimer's disease.	T
12 Amyloid plaques are fragments of protein that build up around the outside of neurons, inhibiting communication between them.	T
13 Neurofibrillary tangles are caused by tau protein deposits inside neurons that inhibit the cell's ability to transport nutrients, leading to cell death.	T
14 A brain scan of someone with Alzheimer's disease would reveal increased brain size caused by the build up of plaque and tangles.	F
15 Alzheimer's disease only develops in very old people.	F

ACTIVITY 7.9

Matching exercise on memory loss due to brain damage

Match each description with the most appropriate term on the right. Write the letter of the term you select to the left of each description. Each term can be used only once.

(f)	**1** The loss of memory for events or experiences that occur after brain trauma.	**(a)** amygdala
(a)	**2** A brain structure with a crucial role in the formation of emotional memories.	**(b)** retrograde amnesia
(e)	**3** A form of dementia characterised by the widespread degeneration of neurons resulting in memory loss, deterioration of cognitive and social skills and personality changes.	**(c)** cerebellum
(h)	**4** A brain structure that when damaged prevents formation of new explicit memories but does not affect formation of new procedural memories.	**(d)** neurodegenerative
(i)	**5** The brain region where most explicit memories are believed to be stored.	**(e)** Alzheimer's disease
(g)	**6** Fragments of a protein that accumulate around neurons, inhibiting their communication.	**(f)** anterograde amnesia
(b)	**7** The loss of memory for events or experiences that occurred before brain trauma.	**(g)** amyloid plaque
(c)	**8** A brain structure that stores simple, classically conditioned reflexes.	**(h)** hippocampus
(j)	**9** Twisted fibres of tau protein that build up inside neurons.	**(i)** cerebral cortex
(d)	**10** The progressive decline in the structure and function of brain tissue not due to normal ageing and resulting in cognitive decline.	**(j)** neurofibrillary tangles

ACTIVITY 7.10

Summarising how context and state dependent cues influence ability and inability to remember

Select terms from the shaded panel below to correctly complete the passage about context and state dependent cues. Each term should be used only once and all terms are used.

accessible	adaptive	cognitive	conscious	context dependent
external	failure	inaccessible	internal	lack
long-term memory	matches	permanently	physiological	prompt
psychological	recover	retrieval	retrieval cue	state dependent

Forgetting refers to the inability to recover information previously stored in memory. When you forget something, it means that it is inaccessible to you at the time when you are trying to remember it. This does not mean the information is permanently lost. It may still be in long-term memory but you were unable to activate the necessary retrieval cue to locate it when required.

If information can be recovered and brought into conscious awareness at a specific time, then it can be said to be accessible. Although frustrating at times, forgetting serves an adaptive purpose, helping to keep our mind uncluttered with irrelevant and trivial information and therefore improving our cognitive efficiency.

A retrieval cue is any stimulus that assists the process of locating and recovering information stored in memory. This acts as a prompt that guides the search and recovery process within the vastness of long-term memory.

When we are unable to access required information because we lack or fail to use the right retrieval cues, then retrieval failure is said to have occurred. This outcome is less likely to occur when a retrieval cue matches the original learning conditions.

ACTIVITY 7.10 *continued*

A context dependent cue is something in the specific situation where a memory was formed that acts as a retrieval cue to help access the memories formed there. The cue therefore matches the external environment in which the memory was formed. Examples include sights, sounds, objects, events and even smells.

A state dependent cue is associated with an individual's internal physiological and/or psychological condition at the time the memory was formed, and acts as a retrieval cue to help access the memory. The cue therefore matches the person's internal environment when the memory was originally formed. For example, if you learn information when you are happy, sad, intoxicated, sober, calm or aroused, that information is more likely to be retrieved when you are feeling the same way.

ACTIVITY 7.11

Distinguishing between context and state dependent cues

Tick the column with the type of cue that prompts retrieval in each example.

Example	Context dependent cue	State dependent cue
1 Noah feels like a cold drink when studying in his bedroom and goes to the kitchen to get one. When he reaches the kitchen, he forgets why he is there. He knew he had gone there for a reason but can't remember what it was. When he returns to his bedroom, the fact that he wanted a cold drink suddenly pops into mind.	✔	
2 Gina is studying while working out on her exercise bike. The next morning, she can't remember a key term in the course notes she was studying. After school, she goes for a run that is about as vigorous as her bike workout. She asks herself the same question during the run and feels relieved when she correctly recalls the key term.		✔
3 A military person experiences a memory flashback and becomes very upset when he hear a news helicopter flying overhead not long after returning from active duty in a war zone.	✔	
4 A laboratory rat learns to successfully run a maze under the influence of a benzodiazepine agent. The rat forgets the path to the goal box when tested later without the drug. When given the drug again, the rat runs the maze successfully.		✔
5 A diver forgets details about a deep sea diving expedition while using 'Trimix' (a special gas mix for deep diving) when she comes to the surface, but then suddenly recalls those details the next time she is diving at depth.		✔
6 Hiroki hears a very funny joke when sitting around a camp fire on a school trip. When he gets home, he feels frustrated when he tries to re-tell the joke at the dinner table because he has forgotten it so quickly. During the next school break when camping with his parents, the joke pops into mind while lighting a camp fire and he successfully tells it.	✔	
7 Alex tends to more readily recall positive events when happy and more readily recall negative events when sad.		✔
8 A lead firefighter recognises the signs of danger when fighting a big fire inside a disused building and orders the crew to evacuate to safety.	✔	
9 Some forgotten names of former high school friends come to mind when Stefan returns to visit the school one weekend as an adult.	✔	
10 Maddi smells the scents of a farm when walking through a large suburban park and recalls some of her childhood memories of growing up on a farm.		✔

ACTIVITY 7.12

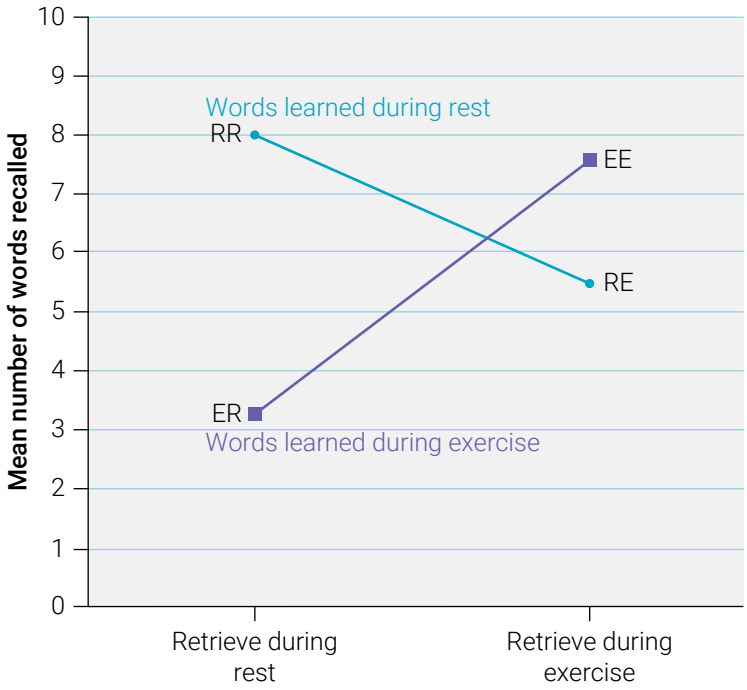
Evaluation of research on retrieval cues

A researcher was interested in finding out if a person would recall more when in the same physiological state as when the original learning took place compared with when their learning and recall states differ. In order to do so, the researcher conducted an experiment in which participants learned lists of 30 nonsense words (e.g. qar, nir, mev) in two physiological states: at rest and while exercising aerobically on an exercise bike. They were then required to recall the words when again in each of these states.

Thirty first-year psychology students (10 males and 20 females) at the university where the researcher worked were recruited. They attended a soundproofed laboratory in the psychology department on four consecutive days at approximately the same time of day and completed a different experimental condition on each occasion. Each participant was tested individually. There were written task instructions, the words were presented through headphones, and all test responses were electronically recorded. All received a gift voucher and there was no participant attrition. There were four experimental conditions, each involving a 3-minute learning phase, a 5-minute memory consolidation phase, and a 2-minute retrieval phase. The conditions were:

1. Rest-Rest (RR): The participant performed the complete task while seated on, but not pedalling, the exercise bike.
2. Rest-Exercise (RE): The participant sat at rest on the bike during the learning phase. During the 5-minute consolidation phase the participant remained seated for the first 3 minutes, then pedalled for the next 2 minutes until their heart rate increased to between 120 and 150 beats per minute (bpm). This was followed by the 2-minute retrieval phase during which the participant continued to pedal at the same rate while they recalled the words in any order.
3. Exercise-Rest (ER): Two minutes prior to the learning phase the participant began pedalling until their heart rate increased to between 120 and 150 bpm, then continued to pedal at this rate throughout learning phase. The participant rested during the 5-minute consolidation phase, then recalled the words during the 2-minute rest period.
4. Exercise-Exercise (EE): Two minutes prior to the learning phase the participant began pedalling until their heart rate increased to between 120 and 150 bpm, then continued to pedal at this rate throughout the learning phase. The participant rested for the first 3 minutes of the consolidation phase, then pedalled for the remaining 2 minutes at the same pace as in the learning phase. The participant continued to pedal at this pace throughout the 2-minute recall phase.

The participant's heart rate was noted at the beginning and end of each of the learning, consolidation and retrieval phases of the experiment. An elevated rate of between 120 and 150 bpm is about twice the normal level. The results for each condition are shown in the graph on the next page.



Source: Adapted from Miles, C., & Hardman, E. (1998). State-dependent memory produced by aerobic exercise. *Ergonomics*, *41*(1), 20–28.

1 Formulate a research hypothesis for this experiment.

Examples: If a person is in the same state when they learn and recall information, they will recall more than if they are in a different state for learning and recalling; Better recall will occur in those state retrieval conditions that match the learning conditions.

2 Identify the experimental research design.

repeated measures

3 Identify the sampling procedure.

convenience sampling

4 Identify the operationalised independent and dependent variables.

independent variable: change in heart rate

dependent variable: number of correct words recalled

ACTIVITY 7.12 *continued*

5 Which type of retrieval cue did the researcher investigate?

state dependent

6 Which type of recall was used during the retrieval phase?

free recall

7 Give three examples of the use of standardised instructions and procedures in the experiment.

Examples include: all participants were tested in the same laboratory; all participants used the same exercise bike; all participants were tested at approximately the same time of day; each participant was tested individually; use of the same written task instructions for each participant; word presentation through headphones; electronic recording of test responses.

8 Why were nonsense words used instead of ordinary, everyday words?

To control the potential influence of word familiarity/prior knowledge of the words by participants

9 Explain whether individual participant differences were controlled.

Explanation should demonstrate understanding that individual participant differences were controlled through the use of counterbalancing, with all participants in each of the four conditions in a different order.

10 Identify and explain a potential extraneous or confounding variable of relevance to this particular experiment.

Explanation should demonstrate that the researcher isolated change in heart rate as the independent variable. However, pedalling on an exercise bike would have initiated changes in the physiological state in addition to that of increasing the heart rate; for example, an increase in body temperature and respiration rate; change in the rate of oxygen uptake for use by working muscles. These may have independently or in combination influenced retrieval scores so it remains unclear as to which physiological variable would better predict the retrieval performance change.

11 Write a valid conclusion from the results of the experiment.

Example: The results show that recall of nonsense words is superior when in the same physiological state as when the original learning took place compared with when the learning and recall states differ. For example, word lists learned during aerobic exercise were recalled best during aerobic exercise and vice versa. It can therefore be tentatively concluded that retrieval from long-term memory is enhanced when the retrieval occurs in the same physiological state as the state in which the original learning takes place. However, it is possible that other changes initiated by aerobic exercise, in addition to heart rate, may influence retrieval. In addition, state-dependent retrieval may depend critically on the use of free recall rather than some other retrieval method and may therefore be limited to the use of free recall.

12 Explain two crucial ethical requirements of relevance to this particular experiment.

Examples:

- The researcher must consider the intensity of exercise necessary to induce a change in cardiovascular state and ensure participant physical health and wellbeing is not adversely affected by the physical exercise procedure.
- The researcher recruited psychology students from their workplace — the psychology department at their university — and must ensure that all participants willingly participated without feeling obligated or coerced in any way to volunteer their participation or not to withdraw at any time if they wanted to.

ACTIVITY 7.13

Distinguishing between maintenance and elaborative rehearsal

Complete the table to summarise key differences between maintenance and elaborative rehearsal.

	Maintenance rehearsal	Elaborative rehearsal
Definition	• continual repetition of information to retain information in STM for as long as required	• linking new information in a meaningful way with other new information or information already stored to aid in its storage and future retrieval from LTM
Key features of this type of rehearsal	• involves repetition of information • a simple process • shallow/superficial processing of information • no focus on meaning	• focuses on meaning • actively thinking about the meaning and trying to form links with other information • a more active and effortful process than maintenance rehearsal • a deeper level of processing
Advantages of using this type of rehearsal	• simple and minimal effort • useful for coping with the limited duration of STM • useful for retaining a finite amount of information in STM indefinitely • enables information to be retained long enough to process its meaning (but doesn't in itself process meaning)	• helps ensure information is encoded and consolidated well in LTM and is therefore more effective for remembering new information e.g. results in more durable memories • may enhance organisation of information in LTM in a way that aids retrieval e.g. linking related information

	Maintenance rehearsal	Elaborative rehearsal
		• may make information in LTM more accessible as it can create more potential retrieval cues
Limitations of using this type of rehearsal	• continual renewal process restricts entry of new information into STM (due to the limited storage capacity of STM) • limited effectiveness for transferring new information to LTM for relatively permanent storage • less likely to result in durable long-term memories	• more complex (than maintenance rehearsal) • more effortful (than maintenance rehearsal) • does not guarantee encoding or consolidation into LTM and therefore long-term retention
Example of this type of rehearsal	• repeating a new phone number over and over sub-vocally to remember it just before dialling	• remembering a shopping list by making up a story that contains the names of the items to be remembered

ACTIVITY 7.14

Graphing and interpreting the serial position effect

1 What is the serial position effect?

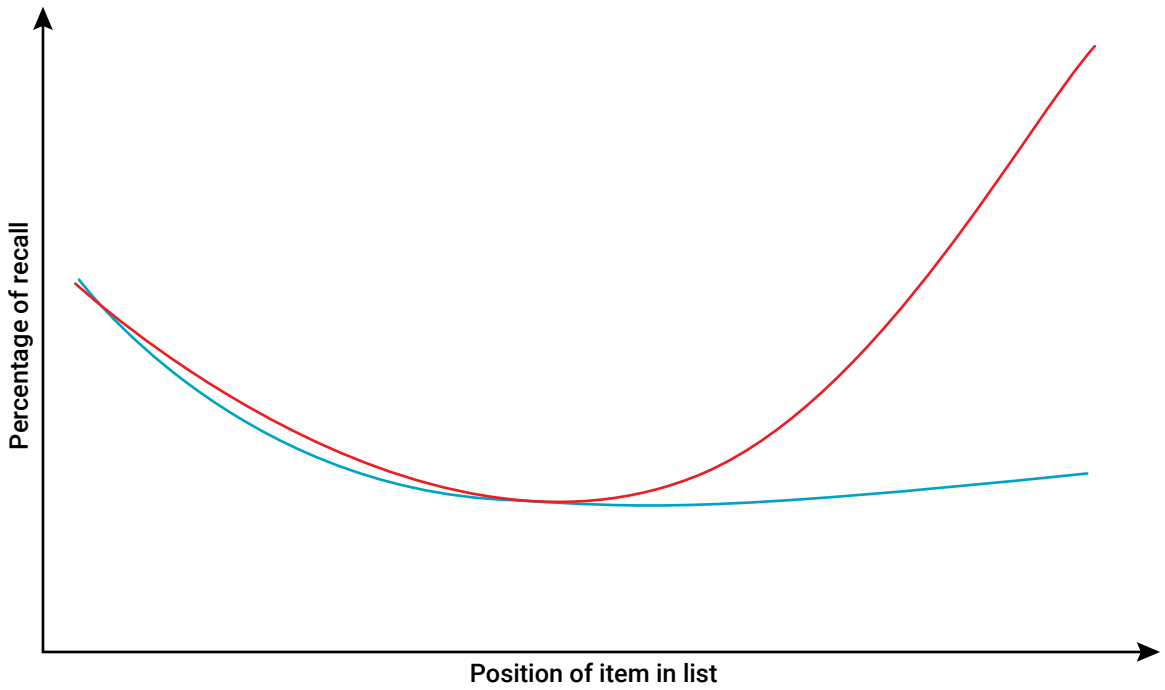
The serial position effect is a research finding that free recall is better for items at the end and beginning of a list than for items in the middle of the list.

2 Distinguish between the primacy and recency effects.

The primacy effect refers to the superior recall for items at the beginning of the list.

The recency effect refers to the superior recall for items at the end of the list.

3 Using the axes below, draw two typical serial position effect curves likely to be generated under different recall conditions. First, draw a curve in red that would be expected if recall occurs immediately after learning a list of 15 items. Second, draw a curve in blue that would be expected if recall of the items occurs after a delay of about 30 seconds.



ACTIVITY 7.14 *continued*

4 The two curves should be different. Describe the difference between the two curves and explain why the curves are different.

- Description: The difference between the two curves is that the red curve (immediate recall) shows a recency effect, whereas the blue curve (delayed recall) does not. (But both curves should show a primacy effect.)

- Explanation: When recall is immediate (red curve), the last few items in a list are remembered best because they are still in STM at the time of recall.

When recall is delayed for 30 seconds (blue curve), the latter items in the list have been lost from STM so no recency effect is evident. (Note the usual duration of STM i.e. 18–20 seconds but possibly up to 30 seconds.)

ACTIVITY 7.15

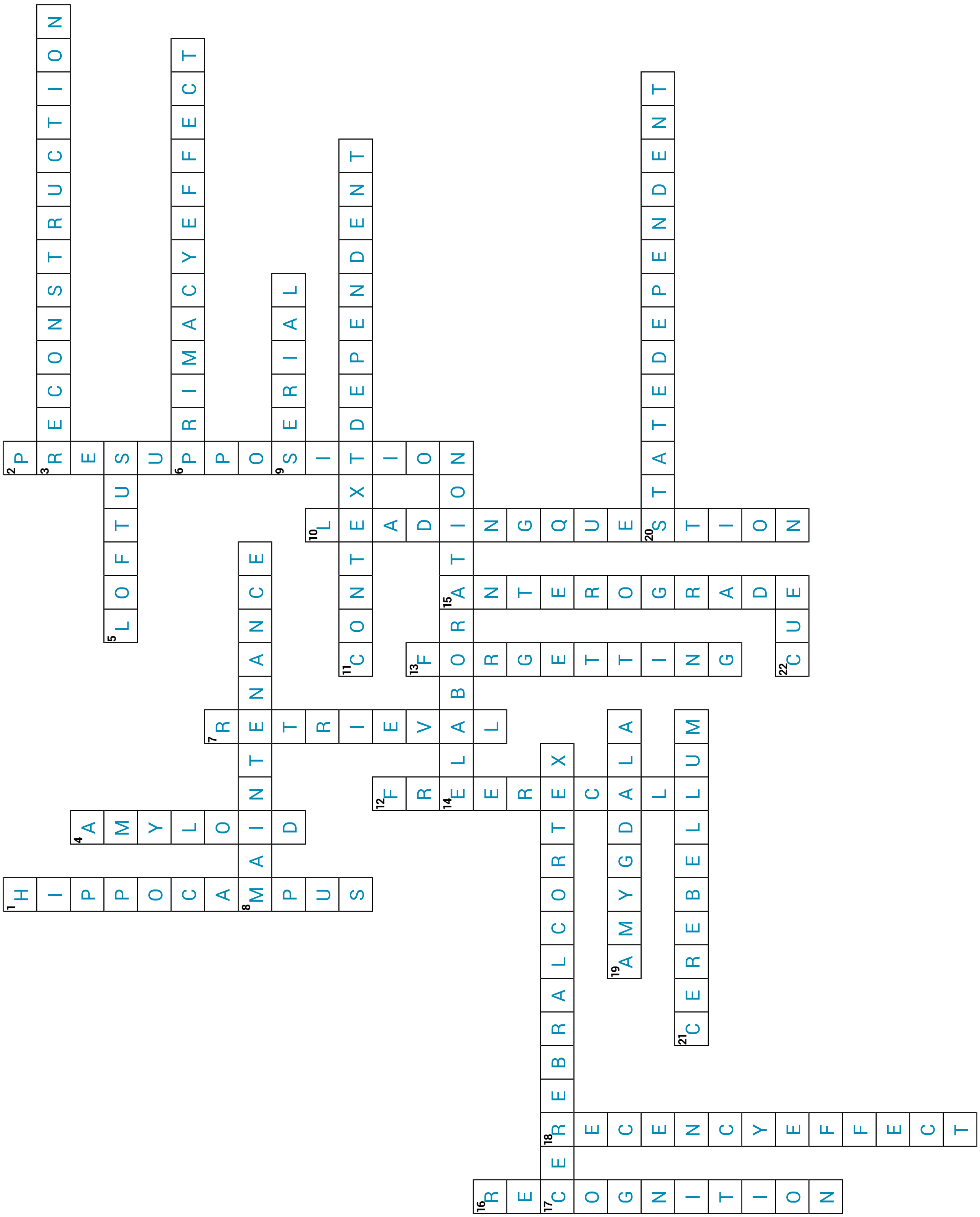
Crossword on concepts and terms in reliability of memory

Across

3 A retrieval process whereby memory gaps are filled to become more consistent with what is known or believed.
5 The researcher best-known for experiments on eye-witness testimony.
6 A tendency for the first items in a sequence to be better recalled than most of the following items.
8 Rehearsal through repetition alone.
9 A type of recall where items are remembered in the same order in which they were learned.
11 A retrieval cue that relies on specific aspects of the external environment present at the time of encoding.
14 Process by which information to be remembered is linked or related to information already known.
17 Explicit long-term memories are stored throughout this part of the brain.
19 A brain structure crucial for encoding the emotional qualities of a long-term memory.
20 A retrieval cue that relies on some aspect of a person's physiological or psychological state at the time of encoding.
21 A brain structure that stores classically conditioned involuntary motor responses.
22 A prompt that aids recall.

Down

1 A brain structure crucial for long-term explicit memory formation.
2 Content in a leading question that should or must be true in order for the question to make sense.
4 A plaque which accumulates around neurons and is implicated in Alzheimer's disease.
7 The process of bringing to conscious awareness information from memory storage.
10 Has content or is phrased in such a way as to suggest a pre-determined answer.
12 A retrieval task requiring a person to recall items of information in any order.
13 When failure to access stored information occurs.
15 A type of amnesia involving inability to form or store new long-term explicit memories.
16 When the presence of the correct information acts as a retrieval cue.
18 A tendency for the last few items in a sequence to be well recalled.


1 HIPPOCAMPUS
2 PRESUPPOSITION
3 RECONSTRUCTION
4 AMYLOID
5 LOFTUS
6 PRIMACY EFFECT
7 RETRIEVAL
8 MAINTENANCE
9 SERIAL
10 LEADING QUESTION
11 CONTEXT DEPENDENT
12 FREE RECALL
13 FORGETTING
14 ELABORATION
15 ANTEROGRADE
16 RECOGNITION
17 CEREBRAL CORTEX
18 RECENCY EFFECT
19 AMYGDALA
20 STATE DEPENDENT
21 CEREBELLUM
22 CUE

ACTIVITY 7.16

True/False quiz on the reliability of memory

Indicate whether each item is true or false by writing T or F in the column on the right.

Statement	T or F
1 Being in an environment similar to that in which you experienced something will tend to help you recall that experience.	T
2 If you have learned something and then forgotten it, you will probably be able to relearn it more quickly than you did originally.	T
3 Time spent in associating material with what you already know is more beneficial for long-term retention than time spent repeating information over and over again.	T
4 Realising that you know someone when you walk past them on the street is an example of recall.	F
5 According to the serial position effect, when recalling a list of words, you should have the greatest difficulty with those in the middle of the list.	T
6 Research by Elizabeth Loftus demonstrates how using retrieval cues improves the accuracy of eye-witness testimony.	F
7 People with damage to the amygdala will probably still remember the semantic and episodic details of a happy or traumatic event.	T
8 People with damage to the hippocampus will probably still retain implicit memories as these are processed elsewhere in the brain.	T
9 Free recall is a more sensitive measure of retention than cued recall.	F
10 The cerebral cortex is the storage site of most explicit memories.	T
11 Memory reconstruction occurs during the process of retrieval.	T
12 People with amnesia typically experience disruption of implicit memories.	F
13 In anterograde amnesia, there is little or no disruption to your STM.	T
14 An inability to recall information about events leading up to the moment of brain injury is a key characteristic of anterograde amnesia.	F
15 Emotion is a state-dependent retrieval cue.	T
16 Remembering more items at the end of a long list than in the middle is characteristic of reconstructive memory.	F
17 The cerebellum stores simple explicit memories.	F
18 Eye-witness testimony can be altered by using questions that include misleading information.	T
19 People with damage to the hippocampus will probably lose the ability to process new facts for storage.	T
20 Savings from relearning can be calculated by subtracting the number of times it takes to relearn information the second time from the number of times it took to learn the information the first time.	T
21 Increasing age is the biggest risk factor for Alzheimer's disease.	T
22 Research on memory construction shows that memories can reflect a person's biases and assumptions.	T

ACTIVITY 7.16 *continued*

Statement	T or F
23 Neurofibrillary tangles are formed by the build-up of tau protein outside neurons in the brain.	F
24 The smell of freshly baked apple pie could act as a context dependent retrieval cue.	T
25 Retrieval tends to be easier when encoding and retrieval cues are similar.	T

UNIT 4

HOW IS WELLBEING DEVELOPED AND MAINTAINED?

CHAPTER 8

Nature of consciousness

	Activities													
Key knowledge	8.1	8.2	8.3	8.4	8.5	8.6	8.7	8.8	8.9	8.10	8.11	8.12	8.13	8.14
• consciousness as a psychological construct that varies along a continuum, broadly categorised into normal waking consciousness and altered states of consciousness (naturally occurring and induced)	✔	✔	✔	✔							✔		✔	✔
• the measurement of physiological responses to indicate different states of consciousness, including electroencephalograph (EEG), electromyograph (EMG), electro-oculograph (EOG) and other techniques to investigate consciousness (measurement of speed and accuracy on cognitive tasks, subjective reporting of consciousness, including sleep diaries, and video monitoring)					✔	✔	✔	✔			✔		✔	✔
• changes in a person's psychological state due to levels of awareness, controlled and automatic processes, content limitations, perceptual and cognitive distortions, emotional awareness, self-control and time orientation			✔	✔					✔	✔	✔		✔	✔
• changes in levels of alertness as indicated by brain waves patterns (beta, alpha, theta, delta) due to drug-induced altered states of consciousness (stimulants and depressants)								✔			✔		✔	✔
• the effects on consciousness (cognition, concentration and mood) of one night of full sleep deprivation as a comparison with effects of legal blood-alcohol concentrations.												✔	✔	✔

Source: VCE Psychology Study Design extracts © VCAA; reproduced by permission.

ACTIVITY 8.1

Explaining characteristics of consciousness

Complete the following table about the nature of consciousness.

Characteristic	Explanation	Example
Consciousness is a psychological construct.	Consciousness is a concept that is 'constructed' (created) to describe specific 'psychological' activity (or a pattern of activity) that is assumed to occur or exist but cannot be directly observed.	Inferring our state of consciousness (or someone else's) from observable activity using such measures as self-reports, cognitive tests and physiological changes/ responses
Consciousness is our awareness of objects and events (stimuli) in the external world at any given moment.	Our awareness of our surroundings, such as our perceptions of where we are, who we are with and what we see, hear, feel or smell	Being aware that I am with a friend and surrounded by many others at a football grand final at the MCG while being bombarded by all types of sensory stimuli
Consciousness is our awareness of our internal sensations and mental experiences at any given moment.	Our awareness of the sensations occurring within our body and of our thoughts and feelings at any point in time	Being aware of my rapid breathing, racing heartbeat, pain in my right knee and feelings of relief and self-satisfaction as I finish a long bike ride

Characteristic	Explanation	Example
Consciousness is our awareness of our own beliefs and attitudes.	Our awareness of our personal beliefs and attitudes that underlie and influence our behaviour, feelings and other thoughts	Being aware that I am a vegetarian who avoids eating meat because I believe that killing other animals for food is cruel and unethical
Consciousness is our awareness of our own existence and identity.	Our awareness of who we are, that we are a unique person and that we exist as an individual living human being among others	I can recognise myself when I see my reflection in a mirror and I know how I am like and unlike others.
Consciousness is our awareness of personal memories.	Our awareness of personal experiences throughout our life	I can remember some good and bad experiences, including childhood and recent experiences; I can recall who my friends and family are, where I live, what I like to eat and my favourite songs and movies.

Characteristic	Explanation	Example
Consciousness is personal.	Consciousness is subjective, private and unique to the individual.	Only I truly know what I am thinking or feeling at any point in time, I can keep my thoughts and feelings to myself, and how I think or feel about an event can be different to how someone else thinks or feels when they have that experience.
Consciousness is selective.	At any given moment we can choose to attend to some particular thing and to ignore something else that is occurring at the same time.	I have decided to listen carefully to my teacher and ignore my best friend who wants to talk about an upcoming party.
Consciousness is continuous.	We are always aware of something in the course of a typical day.	My consciousness is never 'empty' when I am awake — there is a constant, never-ending flow of thoughts and feelings which I become aware of each day.

Characteristic	Explanation	Example
Consciousness is constantly changing.	What we are aware of is continually different due to the variability of internal and external stimuli, especially when awake and alert.	What is in my mind throughout each day changes as I am exposed to and respond to ever-changing stimuli.

ACTIVITY 8.2

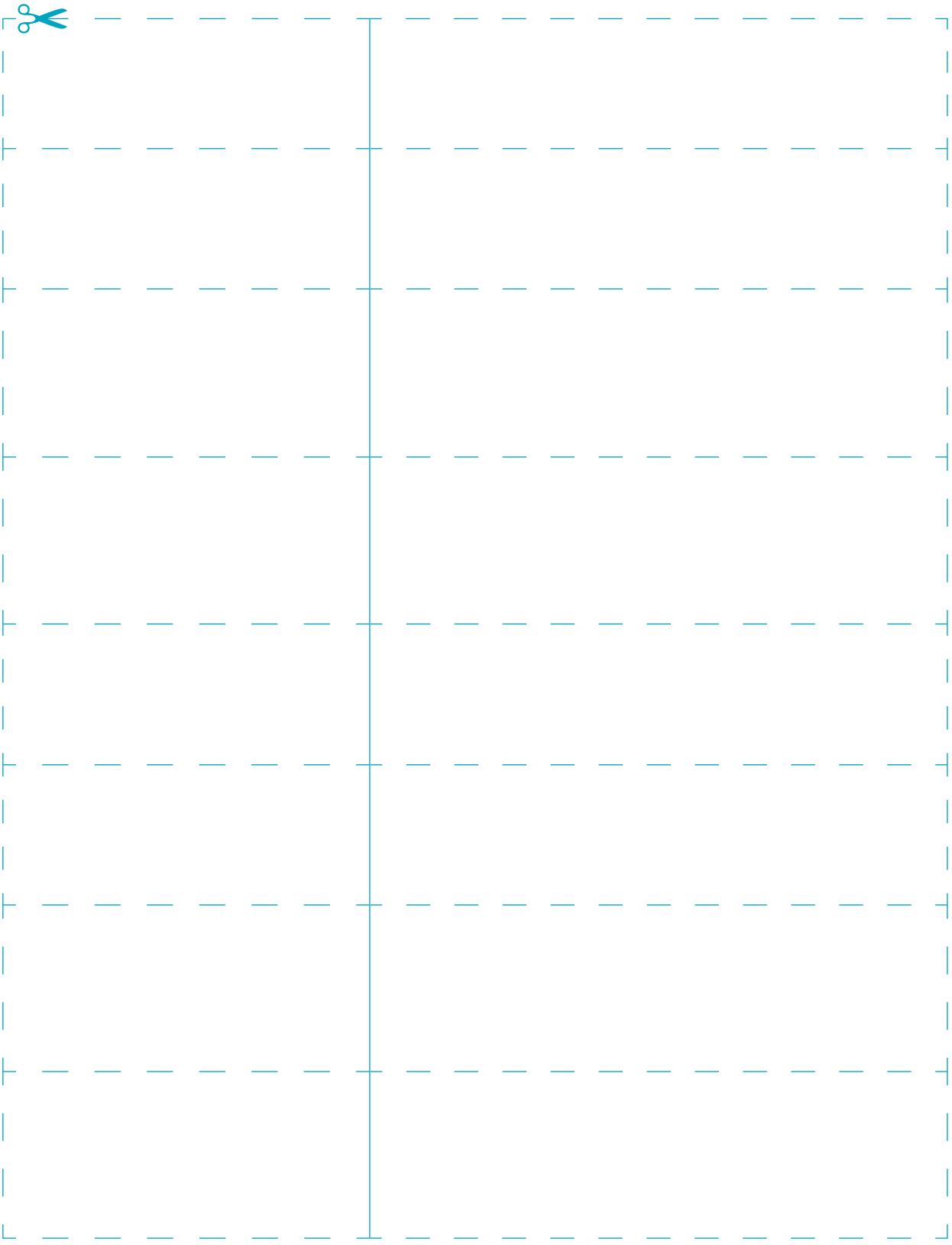
Mapping states of consciousness on a continuum

Consciousness varies along a continuum of awareness broadly categorised into normal waking consciousness and altered states of consciousness (naturally occurring and induced).

Cut and paste each of the states and their descriptions on page 249 in the most appropriate place on the consciousness continuum opposite.

State of consciousness	Description of state
Total awareness	Fully conscious of internal or external events or experiences
Focused attention	Highly focused and acutely aware of some aspect of one's internal or external environment e.g. when selectively attending to a difficult task
Normal wakefulness	A naturally occurring state of consciousness associated with being awake and aware of objects in the external world, and of one's sensations, mental experiences and own existence
Daydreaming	A naturally occurring altered state of consciousness in which attention shifts from external stimuli to internal thoughts, feelings and imagined scenarios
Meditative state	An intentionally induced altered state of consciousness characterised by a deep state of relaxation achieved through the use of a meditation technique
Hypnotised	An intentionally induced altered state of consciousness characterised by responsiveness to suggestions made by the hypnotist and the subjective experience of consciousness
Asleep	A naturally occurring altered state of consciousness characterised by perceptual disengagement from and unresponsiveness to the environment
Anaesthetised	An intentionally induced altered state of consciousness characterised by unconsciousness when general anaesthesia is used (or loss of sensation when a local or regional anaesthetic is used). Location on the continuum may vary in relation to the type of anaesthesia.
Coma	An unintentionally induced altered state of consciousness in which there is a complete or nearly complete loss of all basic functions of consciousness, including loss of awareness
Total lack of awareness	No consciousness of internal or external events or experiences

Focused attention	A naturally occurring altered state of consciousness in which attention shifts from external stimuli to internal thoughts, feelings and imagined scenarios
Normal wakefulness	A naturally occurring altered state of consciousness characterised by perceptual disengagement from and unresponsiveness to the environment
Daydreaming	A naturally occurring state of consciousness associated with being awake and aware of objects in the external world, and of one's sensations, mental experiences and own existence
Meditative state	An unintentionally induced altered state of consciousness in which there is a complete or nearly complete loss of all basic functions of consciousness, including loss of awareness
Hypnotised	An intentionally induced altered state of consciousness characterised by a deep state of relaxation achieved through the use of a meditation technique
Asleep	Highly focused and acutely aware of some aspect of one's internal or external environment e.g. when selectively attending to a difficult task
Anaesthetised	An intentionally induced altered state of consciousness characterised by responsiveness to suggestions made by the hypnotist and the subjective experience of consciousness
Coma	An intentionally induced altered state of consciousness characterised by unconsciousness when general anaesthesia is used (or loss of sensation when a local or regional anaesthetic is used)



ACTIVITY 8.3

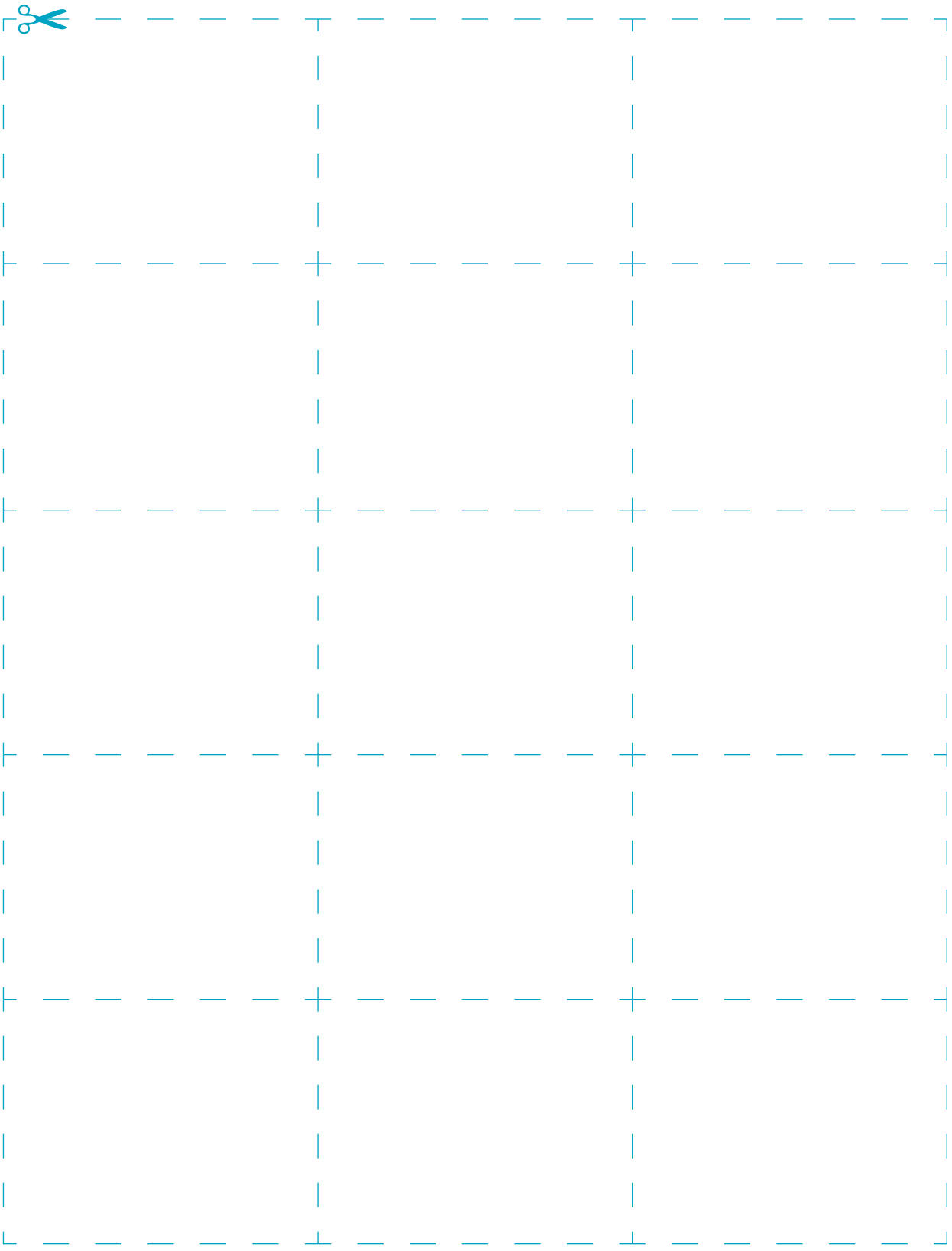
Distinguishing between selective and divided attention

Distinguishing between selective and divided attention

Cut out each of the statements on page 253 and paste them in the correct panel under either selective attention or divided attention.

SELECTIVE ATTENTION		
When our attention is completely focused on one thing	More likely to use this type of attention when we are learning how to do a task for the first time, but less likely when we become more proficient	This type of attention is required when completing a task requiring considerable mental effort, such as when threading a needle or solving a difficult mathematics problem
When we filter out irrelevant information to help us focus on something that requires a lot of attention	More likely to use this type of attention when something is new or unusual in some way	Explains why we can miss an event occurring right in front of us because we are focused on another stimulus at that moment
Located towards the total awareness end of a consciousness continuum	When we focus on only a limited range of all that we could experience	This type of attention is used when distracted by a hovering fly while completing this workbook activity.
DIVIDED ATTENTION		
Having a conversation with a friend while bushwalking is an example of this type of attention.	The ability to distribute our attention and undertake two or more tasks simultaneously	Associated with 'multi-tasking'
The more mental effort required for two or more tasks, the more difficult it is to apply this type of attention.	Easier to apply when the tasks are sufficiently similar, well-rehearsed or simple to perform	More likely to use this type of attention for an activity that requires little awareness or mental effort

Having a conversation with a friend while bushwalking is an example of this type of attention.	When our attention is completely focused on one thing	More likely to use this type of attention when we are learning how to do a task for the first time, but less likely when we become more proficient
This type of attention is required when completing a task requiring considerable mental effort, such as when threading a needle or solving a difficult mathematics problem.	When we filter out irrelevant information to help us focus on something that requires a lot of attention	The ability to distribute our attention and undertake two or more tasks simultaneously
Associated with 'multi-tasking'	The more mental effort required for two or more tasks, the more difficult it is to apply this type of attention.	More likely to use this type of attention when something is new or unusual in some way
Explains why we can miss an event occurring right in front of us because we are focused on another stimulus at that moment	Easier to apply when the tasks are sufficiently similar, well-rehearsed or simple to perform	Located towards the total awareness end of a consciousness continuum
When we focus on only a limited range of all that we could experience	More likely to use this type of attention for an activity that requires little awareness or mental effort	This type of attention is used when distracted by a hovering fly while completing this workbook activity.



ACTIVITY 8.4

Sorting examples of selective and divided attention

Tick the type of attention that is involved in each example.

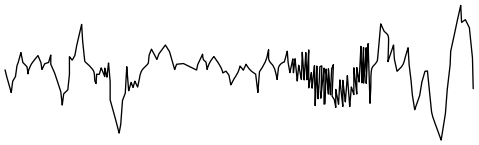
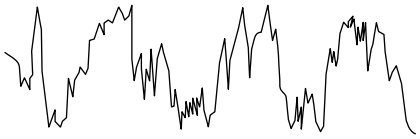
Example	Selective attention	Divided attention
1 Reading a novel and being engrossed in the story.	✔	
2 Following a recipe for baking biscuits while listening to music.		✔
3 Inserting a sim card into a new phone while reading the instructions.		✔
4 Noticing that your stomach is rumbling because you are feeling hungry.	✔	
5 Talking on your mobile phone while texting another friend.		✔
6 Trying to kick a goal when taking a penalty in a soccer match.	✔	
7 Hearing a strange noise outside your home and going outside to investigate while in a heightened state of arousal.	✔	
8 Trying to juggle three balls for the first time.	✔	
9 Answering a phone call using hands-free while driving in city traffic.		✔
10 Playing in a highly competitive tennis final.	✔	
11 Swatting a fly away from your face while barbequing with friends.		✔
12 Trying to hit the bullseye at the centre of the dart board when throwing a dart.	✔	
13 Checking text messages while listening to an oral presentation.		✔
14 Recalling an item that you know you know but cannot state because it is on the tip of your tongue.	✔	
15 Retrieval of your best friend's name from long-term memory during a conversation with another friend.		✔

ACTIVITY 8.5

Comparing brain waves and associated levels of alertness

Complete the table to summarise different types of brain waves and the level of alertness they indicate.

Beta wave	Alpha wave
Sketch of wave pattern: 	**Sketch of wave pattern:** 
Description of wave pattern (with reference to frequency, amplitude and other waves): high frequency (i.e. fast); low amplitude (i.e. small); irregular pattern; fastest of the waves	**Description of wave pattern (with reference to frequency, amplitude and other waves):** medium to high frequency (i.e. quite fast but slower than beta); low amplitude (slow, but slower than beta and not as slow as delta); regular pattern (like the teeth of a comb)
Level of alertness indicated: very alert and actively processing information	**Level of alertness indicated:** awake and alert but relaxed, calm and internally focussed (typically with eyes closed)
Example of when the wave pattern may be present: any example involving attentiveness/concentration during mental and/or physical activity in NWC (or when dreaming during REM sleep).	**Example of when the wave pattern may be present:** any example involving an awake, mentally and physically relaxed state, especially with an internal focus and not actively processing information.

Theta wave	Delta wave
Sketch of wave pattern: 	**Sketch of wave pattern:** 
Description of wave pattern (with reference to frequency, amplitude and other waves): medium frequency (slower than alpha and beta) with a mix of high (higher than alpha and beta) and low amplitude waves (with some as large as delta); very irregular pattern	**Description of wave pattern (with reference to frequency, amplitude and other waves):** low frequency (very slow); high amplitude (very large); slowest and largest of all the brain waves
Level of alertness indicated: drowsiness or possibly awake and alert while internally or externally focused during certain activities (as per examples below)	**Level of alertness indicated:** no alertness (except in some very young and elderly people during NWC)
Example of when the wave pattern may be present: falling asleep or waking up; very focussed on a highly creative task; deeply meditating	**Example of when the wave pattern may be present:** deep sleep or unconsciousness

ACTIVITY 8.6

Identifying brain wave patterns for different activities

Tick the brain wave pattern most likely to be recorded during each activity.

Activity	beta	alpha	theta	delta
1 Reading for a few minutes in bed before going to sleep.	✔			
2 Closing your eyes to sleep after having read for a few minutes in bed.		✔		
3 Drifting off to sleep when in bed.			✔	
4 In deep sleep in bed but not dreaming.				✔
5 Dreaming during REM sleep when the eyes move about.	✔			
6 Contemplating the activities of the upcoming day while awakening from sleep.			✔	
7 Planning a date in detail while lying in bed fully awake with eyes open.	✔			
8 Experiencing a flow of ideas about what to wear to a 21st birthday party while showering in a relaxed state.			✔	
9 Relaxing on a couch at home, with eyes closed and thinking about what a great day you had.		✔		
10 Under the influence of a stimulant drug that increases nervous system activity.	✔			
11 Under the influence of a depressant drug that decreases nervous system activity.				✔
12 Feeling drowsy during a boring classroom lesson.			✔	
13 Dividing your attention between two complex tasks that must be urgently completed.	✔			
14 Taking time out from a task to reflect for a short while.		✔		
15 Taking time out from a task to meditate for a short while.		✔		
16 Beginning to daydream when taking time out from a task.			✔	
17 Deeply meditating using a well-known meditative technique.			✔	
18 Trying to identify the correct piece when completing a jigsaw puzzle.	✔			
19 Riding on a roller coaster.	✔			
20 Safely riding a bicycle on the road during peak hour.	✔			
21 Fantasising about your ideal job.			✔	
22 Lying unconscious on a football field.				✔
23 Lying in a coma on a hospital bed.				✔
24 Debating in an English lesson.	✔			
25 Responding with fight–flight–freeze after experiencing an unexpected fright.	✔			
26 Experiencing dreamlike imagery after taking strong pain medication.			✔	
27 Playing in a basketball match.	✔			
28 Visualising a scene based on the text of an enjoyable novel you are reading.			✔	
29 Trying to work out what a distant object is when enjoying the view at a scenic lookout.	✔			
30 Rearranging your letters to create the word with the highest possible score during a Scrabble game.	✔			

ACTIVITY 8.7

Measurement of physiological, psychological and behavioural responses indicating different states of consciousness

Complete the table to summarise techniques that can be used to investigate consciousness.

Technique	Description	How it can indicate different states of consciousness
electroencephalograph (EEG)	An electronic device that uses electrodes placed on the surface of the scalp to detect, amplify and record electrical activity produced spontaneously and continuously by cortical neurons	Distinctive brain wave patterns that vary in frequency (speed) and amplitude (intensity) are associated with changes in level of awareness/alertness e.g. beta with alertness and intensive mental activity during NWC and delta with deep, dreamless sleep or unconsciousness

Technique	Description	How it can indicate different states of consciousness
electromyograph (EMG)	An electronic device that uses electrodes placed on the skin above relevant muscles to detect, amplify and record electrical activity that results from muscle movement and changes in muscle tone	There are identifiable changes in muscle activity (movement) and muscle tone (tension) during different states of consciousness. Generally, the higher the level of muscular activity and tone, the more alert/aware we tend to be and vice versa e.g. progressively lower level of muscular activity and tension as a person becomes more relaxed and internally focused, or shifts from light sleep to deep sleep stages
electro-oculograph (EOG)	An electronic device that detects, amplifies and records electrical activity in eye muscles that control eye movements	Different muscle activity associated with changes in eye movement can indicate different states of consciousness, especially changes in eye movements during different types and stages of sleep e.g. in REM sleep the eyes typically show rapid and repetitive darting movements, whereas in NREM sleep there is usually little or no eye movement

Technique	Description	How it can indicate different states of consciousness
speed and accuracy on cognitive tasks	Typically involves computer-based testing where speed (e.g. reaction time to an unpredictable stimulus) and accuracy (number of correct responses compared to incorrect responses) are recorded as participants complete a task/s requiring cognitive activity (e.g. decision making, problem solving) over a number of trials	A higher or lower level of performance is often caused by/co-related with a higher or lower level of alertness, which in turn may be used to make inferences about someone's state of consciousness.
sleep diaries	A log/journal/calendar used to self-record and self-report sleep and waking time activities over a period of time	Most commonly used in the study of sleep. Data can be used to identify patterns or trends of relevance to the topic of research interest e.g. if the researcher is investigating a sleep onset disturbance, they will be interested in behaviours that might impair sleep onset, such as vigorous exercise pre-sleep, inappropriate dietary habits etc.

ACTIVITY 8.7 *continued*

Technique	Description	How it can indicate different states of consciousness
video monitoring	Using a video camera to observe and record an individual's behaviour (i.e. externally observable physiological responses) in real time, usually behaviour throughout a sleep episode in a sleep centre or home environment	Certain behavioural responses are associated with or influenced by one or more aspects of a state of consciousness e.g. there is more bodily movement during sleep onset and little or no movement during deep or REM sleep; progressive behavioural changes may occur after having taken a stimulant or depressant during NWC; could be used to record self-report interviews

ACTIVITY 8.8

Summarising changes in levels of alertness due to stimulants and depressants

Read the following statements about stimulants and depressants and cross out the incorrect terms to make each statement true.

1 Changes in levels of alertness due to stimulants and depressants are examples of (**~~naturally occurring~~/drug induced**) altered states of consciousness.

2 A stimulant is a substance that (**increases/~~decreases~~**) activity in the central nervous system and the rest of the body, whereas a depressant (**~~increases~~/decreases**) activity in the central nervous system and the rest of the body.

3 A stimulant has a/an (**~~calming~~/activating**) effect, making the brain and body (**more/~~less~~**) alert, whereas a depressant has a/an (**calming/~~activating~~**) effect, making the brain and body (**~~more/~~less**) alert.

4 Mild stimulants include (**caffeine and nicotine/~~alcohol and amphetamines~~**), whereas depressants include (**~~caffeine/nicotine/amphetamines/cocaine/~~alcohol/barbiturates and benzodiazepines**).

5 Stimulants will tend to increase (**~~alpha~~/beta/~~theta/delta~~**) brain wave activity while (**~~increasing/~~decreasing**) other types of brain wave activity, whereas depressants will tend to increase (**~~alpha/beta/theta/~~delta**) brain wave activity while (**~~increasing/~~decreasing**) other types.

ACTIVITY 8.9

Controlled verses automatic processes

1 Explain the difference between controlled and automatic processes.

Controlled processes involve conscious, alert awareness and mental effort in which the individual actively focuses their attention on achieving a particular goal. In contrast, automatic processes involve little conscious awareness and mental effort, minimal attention and does not interfere with performance in other tasks.

2 Indicate whether each activity primarily involves controlled, automatic or a combination of both types of processing and justify your answers.

Activity	Type of processing C = controlled A = automatic	Justification
(a) An L-plate driver practising parallel parking for the first time	C	A new and complex task that requires considerable attention and conscious mental effort throughout

Activity	Type of processing C = controlled A = automatic	Justification
(b) An experienced busker juggling while telling funny jokes to the crowd	A & C	Automatic and controlled processing can proceed in parallel with one another. The busker's juggling is a well-learnt motor task involving procedural (implicit) memory so requires relatively little conscious mental effort (nor does it impede joke- telling). Joke-telling is a second, different task drawing on explicit memory and involving controlled processing with attention focused on what is said, moment-by-moment decision making on what to say next, etc.
(c) Texting your best friend to explain why you cannot come to their party	C	Composing a text explanation is a complex task that requires considerable attention and conscious mental effort. However, the manual texting procedure for some people may be so well learned (like touch typing without looking at the screen) that automatic processing may also be correct.

Activity	Type of processing C = controlled A = automatic	Justification
(d) Riding an exercise bike at a gym while listening to music through headphones	A	The bike riding is a well-learnt motor task involving procedural (implicit) memory so requires relatively little conscious mental effort. Similarly, listening to music in this context typically requires minimal conscious alert awareness and mental effort, nor does it impede bike riding performance.
(e) Watching a movie and understanding the plot while knitting a scarf at the same time	C & A	Controlled and automatic processing can proceed in parallel with one another. Comprehending a movie plot requires considerable attention and conscious mental effort, whereas scarf knitting is most likely a well-learnt procedural (implicit) memory task requiring relatively little attention and conscious mental effort.

ACTIVITY 8.9 *continued*

Activity	Type of processing C = controlled A = automatic	Justification
(f) Swimming freestyle laps in a pool as part of a daily fitness routine	A	A well-learnt procedural (implicit) memory task requiring relatively little attention and conscious mental effort to execute the correct movements in a smooth coordinated way
(g) Swimming freestyle in a pool as a learner during a swimming lesson	C	Although primarily physical, it is a new and complex task that requires considerable attention and conscious mental effort throughout e.g. using the correct stroke technique, coordinating breathing and movements etc.

Activity	Type of processing C = controlled A = automatic	Justification
(h) An experienced driver safely navigating through heavy traffic on the way home	C	Although driving and the route are well-learnt, safely navigating through heavy traffic requires considerable attention and conscious mental effort.
(i) Taking a selfie that makes you look good for posting on your Instagram account	C	Although a selfie typically requires minimal effort or skill, considerable attention and conscious mental effort are required to compose the picture that will make you look good.

ACTIVITY 8.9 *continued*

Activity	Type of processing C = controlled A = automatic	Justification
(j) Reading a chunk of psychology text about a complex concept you need to understand	C	Requires considerable attention and conscious mental effort throughout, especially as it involves new and complex information
(k) Retrieval of your best friend's name from long-term memory during a conversation with another friend.	A & C	Automatic and controlled processing can proceed in parallel with one another and we can alternate their use when required. Meaningful conversation is a complex cognitive activity requiring controlled processing as you focus attention on what is said while you process words for meaning and understanding and make moment-by-moment decisions about what to say next, etc. Your best friend's name is well-learnt and encoded in memory, therefore requiring minimal attention or effort to retrieve.

ACTIVITY 8.10

Psychological states associated with levels of alertness

Complete the following table by listing each of the following specific characteristics of NWC or ASC in the correct section and under the correct heading. The first one included is an example.

- tend to have more control over information that enters or is maintained in consciousness
- tend to have less control over information that enters or is maintained in consciousness
- errors in processing of sensory information are more likely
- processing of sensory information is less fallible
- tasks requiring a high level of attention and mental effort tend to be easier to achieve
- loss of ability to regulate own thoughts, feelings and behaviour control is relatively common e.g. normal inhibitions may be weakened
- may be loss of perception and awareness of time in relation to the past, present and future e.g. estimation passage of time can be distorted
- tasks requiring a high level of attention and mental effort tend to be harder to achieve
- memory functions as per normal, thinking tends to be organised and logical, decision-making, problem-solving occur as per normal
- usual awareness and experience of own feelings and those of others e.g. within the usual range of intensity and appropriate to the situation experienced
- tend to be less able to filter incoming information, so less restricted
- tend to be able to filter incoming information, so more restricted
- some tasks requiring little or no attention and mental effort may not be easy to e.g. walking in a straight line when intoxicated
- usual perception and awareness of time in relation to the past, present and future e.g. perception of passage of time is accurate
- mental abilities such as memory and thinking may be impaired
- heightened or reduced awareness and experience of own feelings and those of others is relatively common e.g. may be amplified or diminished expression and inappropriate to the situation experienced
- tasks requiring little or no attention and mental effort tend to be easier to achieve
- ability to regulate own thoughts, feelings and behaviour is normal e.g. behaviour is appropriate

Characteristics	Normal waking consciousness (NWC)	Altered state of consciousness (ASC)
content limitations	• *tend to have more control over information that enters or is maintained in consciousness* • tend to be able to filter incoming information, so more restricted	• tend to have less control over information that enters or is maintained in consciousness • tend to be less able to filter incoming information, so less restricted

Characteristics	Normal waking consciousness (NWC)	Altered state of consciousness (ASC)
controlled and automatic processes	• tasks requiring a high level of attention and mental effort tend to be easier to achieve • tasks requiring little or no attention and mental effort tend to be easier to achieve	• tasks requiring a high level of attention and mental effort tend to be harder to achieve • some tasks requiring little or no attention and mental effort may not be easy to e.g. walking in a straight line when intoxicated
perceptual and cognitive distortions	• processing of sensory information is less fallible • memory functions as per normal, thinking tends to be organised and logical, decision-making, problem-solving occur as per normal	• errors in processing of sensory information are more likely • mental abilities such as memory and thinking may be impaired

ACTIVITY 8.10 *continued*

Characteristics	Normal waking consciousness (NWC)	Altered state of consciousness (ASC)
emotional awareness	• usual awareness and experience of own feelings and those of others e.g. within the usual range of intensity and appropriate to the situation experienced	• heightened or reduced awareness and experience of own feelings and those of others is relatively common e.g. may be amplified or diminished expression and inappropriate to the situation experienced
self-control	• ability to regulate own thoughts, feelings and behaviour is normal e.g. behaviour is appropriate	• loss of ability to regulate own thoughts, feelings and behaviour control is relatively common e.g. normal inhibitions may be weakened

ACTIVITY 8.10 *continued*

Characteristics	Normal waking consciousness (NWC)	Altered state of consciousness (ASC)
time orientation	• usual perception and awareness of time in relation to the past, present and future e.g. perception of passage of time is accurate	• may be loss of perception and awareness of time in relation to the past, present and future e.g. estimation passage of time can be distorted

ACTIVITY 8.11

Matching exercise on the nature of consciousness

Match each description with the most appropriate term or phrase on the right. Write the letter of each term or phrase you select to the left of each description. Each term or phrase can be used only once.

(e)	**1** Awareness of external and internal stimuli and events.	**(a)** delta waves
(m)	**2** Task completion with considerable conscious, alert awareness and mental effort.	**(b)** beta waves
(k)	**3** Measures eye movements.	**(c)** automatic processing
(n)	**4** A type of attention used for simultaneous completion of two simple activities.	**(d)** altered state of consciousness
(b)	**5** Brain waves associated with alertness and intensive mental activity during normal waking consciousness.	**(e)** consciousness
(a)	**6** Brain waves associated with deep, dreamless sleep or unconsciousness.	**(f)** stimulant
(o)	**7** Brain waves associated with an awake and alert but relaxed and internally focused state.	**(g)** selective
(l)	**8** A drug that decreases central nervous system activity.	**(h)** sleep diary records
(h)	**9** A subjective report of a consciousness assessment.	**(i)** electroencephalograph
(g)	**10** A type of attention focused on one thing.	**(j)** results of a computer-delivered speed and accuracy test
(c)	**11** Task completion with little conscious, alert awareness and mental effort.	**(k)** electro-oculargraph
(j)	**12** An objective report of a consciousness assessment.	**(l)** depressant
(f)	**13** A drug that produces a brain wave pattern of increased beta activity and decreased delta, alpha and theta waves.	**(m)** controlled processing
(d)	**14** A mental state that differs noticeably from normal waking consciousness.	**(n)** divided
(i)	**15** Measures the brain's electrical activity.	**(o)** alpha waves

ACTIVITY 8.12

Comparing the effects of one night of full sleep deprivation vs legal blood alcohol concentrations

Select items from the shaded panel below to correctly complete the passage about research that has compared effects of sleep deprivation and legal blood alcohol concentrations. Each item should be used only once and not all items will be used.

0.05%	0.5%	17	24	48
alcohol	alcohol consumption	BAC	cause–effect relationship	cognitive
counterbalancing	deprivation	drink	full	impaired
improved	independent	independent groups	matched participants	order
partial	relationship	repeated measures	scores on the psychomotor tests	sleep deprivation
sleeplessness	sustained wakefulness	wakefulness		

Dawson and Reid (1997) have identified a significant relationship between fatigue due to a moderate level of sleep deprivation, legal levels of alcohol consumption and impaired cognitive performance.

The researchers found that participants who had 17 hours of full sleep deprivation (which they called 'sustained wakefulness') experienced a deterioration in performance on cognitive psychomotor tests like that of when they had a blood alcohol concentration (BAC) level of 0.05% (which is the legal limit in Australia). Furthermore, they found that participants who were sleep deprived throughout a 24 hour period experienced the same deterioration in performance on the tests as when they had a BAC of 0.10%.

ACTIVITY 8.12 *continued*

To control participant-related differences that could impact on test performance in unwanted ways, the researchers used a/an repeated measures experimental design. This meant that all participants experienced both conditions of the experiment and therefore the independent variable in each condition. The independent variables were sustained wakefulness (sleep deprivation) for a predetermined period and alcohol consumption to a predetermined BAC level. The scores on the psychomotor tests were used as a measure of the dependent variable. A counterbalancing procedure was used to control potential order effects such as practice and boredom.

ACTIVITY 8.13

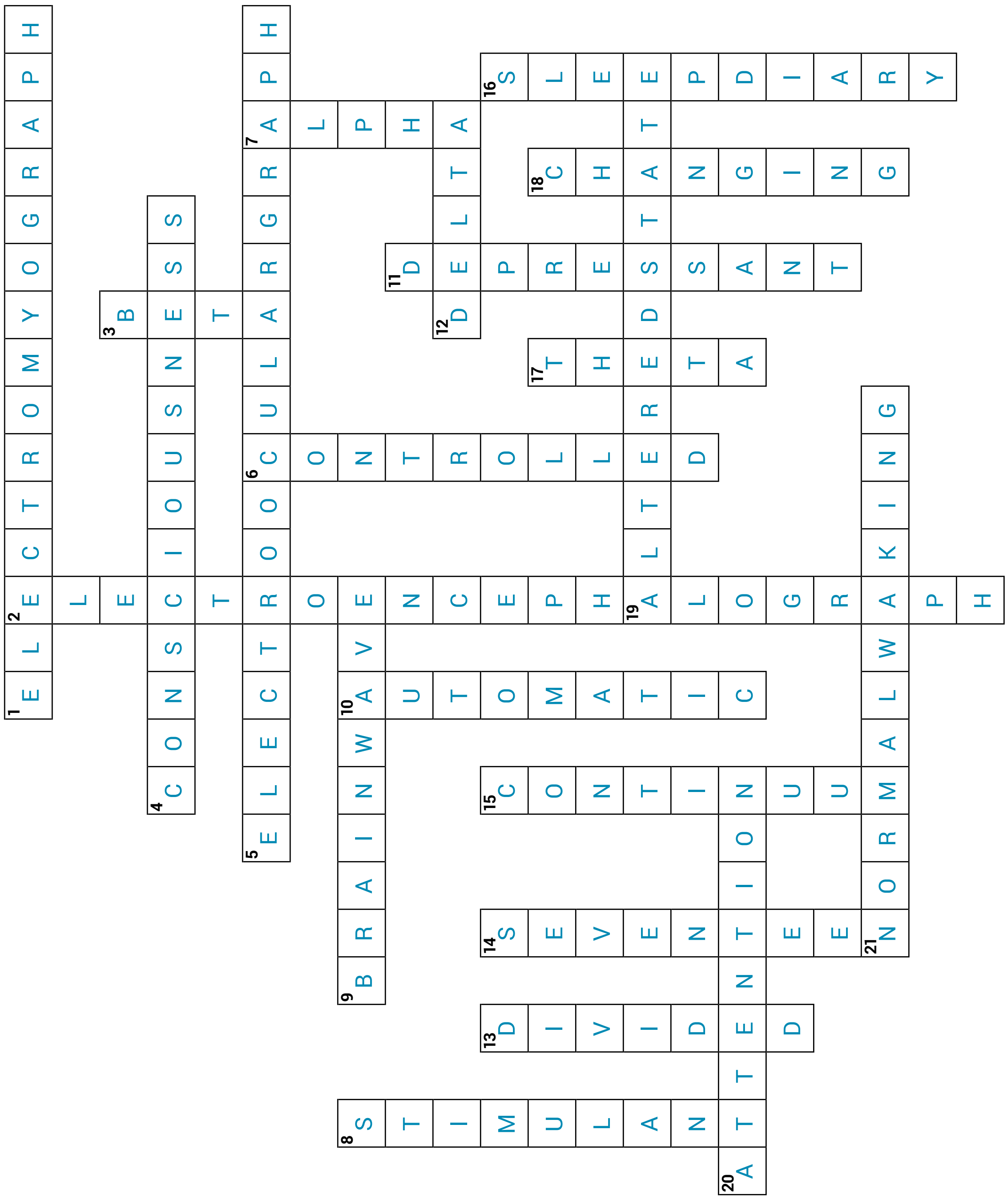
Crossword on concepts and terms in the nature of consciousness

Across

1 Records electrical activity in skeletal muscles
4 All that you are aware of at any moment in time
5 Records electrical activity in muscles that control eye movements
9 A physiological measure of change in level of alertness
12 Brain wave associated with the deepest stage of sleep and loss of consciousness
19 Any state of consciousness involving a shift from the usual waking state
20 Focusing awareness on a specific stimulus while ignoring other stimuli
21 The broad category of consciousness associated with being awake and aware

Down

2 Measures the brain's electrical activity
3 Brain wave associated with intensive cognitive activity or physical movement when awake
6 Information processing involving conscious mental effort and focused attention
7 Brain wave associated with being awake, physically relaxed and internally focused
8 Any drug that has an alerting, activating effect
10 Information processing involving minimal attention, conscious awareness and mental effort
11 Any drug that decreases activity in the central nervous system and the rest of the body
13 When attention is distributed between two or more tasks
14 Number of hours of full sleep deprivation that may impair cognitive performance to about the same extent as a BAC level of 0.05%.
15 A graphical way of showing variations of consciousness
16 A self-report on sleep and waking time activities based on data collected through self-monitoring
17 Brain wave associated with drowsiness, deep meditation and mental imagery
18 A characteristic of any state of consciousness


1 ELECTROMYOGRAPH
2 ELECTROENCEPHALOGRAPH
3 BETA
4 CONSCIOUSNESS
5 ELECTROOCULARGRAPH
6 CONTROLLED
7 ALPHA
8 STIMULANT
9 BRAINWAVE
10 AUTOMATIC
11 DEPRESSANT
12 DELTA
13 DIVIDED
14 SEVENTEEN
15 CONTINUUM
16 SLEEP DIARY
17 THETA
18 CHANGING
19 ALTERED STATE
20 ATTENTION
21 NORMAL WAKING

ACTIVITY 8.14

True/false quiz on the nature of consciousness

Indicate whether each item is true or false by writing T or F in the column at the right.

Statement	T or F
1 Everyone experiences consciousness.	T
2 A person is conscious if awake and responsive to sensory stimulation.	T
3 Psychology's definition of consciousness excludes self-awareness.	F
4 Human consciousness can be directly observed through scientific study.	F
5 Consciousness can be studied by measuring physiological responses.	T
6 Consciousness is a moment-by-moment experience.	T
7 We can control the content of our consciousness.	T
8 A continuum of consciousness shows distinctive boundaries between different states of consciousness.	F
9 We experience different naturally occurring states of consciousness, ranging from wakefulness to deep sleep.	T
10 Some waking states, which are accompanied by marked changes in mental processes, are considered altered states of consciousness.	T
11 We cannot intentionally change our state of consciousness when we choose to do so.	F
12 Level of alertness varies within normal waking consciousness.	T
13 Tracking brain wave patterns can indicate changes in levels of alertness.	T
14 Consciousness may be altered in a dramatic way by the use of legal and illegal drugs.	T
15 Normal waking consciousness is often described as a psychological construct by researchers who do not believe it occurs or exists.	F
16 Many tasks involving automatic processing have become so familiar that we do not have to focus our conscious minds on them in order to successfully perform them.	T
17 There are times in the course of a typical day when normal waking consciousness may have no content.	F
18 Selective attention demonstrates our ability to distribute our attention so that we can simultaneously focus on multiple stimuli.	F
19 When using divided attention, we choose to attend to a specific stimulus to the exclusion of other stimuli.	F
20 A beta brain wave pattern may be observed in both a waking person and a sleeping person.	T
21 The scientific study of consciousness excludes the use of subjective techniques such as those based on self-reports.	F
22 The effect on cognitive performance following 24 hours of sustained wakefulness is equivalent to a BAC of 0.10%.	T
23 Cognitive performance following 17 hours of full sleep deprivation can decrease to a level of performance achieved by someone with a BAC of 0.05%.	T
24 Stimulants decrease physiological arousal, whereas depressants increase arousal.	F
25 Video monitoring may be used for subjective reporting of consciousness during a sleep study.	T

CHAPTER 9
Sleep

	Activities										
Key knowledge	9.1	9.2	9.3	9.4	9.5	9.6	9.7	9.8	9.9	9.10	9.11
• sleep as a regular and naturally occurring altered state of consciousness that follows a circadian rhythm and involves the ultradian rhythms of REM and NREM Stages 1–4 sleep, excluding corresponding brain wave patterns and physiological responses for each stage	✔	✔	✔	✔					✔	✔	✔
• theories of the purpose and function of sleep (REM and NREM) including restoration theory and evolutionary (circadian) theory					✔				✔	✔	✔
• the differences in sleep across the lifespan and how these can be explained with reference to the total amount of sleep and changes in a typical pattern of sleep (proportion of REM and NREM).						✔	✔		✔	✔	✔
Key science skills								✔			

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ACTIVITY 9.1

Examining the definition of sleep

1 Complete the table to explain the 3 key concepts embedded in the following definition of sleep.

> *Sleep may be defined as a **reversible** behavioural state during which an organism experiences an altered state of consciousness involving **perceptual disengagement** from and **unresponsiveness** to the environment.*

Reversible means that…

The sleeper can always be awoken with a strong enough stimulus, such as noise or bodily force, that will quickly return them back to normal waking consciousness.

Perceptual disengagement means that…

The sleeper has no awareness of the external sensory stimuli of which they are usually conscious in normal waking consciousness.

Unresponsiveness means that…

The sleeper does not respond to external sensory stimuli (unless a stimulus is of sufficient intensity to arouse them).

2 To what extent is the sleeping organism unaware of its external environment? Explain your answer.

Explanation should demonstrate understanding that awareness is possible during sleep e.g. the sleeper will wake up when a stimulus of sufficient intensity is applied; during lucid dreaming the sleeper becomes aware that the events being experienced are part of their dream; during sleep walking the sleeper may perform behaviours requiring some degree of awareness for successful execution (even though the sleeper is unlikely to be able to recall such behaviours when they awaken).

ACTIVITY 9.2

Distinguishing between circadian and ultradian rhythms

Complete the following table to summarise differences between circadian and ultradian rhythms.

Circadian rhythm	Ultradian rhythm
Definition: A biological rhythm that involves changes in bodily functions or activities that occur as part of a cycle with a duration of about 24 hours.	**Definition:** A biological rhythm that involves changes in bodily functions or activities that occur as part of a cycle shorter than 24 hours.
Relevance to the human *sleep–wake cycle* Our daily sleep–wake cycle is a circadian rhythm as it has a duration of about 24 hours that coincides with the 24-hour day–night cycle that occurs as the Earth rotates. The naturally occurring day–night periods provide environmental cues (especially light) that influence sleep–wake periods (although the sleep–wake cycle is internally produced and persists in the absence of environmental cues).	**Relevance to the human *sleep cycle*** Our daily sleep cycle is an ultradian rhythm with a duration of about 90 minutes. It occurs as a series of distinctively different states and stages involving alternating periods of sleep with and without rapid eye movements and other varying physiological responses.

Circadian rhythm	Ultradian rhythm
Other examples of circadian rhythms: body temperature, melatonin secretion, cortisol secretion, blood pressure, blood sugar level, digestive secretions	**Other examples ultradian rhythms:** heart rate, respiration, blinking, hunger–eating behaviour, growth hormone, neurotransmitter activity (e.g. dopamine, noradrenaline)
Factors that can influence the circadian sleep–wake cycle: Examples: internal biological factors such as the presence of melatonin (for drowsiness when at a heightened level) and cortisol (for arousal when at a heightened level), hypothalamus activity and SCN function; external factors such as light–dark, clocks, meal times, noise, jobs, social obligations, using digital media	**Factors that can influence the ultradian sleep cycle:** Examples: age, health, diet, environmental cues, legal and illegal, drugs

ACTIVITY 9.3

NREM vs REM sleep characteristics

Tick which type of sleep is relevant to each statement. Either or both sleep types may be selected.

Statement	NREM	REM
1 Begins when you first lie down and close your eyes in readiness for sleep.	✔	
2 Occurs in virtually all mammals and birds.	✔	✔
3 A complete sleep cycle involves this type of sleep.	✔	✔
4 Progressive reduction in physiological activity after sleep onset.	✔	
5 Dominated by a specific brain wave pattern.	✔	✔
6 Brain waves are consistently like those of alert wakefulness.		✔
7 Brain waves at different times can be like those of unconsciousness or general anaesthesia.	✔	
8 Characterised by bursts of rapid eye movements beneath the closed eyelids.		✔
9 Traditionally described as having stages.	✔	
10 The deeper the sleep, the slower the brain waves.	✔	
11 Accounts for approximately 20–25% of total sleep time.		✔
12 Linked to dreaming.		✔
13 Slow rolling eye movements are possible early in a period of this sleep type.	✔	
14 Progressive loss of awareness of external stimuli following sleep onset.	✔	
15 Sometimes called paradoxical sleep because of the active brain in a relaxed body.		✔
16 Dreams are more frequent and tend to be vivid and more likely to be recalled when woken from this type of sleep.		✔
17 Slower frequency delta brain waves become predominant.	✔	
18 Periods of this type of sleep increase as the sleep episode progresses.		✔
19 This type of sleep is experienced first in every sleep cycle.	✔	
20 There is an increase in internal functioning such as heart and respiration rates, but the sleeper appears relaxed.		✔
21 Some parts of this type of sleep may be called slow wave sleep.	✔	
22 Arousal thresholds can vary quite significantly during this type of sleep.	✔	✔
23 A distinctive change in brain wave pattern signals the start and end of this type of sleep.	✔	✔
24 Periods of this type of sleep tend to lengthen and occur closer together as a sleep episode progresses.		✔
25 Periods of this type of sleep tend to become lighter as a sleep episode progresses.	✔	

ACTIVITY 9.4

Drawing a hypnogram showing a typical night's sleep for a healthy young adult

Answer the questions in Part A and then use your answers to draw a hypnogram in Part B.

Part A

Consider the typical sleep episode likely to be experienced by a healthy young adult across a single night.

1 How many ultradian sleep cycles usually occur?

5–6

2 What is the average duration of a single sleep cycle?

about 90 minutes

3 What are the typical start and end points of a single sleep cycle when shown in a hypnogram?

- start point: end of a REM period
- end point: end of the next REM period.

Note that Cycle 1 starts with sleep onset and ends at the end of the first REM period.

4 What proportion of sleep is spent in NREM compared to REM?

approx. 75–80% NREM; 20–25% REM

5 Describe the sequence of sleep types and stages likely to occur during the first sleep cycle.

NREMS1, S2, S3, S4, S3, S2, S1, REM

6 In what two distinctive ways do REM periods tend to change as the sleep episode progresses?

REM periods tend to (1) become longer and (2) occur closer together.

7 In what way will the pattern of NREM sleep change as the sleep episode progresses?

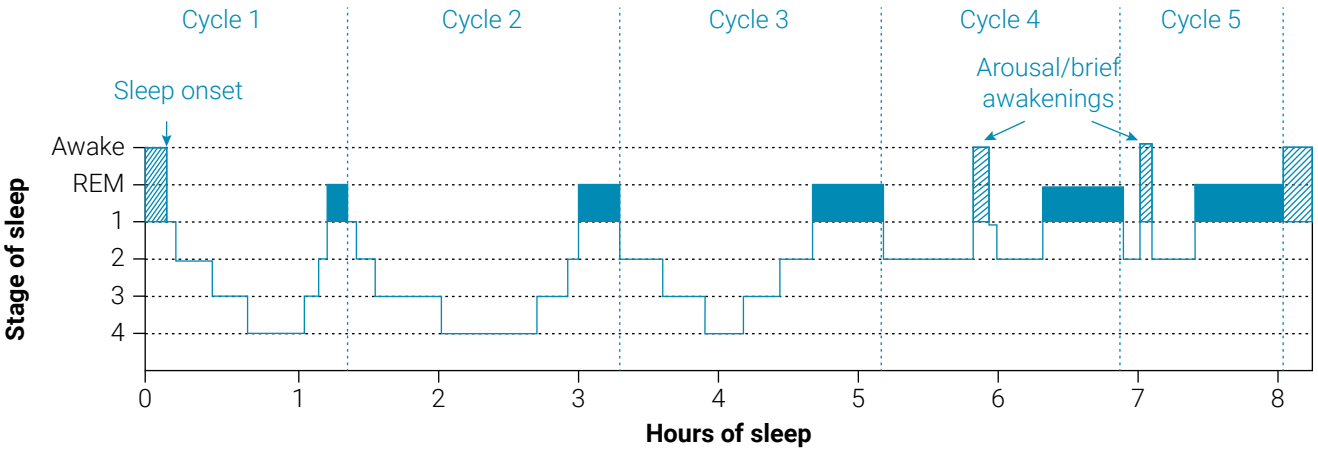
NREM stages 3 and 4 tend to predominate in the first half of the sleep episode and as the episode progresses stage 2 tends to account for the majority of sleep, and stages 3 and 4 may disappear.

8 How many arousals or brief awakenings are likely to occur to and when will they probably be experienced?

1 or 2 arousals or brief awakenings; more likely to occur in latter cycles in association with transitions between NREM/NREMS2 and REM sleep (and when NREM stage 2 is predominant)

Part B

Draw a hypnogram in the graph below using your answers to the Part A questions. Label the ultradian sleep cycles and any arousals or awakenings.



ACTIVITY 9.5

Comparing restoration and evolutionary theories of sleep

Outline the two major theories on the purpose and function of sleep, including research evidence that supports them and their limitations.

Restoration theory of why we sleep

Outline of theory:

Sleep provides 'time out' to recover from depleting activities during waking time that use up the body's physical and mental resources.

Research evidence in support of theory:

Sleep lab studies showing that sleep is a period of physiological rest, as indicated by the slowdown of many bodily functions and processes e.g. respiration, heart rate etc; secretion of growth hormone when asleep — growth hormone also promotes body repair, suggesting a repair function of sleep; sleep deprivation studies showing adverse effects of prolonged sleep loss; people tend to feel refreshed and energised after adequate sleep; people tend to sleep more when recovering from illness and disease.

Limitations of theory:

Has not been conclusively established in a cause–effect way precisely what, if anything, is actually restored, repaired or revitalised during sleep and at no other time; people do not necessarily need to sleep more than usual after a particularly active day; does not account for individual differences in sleep needs and effects of sleep loss (including no lasting effects); does not adequately account for the ultradian nature of sleep or the patterns and proportions of NREM and REM sleep.

Evolutionary (circadian) theory of why we sleep

Outline of theory:

Sleep evolved to enhance survival of a species by protecting its members through making them inactive during the part of the day when it is riskiest or most dangerous to move about. An organism's circadian sleep–wake cycle helps ensure its lifestyle and specific activities are synchronised with the day–night cycle of its environment and at the safest times.

Research evidence in support of theory:

Animals vulnerable to predators tend to sleep little and large predatory animals, which are generally not vulnerable, tend to sleep a lot; organisms with vision suited to daylight sleep during the night; organisms with vision suited to low light sleep during the day; while asleep, organisms tend to be very quiet and still, helping to avoid detection; smaller prey animals that consume high energy foods and sleep in safe places tend to sleep for long periods.

Limitations of theory:

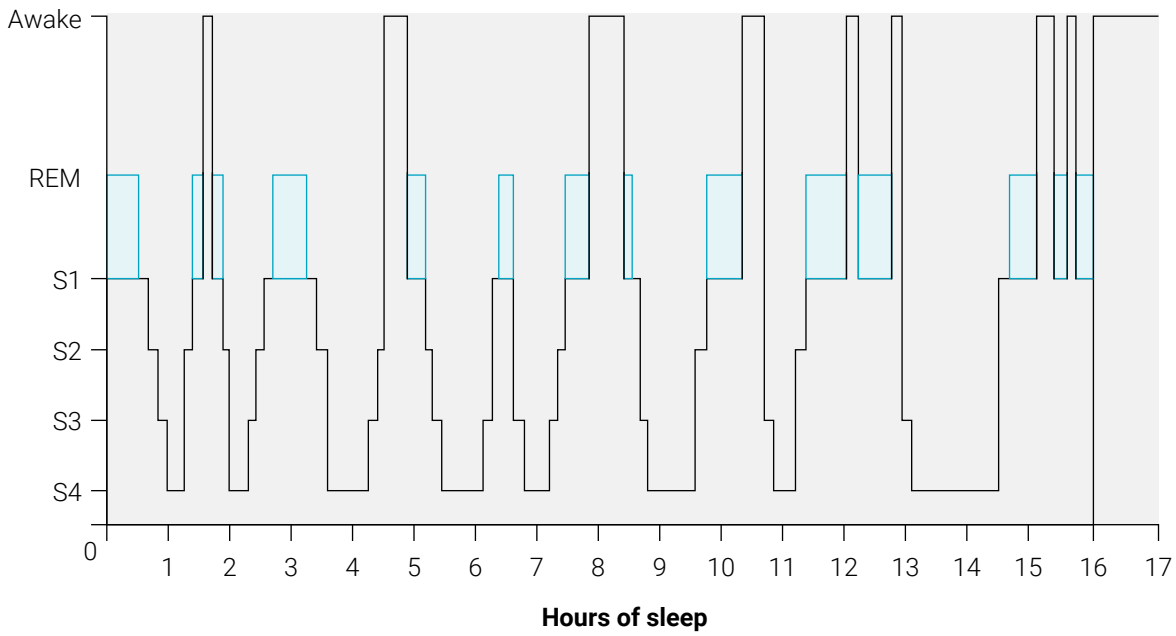
Lack of research evidence e.g. primarily relies on animal studies; does not account for individual differences in sleep needs and effects of sleep loss, especially among humans; does not actually explain the need for sleep — why we (and other mammals) will eventually sleep, regardless of the environmental circumstances and possibly the danger to which we may be exposed if we fall asleep; does not account for the loss of awareness and alertness during sleep, since their loss may place the organism at greater risk.

ACTIVITY 9.6

Comparing sleep patterns across the lifespan

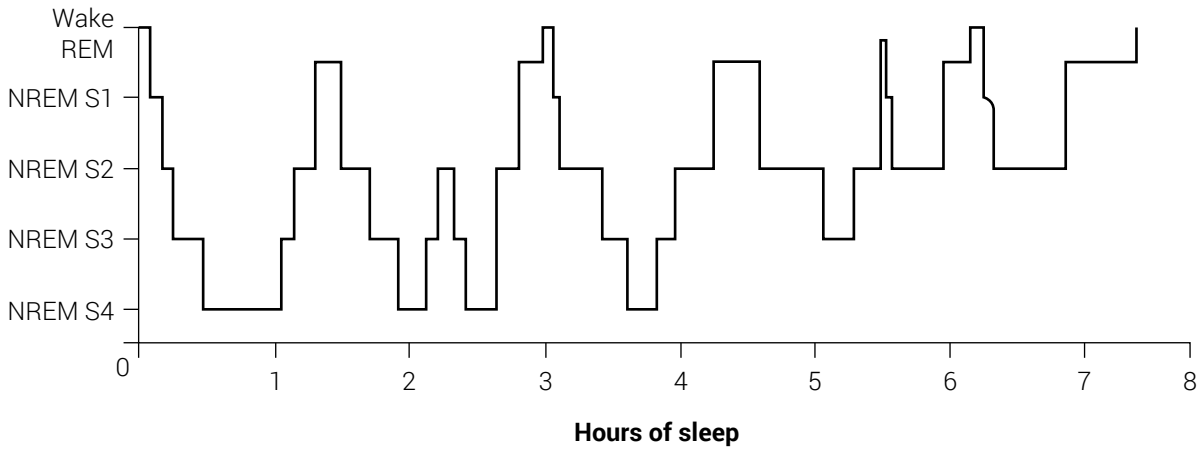
Compare the following three hypnograms labelled A, B and C. For each graph, determine the age of the person it most likely represents — a 2-week-old infant, a 32-year-old adult or a 69-year-old adult — and then analyse the sleep pattern to complete the table.

Hypnogram A



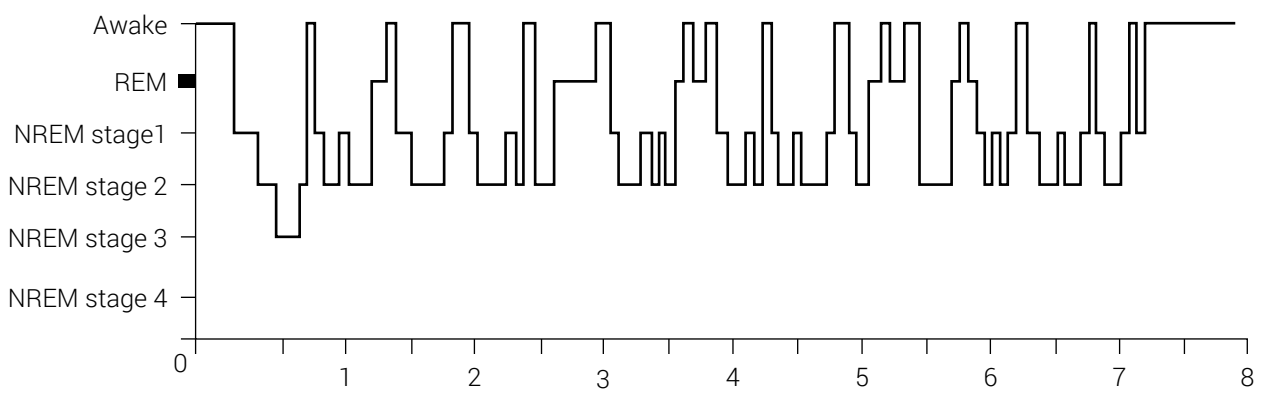
Age	2-week-old infant
Approximate total sleep time	about 16 hours
Proportion of REM to NREM	about 50% REM 50% NREM
Fragmentation (number of awakenings during sleep episode)	8
Sleep onset characteristic	sleep onset directly into REM sleep
Regularity and duration of sleep cycles	irregular sleep cycles, ranging from less than 30 mins to 2 hours

Hypnogram B



Age	32-year-old adult
Approximate total sleep time	about 8 hours
Proportion of REM to NREM	20% REM 80% NREM
Fragmentation (number of awakenings during sleep episode)	3
Sleep onset characteristic	relatively short sleep onset duration; sleep onset into NREM sleep
Regularity and duration of sleep cycles	regular; about 90–100 minutes per sleep cycle

Hypnogram C

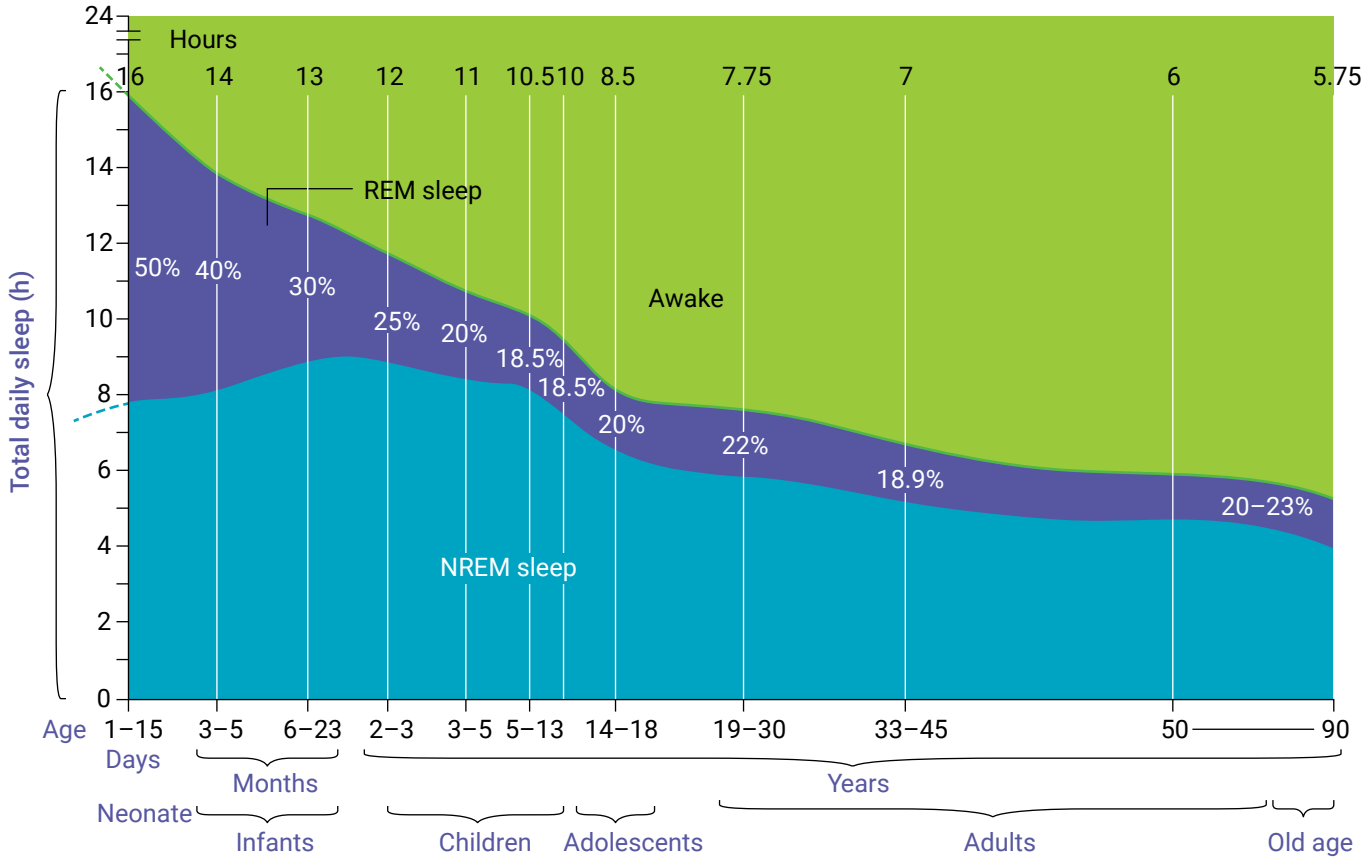


Age	69-year-old adult
Approximate total sleep time	about 7 hours
Proportion of REM to NREM	15–20% REM to 75–80% NREM
Fragmentation (number of awakenings during sleep episode)	15
Sleep onset characteristic	longer sleep onset time; sleep onset into NREM sleep
Regularity and duration of sleep cycles	irregular and more frequent cycles, less than one hour duration

ACTIVITY 9.7

Analysis of data on age-related patterns and proportions of sleep

Consider the graph below showing how sleep changes throughout the human lifespan, then answer the following questions



1 What age group experiences the highest proportion of REM sleep?

neonates (newborn babies)

2 At about what age are people awake as much as they are asleep?

2–3 years old

3 Determine the amount of REM, NREM and total hours of sleep experienced in newborns, toddlers (2–3 years old), adolescents, young adults and the elderly (over 80).

Age group	REM (hours)	NREM (hours)	Total (hours)
newborns	8	8	16
toddlers (2–3 years)	3	9	12
adolescents	2	7	9
young adults	1.5	6.5	8
very old (over 80)	1	5	6

4 How does the amount of REM sleep change as we age?

REM sleep proportion markedly decreases from about 50% between 0–2 years, then stabilises at about 20–25% through to very old age.

5 Describe the pattern of total sleep time as we age.

Total sleep time decreases overall, relatively rapidly from 16 to 9 hours by adolescence, and then remains relatively stable at about 8 hours through to old age.

6 Describe the proportion of REM to NREM from the adolescent years to old age.

REM proportion remains relatively stable at about 20%.

7 What are two other differences between the typical sleep of adolescents and elderly people that are not apparent in the graph?

Differences include: adolescents tend to get less sleep than they need to function at their best; adolescents tend to experience a change in their sleep–wake cycle involving delayed sleep onset and more difficulty waking early; adolescents tend to experience more slow wave deep sleep; elderly people are more likely to experience advanced sleep onset and awaken earlier; elderly people are less able to maintain long sleep episodes e.g. more fragmented sleep.

ACTIVITY 9.8

Summarising sleep as a naturally occurring state of consciousness

Select items from the shaded panel below to correctly complete the passage about sleep. An item may be used more than once but not all items must be used.

24 hours	8 hours	90 minutes	age-related	alertness
amount	amplitude	beta	biological	breathing
circadian	cortisol	cyclical	different	environmental cues
evolutionary	eye movements	four	greater	high
identical	increases	lifespan	light	low
melatonin	NREM	pineal gland	reduction	REM
restorative	sleep	stable	stage 2	suprachiasmatic nucleus
synchronised	time	tone	two	ultradian

Sleep is an altered state of consciousness that is part of a circadian rhythm with a duration of about 24 hours. Our cycle of sleep and wakefulness is regulated by a biological clock called the suprachiasmatic nucleus (SCN) and influenced by environmental cues, especially light. The SCN receives information about the amount (or intensity) of light from the eyes and signals the pineal gland in the brain to produce more or less melatonin, which in turn influences our level of alertness. A higher level of this hormone is associated with greater drowsiness and vice versa. Other cycles of biological activity such as heart and respiration rates that occur in shorter periods are known as ultradian rhythms. Moving through different types and stages of sleep in a cyclical way is another example of this rhythm.

ACTIVITY 9.8 *continued*

The main sleep episode comprises two types of sleep called REM and NREM sleep. REM sleep is characterised by rapid eye movements and beta brain wave activity associated with alert wakefulness. NREM sleep is traditionally divided into four stages ranging from light sleep to deep sleep. Light sleep typically has a brain wave pattern characterised by high frequency and low amplitude brain waves, whereas deep sleep is characterised by low frequency and high amplitude brain waves. NREM sleep also involves progressive reduction in other physiological responses such as heart rate, breathing and muscle tone and movement.

Human sleep patterns change throughout the entire lifespan. There is a general trend of less total sleep time as we get older and an age-related decrease in the proportion of NREM sleep. The proportion of time spent in REM sleep decreases markedly during the first two years and then remains relatively stable through to a very old age. In later adulthood, at around 60 or so, sleep is mostly NREM stage 2 sleep.

Theories on the purpose and function of sleep offer different explanations. For instance, restorative theories propose that sleep provides 'time out' to recover from depleting activities during waking time that use up the body's physical and mental resources. In contrast, evolutionary theories propose that sleep enhances survival of a species by protecting its members through making them inactive during the part of the day when it is riskiest or most dangerous to move about. An organism's circadian sleep–wake cycle helps ensure its lifestyle and specific activities are synchronised with the day–night cycle of its environment and at the safest times.

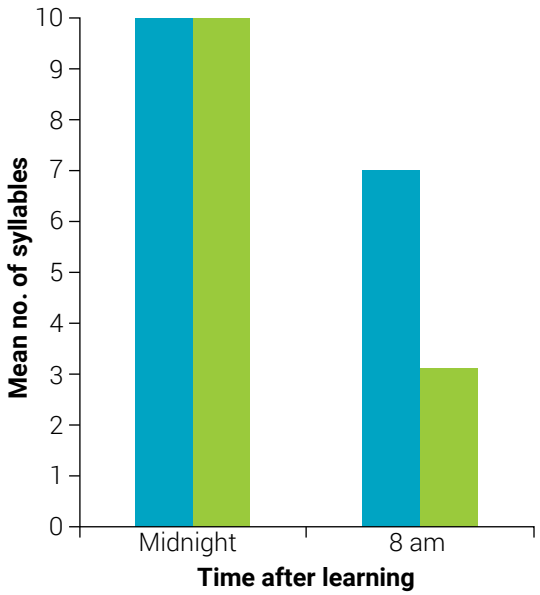
ACTIVITY 9.9

Evaluation of research on sleep and memory

A researcher was interested in finding out if sleeping after studying improves memory of what is learnt. The researcher believed that subsequent learning in the course of everyday life can interfere with a person's memory.

A school camp was used for the experimental setting. The researcher had a group of ten year 12 students learn a list of 10 nonsense syllables (such as muw and xir) at midnight until all syllables could be recalled correctly in any order. Immediately following the learning, half of the participants were protected from interference by going to sleep (Group 1). The other half were required to stay awake and participate in their usual waking activities (Group 2). At 8.00 am the next day, all were tested for recall of the syllables.

The results of the experiment are shown below. Use of inferential statistics showed that the difference in Group 1 and 2 scores was significant and not attributable to chance factors. The results supported the researcher's hypothesis.



1 Formulate a research hypothesis for this experiment.

Example:

- Students who sleep immediately after learning will recall more nonsense syllables than students who stay awake.

ACTIVITY 9.9 *continued*

2 Identify the experimental research design.

independent groups

3 Identify the operationalised independent and dependent variables.

independent variable:

sleep/no sleep immediately after learning; sleeping/staying awake after learning

dependent variable:

score on the test of recall of nonsense syllables

4 Which type of recall was used for retrieval?

free recall

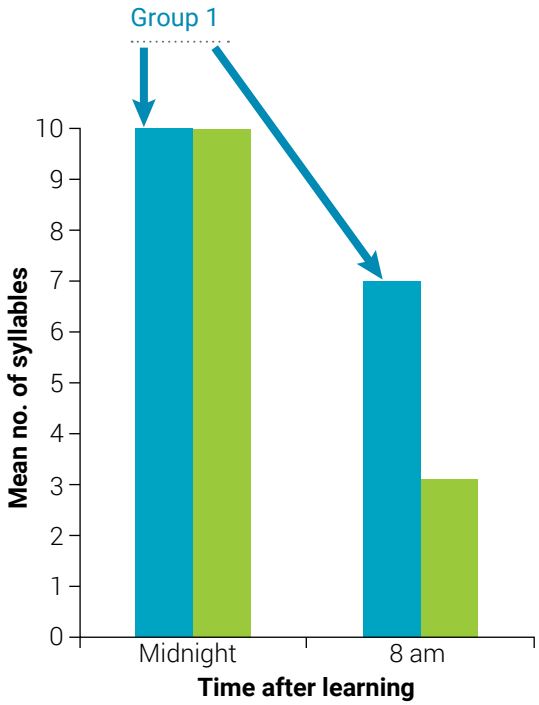
5 Why were nonsense syllables used instead of ordinary, everyday words?

Control the potential influence of word familiarity/prior knowledge of the words by participants

6 Why were inferential statistics used?

Explanation should demonstrate understanding that inferential statistics were used to interpret and give meaning to the results, specifically, whether the difference in the mean score for the two groups is actually a significant difference and more likely to be attributed to the IV than chance factors.

7 Use an X to identify each of the Group 1 results in the following copy of the graph.



8 Write a valid conclusion using the results of the experiment.

Example: The results show that recall was significantly lower for students who stayed awake when compared with students who slept. Given that we are exposed to new information when awake but not when asleep, this suggests that subsequent learning in everyday life can interfere with a person's memory, and that interference can cause memory loss and is a factor that may account for everyday remembering and forgetting.

ACTIVITY 9.9 *continued*

9 Identify and explain a potential confounding variable of relevance to this particular experiment.

Potential confounding variables include:

- The better Group 1 scores may be due to one or more participant variables rather than lack of interference because the researcher did not use a random allocation procedure so there was no control of individual participant differences; e.g. even though both groups initially learnt and remembered all 10 syllables, Group 1 may have had significantly more students with better learning and memory skills (such as use of elaborative rehearsal or an enhanced memory 'mnemonic' aid) and this may be an alternative explanation for their better performance on the post-sleep test (rather than the IV).
- Sleep may aid long-term storage of new information recently acquired during wakefulness through memory consolidation, so the sleep process may be the variable that accounts for the better performance by Group 1, not lack of interference.

10 Identify and explain three significant limitations of the experiment other than failure to control a potential extraneous confounding variable.

Limitations include:

- The small sample size for an experiment on human learning and memory increases the possibility of biased or 'false positive' results, lack of sample representativeness and therefore external validity and wider generalisability of the results; there can also be limitations associated with the statistical analysis
- There was no re-testing at other times so it is unknown how long the interference effect lasts e.g. if sleep merely prevents interference, providing a temporary respite for newly formed memories then, during waking time after sleeping, those memories may be vulnerable to interference once again. If, however, sleep helps consolidate memories then, after sleeping, those memories should be more resistant to interference.
- Use of nonsense material may control prior learning but the amount of forgetting that occurred when tested after the sleep/no sleep conditions and/or at subsequent times may have varied greatly if other stimulus materials were used e.g. more meaningful information. Therefore, the effect may only be relevant to semantic explicit memory and not to other LTM types.

- No control of sleep quality or quantity in the sleep group
- No control of participants' sleep quality or quantity prior to the experiment
- No control of specific activity type in the no sleep group and therefore no control of amount or type of interference
- No control of rehearsal by participants between the initial testing and the retrieval session after the sleep/no sleep conditions
- No control of other behaviours (e.g. from drinking caffeine or alcohol) prior to or possibly during the experiment
- No control of microsleeping or napping in the no sleep group during the sleep deprivation period
- The unusual learning time (i.e. midnight) may limit generalisability e.g. not a typical learning time; may have created an acute fatigue or time of day effect that influenced the results in an unusual way

11 Outline experimental procedures that could avoid these limitations.

Procedures should relate to the specific limitations given for question 10. Examples:

- Randomly allocate participants to groups to control participant variables.
- Periodically re-test after different time intervals to assess whether a lasting effect.
- Use a larger sample which is also big enough to exclude potential participants if they do not meet specific selection criteria e.g. participants maintain a sleep diary for one week prior to the experiment and the data may be used as participant selection/exclusion criteria in order to assess and control pre-experiment activity
- Control post-test rehearsal and how wakefulness time is filled in
- Repeat the experiment in a morning session and compare results with an evening session
- Repeat the experiment to assess learning and memory of a procedural memory task e.g. the mirror drawing task used to assess H.M.

ACTIVITY 9.10

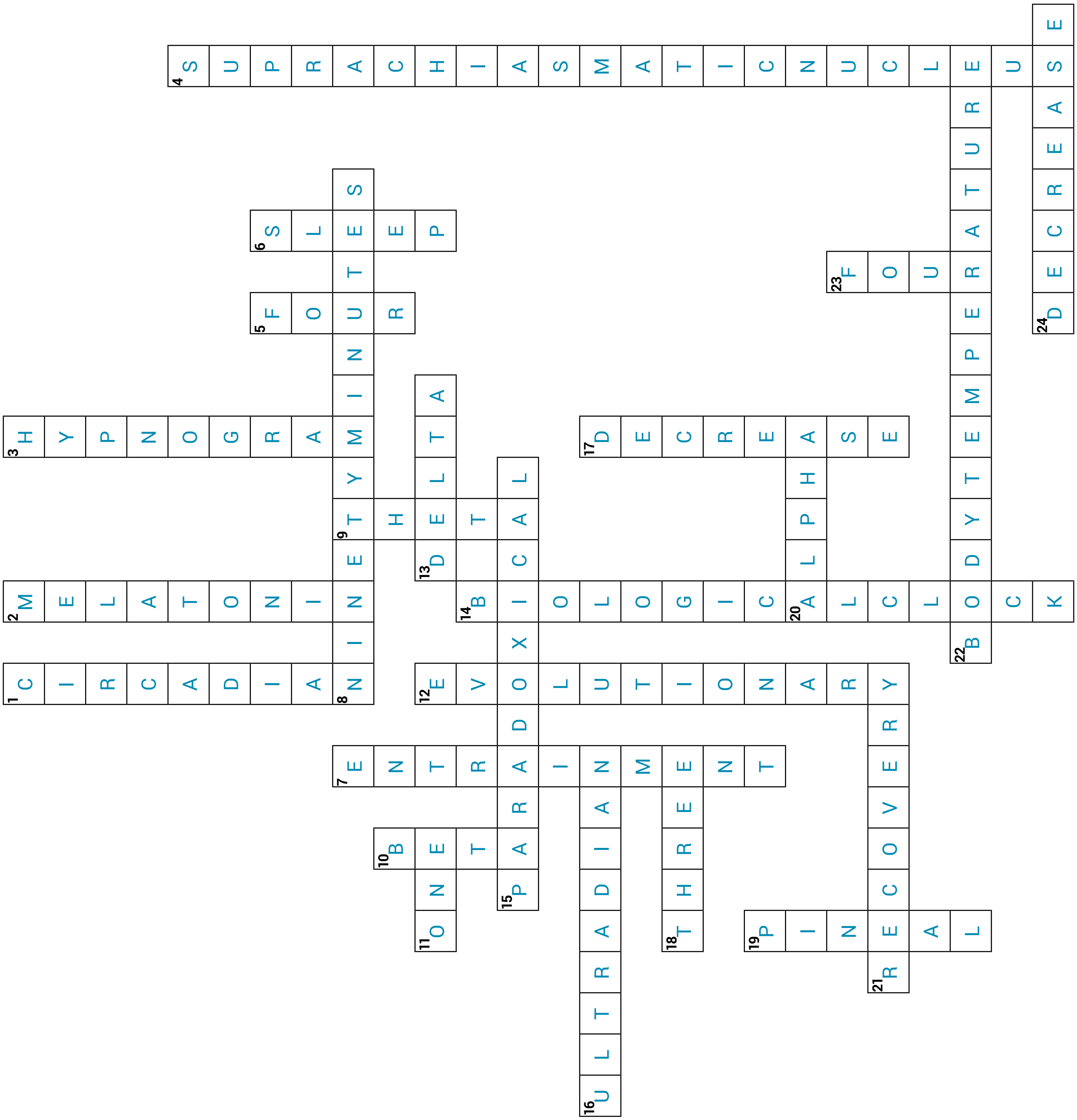
Crossword on concepts and terms in sleep

Across

8 Commonly described as the average length of a single NREM-REM sleep cycle.
11 NREM sleep stage with the lowest arousal threshold.
13 Slowest brain waves associated with the deepest level of sleep.
15 Another term for REM sleep to describe the active brain in the virtually paralysed body.
16 A biological rhythm involving changes in bodily functions or activities that occur as part of a cycle shorter than 24 hours.
18 NREM stage in which delta waves are first observed.
20 Brain waves associated with feeling relaxed and calm, usually with eyes closed.
21 Another term for restorative theory.
22 A physiological change that occurs as a biological rhythm and influences drowsiness and sleep onset.
24 The direction of change in the proportion of NREM stages 3 and 4 among older adults.

Down

1 A biological rhythm involving changes in bodily functions or activities that occur as part of a 24 hour cycle.
2 A hormone secreted in a greater amount in conditions of low light and which influences alertness.
3 A type of sleep graph.
4 Brain structure that regulates the timing and activity of the sleep–wake cycle.
5 NREM sleep stage with the highest arousal threshold.
6 A reversible behavioural state of perceptual disengagement from and unresponsiveness to the environment.
7 The process of synchronising the sleep–wake cycle with the environmental 24 hour day–night cycle.
9 Brain waves associated with drowsiness, imagery and deep meditation.
10 Brain waves mostly associated with being awake and very alert.
12 Name of the theory of why we sleep, proposing enhanced survival due to being less active during the part of the day when it is most risky to move about.
14 An internal mechanism or neural system governing a biological rhythm.
17 The direction of change in the proportion of REM sleep time during the first two years of life.
19 A gland in the brain that secretes melatonin.
23 NREM sleep stage entered when delta waves occur more than 50% of the time.


1 CIRCADIAN
2 MELATONIN
3 HYPNOGRAM
4 SUPRACHIASMATICNUCLEUS
5 FOUR
6 SLEEP
7 ENTRAINMENT
8 NINETYMINUTES
9 THETA
10 BETA
11 ONE
12 EVOLUTIONARY
13 DELTA
14 BIOLOGICALCLOCK
15 PARADOXICAL
16 ULTRADIAN
17 DECREASE
18 THREE
19 PINEAL
20 ALPHA
21 RECOVERY
22 BODYTEMPERATURE
23 FOUR
24 DECREASE

ACTIVITY 9.11

True/False quiz on sleep

Indicate whether each item is true or false by writing T or F in the column at the right.

Statement	T or F
1 Patterns and proportions of sleep types and stages vary considerable among individuals.	T
2 Some people never sleep.	F
3 Sleep can be a purposely induced altered state of consciousness.	T
4 Approximately one-third of our lives is spent sleeping.	T
5 Sleep is an ultradian rhythm.	T
6 Sleep is a biological rhythm.	T
7 Core body temperature is not a biological rhythm.	F
8 Light is the main environmental cue that influences the sleep–wake cycle.	T
9 A high level of melatonin in the blood makes us feel more alert.	F
10 About 75–80% of a child's sleep is REM sleep.	F
11 NREM sleep is often described as paradoxical sleep.	F
12 An electro-oculargraph can record eye position.	T
13 Total sleep time in very old age tends to average about eight hours.	F
14 Slow wave sleep tends to be rarely experienced by people aged 90 years or older.	T
15 REM rebound involves microsleeps that enable recovery of lost REM sleep.	F
16 REM sleep periods tend to lengthen and get closer together during a normal night's sleep by a healthy young adult.	T
17 The observation that people consistently sleep longer after a particularly active day provides support for restorative theories of sleep function.	F
18 NREM Stage 1 sleep tends to last less than five minutes.	T
19 Both restorative and evolutionary theories emphasise biological aspects of sleep, overlooking psychological aspects.	T
20 People woken during REM sleep rarely show sleep inertia.	F
21 Brain waves associated with REM sleep are as fast as when awake and alert.	T
22 Dreaming occurs during REM sleep but not NREM sleep.	F
23 Dreaming is more likely to occur in the latter half of a typical night's sleep.	T
24 There is research evidence that REM sleep assists with memory formation and consolidation of newly learned information.	T
25 Everyone experiences all NREM stages whenever they sleep.	F

CHAPTER 10

Sleep disturbances

	Activities											
Key knowledge	10.1	10.2	10.3	10.4	10.5	10.6	10.7	10.8	10.9	10.10	10.11	10.12
• changes to a person's sleep–wake cycle and susceptibility to experiencing a circadian phase disorder, including sleep–wake shifts in adolescence, shift work and jet lag				✔	✔		✔			✔	✔	✔
• the effects of partial sleep deprivation (inadequate sleep either in quantity or quality) on a person's affective (amplified emotional responses), behavioural and cognitive functioning						✔	✔			✔	✔	✔
• the distinction between dyssomnias (including sleep-onset insomnia) and parasomnias (including sleep walking) with reference to the effects on a person's sleep–wake cycle	✔	✔	✔							✔	✔	✔
• the interventions to treat sleep disorders including cognitive behavioural therapy (with reference to insomnia) and bright light therapy (with reference to circadian phase disorders).								✔	✔	✔	✔	✔
Key science skills							✔					

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ACTIVITY 10.1

Dyssomnias versus parasomnias

Complete the table below by listing each of the following dyssomnia and parasomnia features under the correct heading.

- sleep disturbance involving difficulty initiating, maintaining and/or timing sleep
- sleep disturbance involving inappropriate physiological and/or psychological activity during sleep or during a transitional stage of sleep (e.g. when falling asleep or awakening)
- sleep is disturbed by a specific event during a sleep episode
- involves a problem with a sleep–wake cycle process (e.g. difficulty falling or staying asleep)
- not usually associated with abnormal behaviour or experiences during sleep
- sleep-onset insomnia is an example
- sleep walking is an example
- sleep–wake cycle disturbance due to jet lag is an example
- sleep apnoea is an example
- sleep awakenings due to night terrors is an example
- may be associated with inappropriate central nervous system activation
- primarily caused by a change to a mechanism or process that generates or times sleep (including naturally occurring changes and abnormalities)
- the main complaint is about the sleeplessness or excessive sleepiness produced by this type of disturbance
- sleep–wake cycle shift in adolescence is an example
- sleep–wake cycle disturbance due to shift work is an example
- the main complaint is about the unusual behaviour or experience during sleep produced by this type of disturbance
- disturbed sleep due to nightmares is an example
- does not involve a dysfunction in any process or mechanism that generates or times sleep

Dyssomnia	Parasomnia
• sleep disturbance involving difficulty initiating, maintaining and/or timing sleep • primarily caused by a change to a mechanism or process that generates or times sleep (including naturally occurring changes and abnormalities) • sleep-onset insomnia is an example • sleep–wake cycle shift in adolescence is an example • sleep–wake cycle disturbance due to shift work is an example	• sleep disturbance involving inappropriate physiological and/or psychological activity during sleep or during a transitional stage of sleep (e.g. when falling asleep or awakening) • sleep walking is an example • sleep apnoea is an example • disturbed sleep due to nightmares is an example • sleep awakenings due to night terrors is an example

ACTIVITY 10.1 *continued*

Dyssomnia	Parasomnia
• sleep–wake cycle disturbance due to jet lag is an example	• may be associated with inappropriate central nervous system activation
• involves a problem with a sleep–wake cycle process (e.g. difficulty falling or staying asleep)	• sleep is disturbed by a specific event during a sleep episode
• not usually associated with abnormal behaviour or experiences during sleep	• the main complaint is about the unusual behaviour or experience during sleep produced by this type of disturbance
• the main complaint is about the sleeplessness or excessive sleepiness produced by this type of disturbance	• does not involve a dysfunction in any process or mechanism that generates or times sleep

ACTIVITY 10.2

Analysing sleep-onset insomnia

Insomnia is a sleep disorder that involves persistent difficulty initiating or maintaining sleep. Many famous people and celebrities have been reported as having some type of insomnia, including Leonardo Da Vinci, Wolfgang Mozart, former British PM Margaret Thatcher, former US president Bill Clinton, Madonna, George Clooney and Lady Gaga.

Lady Gaga is believed to suffer from sleep-onset insomnia. She has been quoted as blaming her 'creative and overactive mind' for why she struggles to fall asleep at night. In particular, her ability to perform consistently at the high standard she sets for herself is constantly in mind when she goes to bed. Such thoughts keep her awake, often throughout the entire night.

In the panels on the next page, define sleep-onset insomnia, describe the key symptoms Lady Gaga is likely to be experiencing if she has sleep-onset insomnia, then explain the effects the insomnia would be having on her sleep–wake cycle. In the bottom panel, explain why Lady Gaga might be susceptible to developing a delayed sleep phase disorder.

Sleep-onset insomnia is:

A sleep disorder involving persistent difficulty falling asleep at the usual time.

Key symptoms:

- regular difficulty falling asleep within about 20–30 minutes after intending to go to sleep
- non-restorative sleep i.e. poor quality sleep that does not leave her feeling rested upon awakening
- a consistently reduced amount of total sleep
- difficulty falling asleep at least 3 nights a week that would have occurred for at least the last 3 months
- difficulty falling asleep has occurred despite adequate opportunity to sleep (not lifestyle factors)
- difficulty falling asleep is not due to another sleep disorder or the effects of a substance

Effects on sleep–wake cycle:

- changes in the amount, restfulness and timing of her sleep
- sleep onset tends to occur much later than desired
- sleep tends to be nonrestorative (not restful)
- total sleep time may be less than desired
- excessive daytime sleepiness
- difficulty waking in the morning
- overall, disrupts her natural sleep–wake cycle

Lady Gaga might develop a delayed sleep phase disorder because:

persistent sleep onset and awakening at much later times than desired may shift her sleep–wake cycle/circadian rhythm driven sleep onset and awakening times to the extent that they get 'out of sync' with the time dependent requirements of the rest of society. For example, her sleep–wake cycle may shift forward to 3.00–11.00 am.

ACTIVITY 10.3

Analysing Lady Macbeth's sleep walking episode

Macbeth (1606) is one of William Shakespeare's most famous plays.

Macbeth is a brave and loyal follower of King Duncan of Scotland who becomes consumed by ambition and greed. Macbeth and his wife Lady Macbeth kill King Duncan in his sleep and Macbeth takes the throne. Afterwards, Macbeth's guilt and fear lead him to commit even more murders to secure his position of power and cover up what he has done.

Lady Macbeth, who is now Queen, becomes emotionally fragile and overcome with guilt from the crimes she and her husband committed. Lady Macbeth's gentlewoman (maid) observes her frequently engaging in unusual nocturnal behaviour. Out of concern, the gentlewoman tells a doctor:

> *… I have seen her rise from her bed, throw her nightgown upon her, unlock her closet, take forth paper, fold it, write upon't, read it, afterwards seal it, and again return to bed; yet all this while in a most fast sleep.*

The gentlewoman and doctor stay up during the night in the hope of observing Lady Macbeth's nocturnal behaviour and observe the following:

- Lady Macbeth, dressed in her nightgown, walks calmly past them holding a candle in her hand
- she appears in a trance-like state, unaware of her surroundings
- 'her eyes are open — but their sense is shut'
- she talks a lot — she talks clearly and coherently about the smell of blood, she describes some of the terrible things she and her husband have done and how she never 'thought the old man would have had so much blood in him'
- for 15 minutes she tries to wash imaginary blood off her hands, asking herself 'will these hands ever be clean [of the blood]?'
- she then suddenly stops and goes back to bed.

The gentlewoman then confirms with the doctor that she has seen Lady Macbeth perform these activities and the note writing many times before in her sleep. The doctor says he is amazed by what he has seen and is also very concerned about her.

1 What is sleep walking?

A sleep disorder that involves getting up from bed and walking about or performing other behaviours while asleep.

2 Is sleep walking a dyssomnia or parasomnia?

☐ dyssomnia ☑ parasomnia

3 In which sleep state or stage did Lady Macbeth's sleep walking episodes most likely occur?

deep sleep during NREM stages 3 and 4

4 Which behaviours displayed by Lady Macbeth suggest that she is actually sleep walking?

Behaviours include: her eyes are open; she appears to be in a trance-like state, which is consistent with sleepwalker's eyes which usually having a 'blank stare' or glassy 'look right through you' appearance; she does not walk with her arms extended out in front of her; she is able to maintain coordination and navigate around obstacles; behaviours are relatively simple (although complex behaviour such as note writing is possible); sleep talking is possible (although she was probably talking more clearly and coherently than is typically reported for sleep walking episodes e.g. sleep talking is often mumbled and a few words); sleep walking episodes may occur up to 3—4 times per week — the gentlewoman suggests that it is occurring quite frequently; the sleep walking episode lasts at least 15 minutes — these can last up to one hour or so, but generally last only a few minutes (and rarely beyond 15 minutes); it is implied that she had only one sleepwalking episode like this per night; the episode ends spontaneously.

5 What is a possible trigger for Lady Macbeth's sleep walking?

guilt/stress/anxiety

6 List three possible effects that Lady Macbeth's sleep walking episode could have on her sleep–wake cycle.

Effects may include:

- loss of deep sleep during the relatively prolonged episode (e.g. delta brain waves would not be evident)
- interruption to the natural progression of the sleep cycle during the disturbed sleep episode
- fragmented sleep episode due to the cycle disturbance
- less than the normal number of sleep cycles as she experiences a relatively prolonged episode
- daytime sleepiness.

ACTIVITY 10.4

Analysing circadian rhythm phase disorders associated with different life experiences

In the panels below, describe the sleep–wake cycle change each person is likely to be experiencing and explain why they are susceptible to developing a circadian rhythm phase disorder.

A circadian rhythm phase disorder is:

a sleep disorder involving sleep disruption that is primarily due to a mismatch between an individual's sleep–wake pattern and the pattern that is desired or required, thereby also involving a mismatch between their sleep–wake cycle and their daily activity pattern.

THE ADOLESCENT

- Adolescents experience a biologically (hormonal/melatonin) driven shift of their sleep–wake cycle of about 1–2 hours forward in time. Consequently:
  - they tend to not feel sleepy until much later than they did as a child;
  - although the timing of sleep onset is about 1–2 hours later than it used to be, they still have to get up at the same time for school or work most days each week, which is about 1–2 hours earlier than the biologically required waking time (because of the delayed sleep onset)
  - enforced awakening earlier than required results in nightly sleep loss/deprivation which can accumulate as a 'sleep debt'
  - the attempt to make this up (e.g. during weekends) can further disrupt the sleep–wake cycle (e.g. shift it further forward).
- Adolescents are therefore susceptible to developing a circadian rhythm phase disorder (called delayed sleep phase disorder), which involves a forward shift in their sleep–wake cycle to the extent that there is a mismatch between their actual sleep–wake schedule and the sleep–wake schedule required by their school/workplace/everyday life commitments in society.

THE SHIFT WORKER

- Shift work can involve work times and therefore awake hours that are outside of normal/habitual sleep hours at night.
- Consequently, awake time is not in-sync with a sleep–wake cycle that is biologically programmed for the individual to sleep best at night and to be awake and most alert during the day and early evening e.g. working at night is working against one's normal body clock — the person is required to work when they should be sleeping and to sleep when they should be working.
- Shift workers are therefore susceptible to developing a circadian rhythm phase disorder due to the ongoing mismatch between their sleep–wake cycle and the day–night cycle of their physical environment and/or disruption of their sleep–wake cycle by roster changes that require readjustment of their sleep–wake cycle to a new work schedule (and therefore environmental cues).

THE AROUND-THE-WORLD TRAVELLER

- Rapid travel across multiple times zones disturbs the circadian sleep–wake cycle.
- Because jet travel is quick, our sleep–wake cycle remains aligned to the environmental time cues of the home time zone as there has been insufficient time to adjust to the new time zone cues.
- Consequently, the natural sleep–wake cycle (along with other circadian rhythms) is out of sync and in conflict with the light–dark and other time cues of the external environment.
- This desynchronisation is temporary and our brain and body need to adjust to the new environmental conditions, including re-setting of the sleep–wake cycle.
- In the interim, we experience the jet lag effects during the adjustment process, the symptoms of which can include insomnia, excessive sleepiness, reduced daytime alertness and impaired concentration.
- Around-the-world jet travellers are therefore susceptible to developing a circadian rhythm phase disorder when crossing multiple time zones in one journey due to a mismatch between their sleep–wake cycle and the day–night cycle of their (new) physical environment.

ACTIVITY 10.5

Comparing jet lag when flying in easterly and westerly directions

Long-distance aeroplane passengers who rapidly travel across multiple time zones experience jet lag because their circadian sleep–wake cycle remains aligned to the environmental time cues of their home environment.

Consider the cases of Daniel and Sonya. Daniel will fly from Melbourne to London direct and Sonya will fly from London to Melbourne direct. Melbourne time is 10 hours ahead of London time.

Daniel's flight

Sonya's flight

1 Who will be *most* affected by jet lag and why?

- Sonya.
- Sonya is travelling east. When flying in an easterly direction east, Sonya will travel in the opposite direction to the sun's apparent movement, so the day becomes 'shortened'. This runs counter to the cycle's natural tendency to drift towards 25 hours and lengthen the day. The result is a greater mismatch between the internal and external rhythms and so the effects of jet lag are greater.
- Note that Sonya will experience *phase advance* which requires more adjustment by the traveller than *phase delay*.

ACTIVITY 10.5 *continued*

2 Who will be *least* affected by jet lag and why?

- Daniel.
- Daniel is travelling west. When flying in a westerly direction, Daniel will follow the apparent pathway of the sun.

  The creation of a longer day is more 'in tune' with the inclination of his body's biological clock to extend the day.
- Note that Sonya will experience *phase delay* which requires less adjustment by the traveller than *phase advance*.

ACTIVITY 10.6

Applying effects of partial sleep deprivation

Ken is experiencing partial sleep deprivation because over the last month, he has had a large work project to complete which requires him to work much longer than his usual hours. In addition, he has a 5-month old baby at home. Provide a definition of partial sleep deprivation, then, in the three other panels, outline the effects this sleep deprivation is having on Ken's affective, behavioural and cognitive functioning.

Partial sleep deprivation is:

inadequate sleep, either in quality or quantity, i.e. having less sleep (either quality or quantity) than what is normally required.

Affective functioning

Possible effects include:

- amplified emotional responses i.e. emotional reactions may be too quick and more intense or exaggerated, often out of proportion to how he would ordinarily react when not sleep deprived
- mood change e.g. irritable, short tempered
- poorer emotion perception e.g. inaccurate emotional judgments.

Effects

Cognitive functioning

Possible effects include:

- lapses in attention, inability to maintain prolonged concentration
- impaired problem solving, decision making, errors in judgment
- irrational thinking
- impaired learning and memory.

Behavioural functioning

Possible effects include:

- sleep inertia
- excessive sleepiness during normal waking time
- fatigue
- microsleeps
- sleep disturbances
- slower reaction time
- impaired behaviour control
- reduced motor coordination, particularly eye–hand coordination.

ACTIVITY 10.7

Evaluation of research on night shift work and driving performance

A research team investigated the impact of night shift work on driving performance. Sixteen night shift workers (9 women and 7 men) with a mean age of 48 years participated in the study. All participants completed two, 2-hour driving sessions in a real motor vehicle (a minivan) specially equipped with various data collection instruments in each of two conditions:

1. Condition 1: No night shift. Participants reported having an average of 7.6 hours of sleep during the night before the drive.
2. Condition 2: After night shift. Participants reported having an average of 0.4 hours of sleep between the start of their overnight shift and the start of their post-night shift drive. Participants in this condition were instructed *not to sleep* between the end of the night shift preceding their drive and the start of the drive.

The driving sessions were conducted on a simple, private road circuit purpose-built for road safety research. Driving order was determined by the participant's work schedule: 4 participants first completed the no night shift drive followed by the after night shift drive and 12 participants first completed the after night shift drive followed by the no night shift drive. Statistical analysis indicated that drive order did not significantly affect driving performance.

One of the researchers, acting as a 'safety observer', rode in the front passenger seat monitoring driving performance and using an emergency braking system in potentially dangerous situations. The observer was unaware of whether participants were driving before or after a night shift.

Various driving performance measures were recorded, including the number of lane violations (how often drivers weaved in and out of the lane), near-crash events and drives terminated prematurely (due to safety concerns). Physiological measures of drowsiness were also collected while the participants were driving using electroencephalogram (EEG) electrodes attached to each participant's scalp, electrooculography (EOG) electrodes attached above the eyes, and an infrared device attached to the frame of glasses worn by participants which was used to measure eye and eyelid movements.

Some key results of the research are shown in the table below.

	No night shift	After night shift
Near-crash driving events	0/16 (0%)	6/16 (37.5%)
Drive terminations	0/16 (0%)	7/16 (43.8%)
Lane violations	1.49/min	3.09/min
Microsleep episodes	0.47/hour	1.00/hour
Slow eye movements	10.6/hour	20.1/hour
Eye blink duration (mean)	0.13	0.18

Source: Adapted from Lee, M.L., et al., (2016). High risk of near-crash driving events following night-shift work. *Proceedings of the National Academy of Sciences, 113*(1), 176–181.

ACTIVITY 10.7 *continued*

1 Formulate a research hypothesis for this investigation.

Examples:

- Night shift work impairs driver alertness and impairs driving performance.
- Nightshift work results in increased drowsiness and impaired driving performance.

2 Identify the operationalised independent and dependent variables.

independent variable(s):

whether the person worked a night shift/night shift work vs no night shift work /sleep vs no sleep before driving

dependent variable(s):

scores on driving performance and physiological measures/number of near-crash driving events, drive terminations, lane violations and microsleep episodes; eye movement rate and eye blink duration

3 Identify the experimental and control groups.

experimental group: after night shift

control group: no night shift

4 Identify the type of experimental design used.

repeated measures (each participant was involved in both the E and C groups, and therefore all conditions)

5 Identify the procedure used to control experimenter expectations.

single-blind (the researcher directly working with participants i.e. the safety observer was unaware of whether participants were driving before or after a night shift; all other data were collected electronically and there was no need for other researchers to know which condition participants were in until the data were analysed)

6 Suggest a suitable title for the results table and a header for the column 1.

title:

Example: Comparison of driving performance and drowsiness measures on night shift drives with after night shift sleep drives

header: Example: Variable/Measure/Performance measure

7 Describe the results of the investigation.

Driving performance measures:

- Over one-third of 'after night shift' drives (37.5%) involved near-crash events compared with none of the 'no night shift' drives.
- Seven of the 16 'after night shift' drives (43.8%) were terminated prematurely due to safety concerns.
- Twice as much time was spent in an incorrect lane (i.e. lane violation) during 'after night shift' drives (3.09/min v 1.49/min).
- These results indicate that night shift work adversely affects a person's driver performance i.e. driving ability is more impaired after a night shift than after a night of sleep.

Drowsiness measures:

- All drowsiness measures were higher during 'after night shift' drives than in 'no night shift' drives i.e. more microsleep episodes per hour, more slow eye movements and longer eye blink durations
- These measures indicate that the participants were much drowsier when driving after the night shift than when driving after a night of sleep.

8 Write a conclusion based on the results.

Example: After working a night shift, drivers experience more drowsiness while driving and this increases the chances of lane violations and near-crash events.

9 Identify two possible limitations of this research.

Limitations include:

- Even though the participants were driving behind the wheels of a real car and not a simulator, they were driving on a simple, closed circuit, which is quite different to a typical commute home in the morning e.g. they did not have to navigate traffic, stop signs, pedestrians, etc. It is possible that all of this could have *increased* participant attention and alertness.
- The presence of the safety observer, electrodes on a participant's head and wearing glasses may have also increased participant attention, alertness and awareness of sleepiness compared with that of a worker driving home alone, with the radio on and without observation after a night shift.
- Lack of control of amount of sleep/length of time awake by participants between driving sessions/conditions.
- Small sample size of 16.

ACTIVITY 10.8

Intervening with psychotherapy to treat a sleep disorder

Imagine you are a psychologist specialising in the treatment of sleep disorders and the following client came to see you.

Stanton is a healthy, 37-year-old married father of two children aged 10 and 13. He states that he is 'desperate for help' as he is 'perpetually tired and exhausted' and his work productivity as an architect and relationships with others are being affected by 'his problem'.

Stanton's problem is that he 'does not know how to fall asleep'. For the last 2 years he has been going to bed at around 11pm but is still awake until 3am or so. 'Thoughts just circle around and around in my head.' This happens every night. Some nights, because he 'knows what's coming', he doesn't bother going to bed until 3am and stays up working. But he can't always fall asleep then either. Once asleep, he says he 'sleeps like a rock' but 'hates it' when the alarm sounds because 'getting out of bed and firing up for the day is a huge struggle'. Sometimes during the day, however, he finds he can't help having a short nap at his work desk.

Stanton has found that over the last month or so in particular, he has become increasingly frustrated, is really 'snappy' with others, feels generally lethargic, and has been arguing with his wife and children more than usual. He is having 'too many near misses' when driving to and from work, and, for the first time ever, he was unable to meet an important work deadline as he simply couldn't concentrate on what he had to do or be his 'usual creative self'. Missing the deadline then also got him into an argument with his manager. This was the 'last straw' for Stanton and he knew it was time to get professional help.

Questions

1 Identify Stanton's sleep disorder.

- sleep-onset insomnia i.e. persistent difficulty falling asleep at the usual sleep time

2 What symptoms reported by Stanton led you to your conclusion?

Stanton is experiencing most of the symptoms of sleep-onset insomnia, e.g.

- regular failure to fall asleep within about 20–30 minutes after intending to go to sleep (Stanton goes to bed at 11pm but does not fall asleep until around 3am)
- poor quality sleep that does not leave him feeling rested upon awakening
- reduced amount of total sleep (around 4 hours per night if he gets up around 7am)
- the sleep difficulty occurs at least 3 nights per week (it occurs every night)
- the sleep difficulty is experienced for at least 3 months (he has experienced this problem for the last 2 years)

- the sleep difficulty occurs despite adequate opportunity to sleep (Stanton goes to bed at 11pm which is a 'reasonable hour')
- the sleep difficulty is not due to the effects of a substance (he is described as healthy)
- difficulty falling asleep causes impairment in functioning (his relationships with others are becoming increasingly strained and his productively at work is reduced)
- no difficulty staying asleep once asleep nor waking earlier than desired (therefore not another type of insomnia).

3 Give three examples of thoughts that could be 'circling around and around' in Stanton's mind each night when he goes to bed to sleep.

Examples should include thoughts that are likely to increase arousal and inhibit sleep such as:

- I am powerless over my sleep.
- In order to get to sleep, I must try *really hard*.
- If I do not get 8 hours of sleep, my next day will be ruined!
- If I do not sleep well, I will perform poorly the next day.
- Without an adequate night's sleep, I can hardly function the next day.
- I'll never have a normal night's sleep again.
- This insomnia is ruining my life.
- I won't be able to do well at work if I don't sleep well tonight.

4 Name and describe a psychological intervention that could be offered Stanton to help him overcome his sleep problem. Ensure you state the overall aim of the intervention and outline details of what would be done.

Stanton should be offered cognitive behavioural therapy (about 8–10 sessions).

- The aim of CBT is to help Stanton identify and replace thoughts and behaviours that cause, maintain or worsen his insomnia with more appropriate and realistic thoughts and sleep habits relevant to sleep onset and sleep maintenance. CBT has two components — a cognitive component and a behavioural component.
- Cognitive component: assisting Stanton to recognise and change unrealistic beliefs and thoughts about his sleep and 'sleep problem' in particular. Once he's able to do this, he will be less likely to place undue pressure on himself to fall asleep which in turn will reduce his overall level of physiological arousal (thereby increasing the chances of being able to fall asleep).
- Behavioural component: assisting Stanton to develop good sleep habits and avoid behaviours which prevent him from sleeping well. One technique involves *stimulus control therapy* which aims to strengthen the association between the bed and bedroom as cues/stimuli for sleep. For Stanton, probably the most important part of stimulus control therapy would be that if he goes to bed but finds himself unable to fall asleep, he should get up and do something relaxing until he feels tired (but not using digital media or doing other counterproductive activities), then return to bed and try again. He should not lie in his bed awake for 4 hours, nor should he stay up until 3am.
- Stanton should also be provided with *sleep hygiene education*. This involves providing him with information about practices that tend to improve and maintain good sleep and full daytime alertness e.g. establish a bedtime routine, avoid stimulating activities and big meals an hour before bedtime, avoid napping during the day, etc.

ACTIVITY 10.9

Intervening with bright light therapy to treat circadian rhythm phase disorders

Use the terms in the shaded panel to complete the sentences below about sleep disorders due to a mismatch between an individual's sleep–wake cycle and the sleep–wake schedule they desire or require. Each term may be used more than once but not all terms will be used.

adrenalin	advanced sleep phase disorder	dark	delayed sleep phase disorder	direct sunlight
evening	indoor light	light	light box	melatonin
morning	night light	phase-advance	phase-delay	time

1 Bright light therapy involves timed exposure of the eyes to intense but safe amounts of ..... light .....

2 When undergoing bright light therapy, the most commonly used device is called a/an ..... light box .....

3 Generally, when undergoing bright light therapy, the light emitted is brighter than ..... indoor light ..... but not as bright as ..... direct sunlight .....

4 Bright light therapy works by influencing ..... melatonin ..... secretion from the pineal gland.

5 When using bright light therapy, one of the most important variables is to expose yourself to the ..... light ..... at the right ..... time .....

6 People with a/an ..... advanced sleep phase disorder ..... have little difficulty falling asleep, but feel sleepy early in the evening and wake very early in the morning.

ACTIVITY 10.9 *continued*

7 People with a/an delayed sleep phase disorder tend not to feel sleepy until quite late in the evening, but typically have difficulty waking up in the morning in time for school or work commitments.

8 To correct a delayed sleep phase disorder, exposure to bright light in the morning will help advance the circadian rhythm to an earlier time.

9 To correct an advanced sleep phase disorder, exposure to bright light in the evening will help advance the circadian rhythm to a later time.

10 If someone works night shift, exposure to bright light in the evening may be helpful.

11 For treating jet lag following travel in an easterly direction, the person should expose themself to bright light in the morning.

12 For treating jet lag following travel in a westerly direction, the person should expose themself to bright light in the evening.

ACTIVITY 10.10

Matching exercise on sleep disturbances

Match each description with the most appropriate term on the right. Write the letter of the term you select to the left of each description. Each term can be used only once.

(h)	**1** Another term for somnambulism.	**(a)** parasomnias
(c)	**2** A behavioural therapy that targets unhelpful learned associations that may have been acquired by people with insomnia.	**(b)** circadian rhythm phase disorders
(f)	**3** A group of sleep disorders involving difficulties initiating, maintaining and/or timing sleep.	**(c)** stimulus control therapy
(b)	**4** A group of sleep disorders involving a person's desired and actual sleep-wake patterns being out-of-sync.	**(d)** sleep-onset insomnia
(i)	**5** An involuntary sleep episode with a duration of up to 10 seconds or so.	**(e)** bright light therapy
(l)	**6** A change in the usual timing of a person's major sleep episode.	**(f)** dyssomnias
(a)	**7** A group of sleep disorders involving some kind of unusual or inappropriate sleep-related event.	**(g)** cognitive behavioural therapy for insomnia
(k)	**8** Time zone change syndrome.	**(h)** sleep walking
(d)	**9** A type of sleep disorder involving an ongoing problem falling asleep at the desired time each day.	**(i)** microsleep
(g)	**10** A psychotherapy that targets inappropriate thoughts and behaviours of people with insomnia.	**(j)** delayed sleep phase disorder
(e)	**11** A phototherapy that targets resetting of the biological clock to shift a person's sleep–wake cycle to a desired schedule.	**(k)** jet lag
(j)	**12** A type of sleep disorder involving a sleep–wake cycle shift that causes sleep onset at a later time than previously experienced.	**(l)** sleep–wake cycle shift

ACTIVITY 10.11

Crossword on concepts and terms in sleep disturbances

Across

5 Changes to a person's sleep–wake cycle increase susceptibility to experiencing this type of sleep disorder
10 Inadequate sleep quantity or quality
11 Another term for sleep habits
13 Accumulated sleep loss that needs to be made up
14 The first word for a disorder where a person keeps going to sleep and waking up too early
16 A type of sleep disorder for which unusual events occur during sleep or sleep transitions
17 Getting out of bed and moving around as though awake while actually still asleep
18 A cognitive function that may be impaired by partial sleep deprivation
19 An intervention for treating circadian phase disorders
20 Helps adjustment to local time when jet lagged

Down

1 The first word for a disorder where a person keeps finding it harder to go to sleep until much later at night than desired.
2 An occupational hazard associated with night shift work
3 A type of therapy for insomnia that assumes the bed and bedroom have become conditioned stimuli for anxiety, stress or frustration associated with being unable to sleep.
4 An involuntary sleep episode lasting 1–10 seconds
6 A biologically driven change in the sleep–wake cycle during adolescence
7 A possible effect of partial sleep deprivation on a person's emotional responses
8 A sleep-to-wake transition effect characterised by grogginess, low alertness and disorientation
9 A circadian rhythm sleep disorder related to a person's work schedule
12 Persistent difficulty falling asleep and/or staying asleep for as long as desired
15 A type of sleep disorder that involves a problem with a sleep–wake cycle process or timing of the cycle

1 DEL AYED
2 SLEEPINESS
3 STIMULUS CONTROL
4 MICROSLEEPED
5 CIRCADIAN
6 SLEEPWATKINS
7 AMPLIFICATION
8 SLEEPIEST
9 SHIFTWORKDISORDER
10 SLEEPDEPRIVED
11 SLEEPHYGIENE
12 INSOMNIA
13 SLEEPDEBT
14 ADVANCED
15 DELAYED
16 PARASOMNIA
17 SLEEPWALKING
18 MEMORY
19 BRIGHT
20 SUNLIGHT

ACTIVITY 10.12

True/False quiz on sleep disturbances

Indicate whether each item is true or false by writing T or F in the column on the right.

Statement	T or F
1 A sleep disorder is a condition that frequently impacts on your ability to get enough quality sleep.	T
2 The only long-term consequence of not getting enough sleep is that you'll be tired.	F
3 Insomnia is simply a problem with falling asleep.	F
4 Parasomnias are specific events that occur mainly during sleep episodes.	T
5 Sleep hygiene education primarily involves advice on keeping the bedroom and bedding clean and ready for sleep.	F
6 Shift work can disrupt a person's sleep–wake cycle and make them susceptible to developing a parasomnia.	F
7 The internal biological clocks of adolescents can keep them awake later in the evening and wake them later in the morning.	T
8 Sleep walking typically occurs during REM sleep.	F
9 Sleep-onset insomnia is a type of dyssomnia.	T
10 If you wake up in the middle of the night and can't fall back to sleep within 20 minutes or so you should get out of bed and do a relaxing or calming activity until you feel tired.	T
11 The aim of stimulus control therapy is to expose the eyes to controlled amounts of light to help shift the sleep–wake cycle in the desired direction.	F
12 Sleep debt continues to build up until it is all repaid.	F
13 A key symptom of sleep-onset insomnia is awakening prematurely from sleep with an inability to fall asleep again.	T
14 In some cases, sleep disorders can be a symptom of another physical or mental health condition.	T
15 Amplified emotional responses are a possible effect of partial sleep deprivation.	T
16 Sleep quantity influences our judgment of sleep quality.	T
17 Jet lag tends to be more disruptive when we travel in a westerly direction.	F
18 Most sleep disorders can be easily treated by taking naps in the day.	F
19 An assumption of cognitive behavioural therapy for insomnia is that our thoughts play a role in our ability to sleep.	T
20 Bright light therapy influences melatonin secretion from the pineal gland.	T
21 Work rosters with rotating shift work schedules are associated with a higher frequency of sleep disturbances than rosters with fixed schedules.	T
22 Sleepwalking tends to be most common towards the end of the major sleep episode when it is near waking time.	F
23 Sleep inertia is one of the immediate effects of partial sleep deprivation on affective functioning.	F

ACTIVITY 10.12 *continued*

Statement	T or F
24 Jet lag is a temporary disruption in circadian rhythms that occurs when you travel speedily across different time zones.	T
25 The effects of partial sleep deprivation tend to be minor and temporary when they occur occasionally or on a short-term basis.	T
26 Shift workers tend to adapt more quickly when the move from one shift to the next is a forward move so the new shift begins later in the day.	T
27 Bright light therapy can help minimise the effects of jet lag if used at the right times.	T
28 Sleep walking is a type of parasomnia.	F
29 Most dyssomnias result from inappropriate activation of the central nervous system at incorrect times.	F
30 Sleep-onset insomnia can result in difficulty waking up in the morning.	T

CHAPTER 11

Mental health

	Activities							
Key knowledge	**11.1**	**11.2**	**11.3**	**11.4**	**11.5**	**11.6**	**11.7**	**11.8**
• mental health as a continuum (mentally healthy, mental health problems, mental disorders) influenced by internal and external factors that can fluctuate over time	✔	✔				✔	✔	✔
• the typical characteristics of a mentally healthy person, including high levels of functioning, social and emotional well-being and resilience to life stressors			✔			✔	✔	✔
• ethical implications in the study of, and research into, mental health, including informed consent and use of placebo treatments.				✔	✔	✔	✔	✔
Key science skills					✔			

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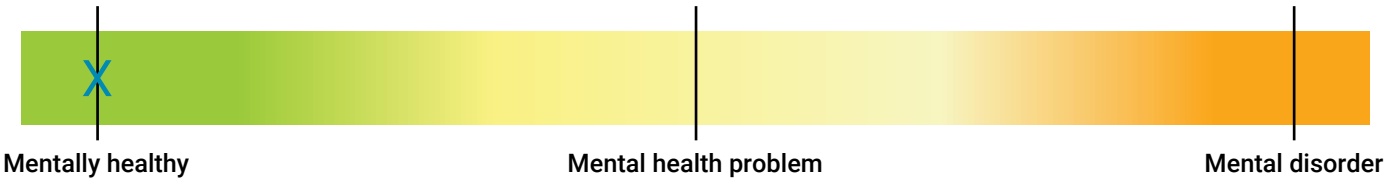
ACTIVITY 11.1

Plotting mental health on a continuum

Read the following case studies and place each person on the mental health continuum using an 'X' and their name. Then, underneath the continuum, in the spaces provided, state the reasons for your answers.

HELEN: Helen's husband died in a car accident nearly 30 years ago. Although Helen has lived alone since then, she plays competition and social lawn bowls each week, regularly goes out with friends to see the latest movies and for lunch, regularly spends time with her grandchildren and also enjoys travelling with her friend Shirley who is also a widow. Helen walks her dog every day and volunteers 2 days per week at the local hospital canteen. Helen recently had a large 'cancer spot' removed from her forearm but she followed her doctor's orders, maintained a positive attitude, and was back playing lawn bowls and doing her volunteer work within two weeks.



HELEN:

Helen is mentally healthy so she should be placed towards the left of the continuum. Despite living alone, Helen is connected with others and the community and stays fit and healthy. When faced with a challenge (e.g. her recent health scare), she demonstrated the ability to cope well and dealt with it positively. Although she has also had to deal with the sad death of her husband many years ago, Helen has managed to go on to have a fulfilling life and flourish.

KOSTA: When Kosta was 15 he began to feel as though he was 'dead inside' and could no longer experience emotions. By age 18, his mood was often low and irritable, and he couldn't enjoy things he previously enjoyed. However, he was still able to function well at school and at work. By age 29, Kosta found himself easily fatigued despite excessive sleep. His energy level was persistently low. His capacity to be productive at work was drastically reduced. By age 35, Kosta could not sustain work any longer because of persistent low mood.

KOSTA:

Kosta is experiencing a diagnosable mental disorder (major depression) so he should be placed towards the right of the continuum. Kosta has been fluctuating between having a mental health problem and mental disorder for many years. However, he now has a mental disorder as his mental health symptoms are so severe that he is unable to work (function). These symptoms include low mood, anhedonia (lack of enjoyment in life experiences), low energy level and hypersomnia (excessive sleepiness). He may also have had some concentration difficulties and difficulties making decisions which would have affected his ability to work.

SABEEN: Sabeen lives at home with her parents and 2 younger sisters. She is an 'A' student, has a large group of friends with whom she socialises regularly, is an active participant in sporting activities (she plays competition tennis at a high level) and is also very musical. However, Sabeen's mother has just been diagnosed with breast cancer. Since the diagnosis, Sabeen has been feeling very sad, angry and confused, has been sleeping more than usual, has lost her appetite, and has had difficulties concentrating on her school work.

SABEEN:

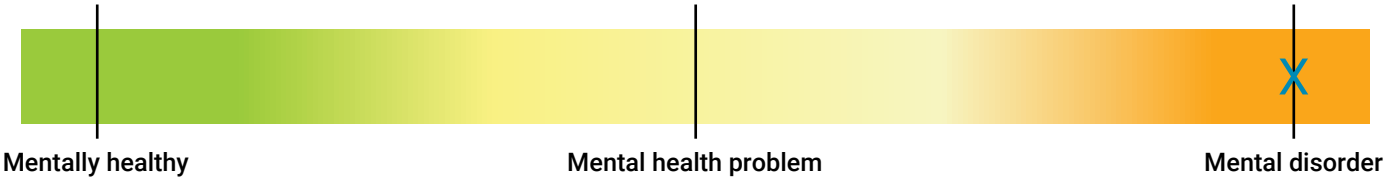
Sabeen is experiencing a mental health problem so she should be placed around the middle of the continuum. There has been a distinct change in her functioning, including thoughts, feelings and behaviour. Prior to her mother's diagnosis, Sabeen was functioning very well in all aspects of her life. Given she was functioning so well, it can be reasonably assumed that once she adjusts to the bad news, her mother receives treatment, etc., she will return to her prior level of good functioning so her current mental health state may be considered temporary.

CALLUM: When Callum was a young child he was full of energy and life, always curious about the world around him and loved to learn. When he was 10 years old, his father didn't come home from work one day. He learnt his father had a sudden heart attack at work and died. After that, Callum became shy and withdrawn. He refused to go to school, he cried a lot and had nightmares. By the time he was 12, Callum had gradually started going out with friends again and going back to school. By age 14, although he still missed his father, 'the old Callum' had returned — he was attending school regularly and hanging out with friends.

CALLUM:

Callum experienced a mental health problem after the death of his father so he should be placed around the middle of the continuum. After his father died, there was a distinct change in Callum's thoughts, feeling and behaviour. For example, prior to his father's death he loved going to school but afterwards he refused to go. His symptoms resolved over time (presumably once he came to terms with his grief) and Callum gradually returned to his usual state of functioning — back to attending school and socialising with friends.

SIMON: Simon is 8 years old. He has severe difficulties concentrating, listening and following instructions. His parents and teachers report that he is physically restless and is 'constantly running around'. He often blurts out answers and interrupts other students in the classroom. Simon has been involved in several incidents in which he hit his class mates. He is now falling behind academically. A paediatrician has prescribed a medication to help Simon manage his difficulties with concentration, hyperactivity and impulsivity.



SIMON:

Simon is experiencing a diagnosable mental disorder (most likely attention deficit hyperactivity disorder, or ADHD) so he should be placed towards the right of the continuum. His symptoms of inattention, hyperactivity and impulsivity are so severe that they are getting in the way of his functioning (e.g. his ability to learn and get along with his classmates). Simon needs intervention from a mental health professional in order to manage his symptoms because these are not going to resolve over time on their own.

PETRINA: Petrina has been married to Salvadore for 11 years, but Salvadore recently told Petrina he wants a divorce. Petrina was devastated and her emotions have been 'all over the place'. However, she has been seeking regular emotional support from her friends and family, exercising regularly, and making sure she is eating healthily and getting enough sleep. Petrina is still going to work each day and being productive. She is also consulting a lawyer so that she can learn about the best way to divide the assets she co-owns with her husband.

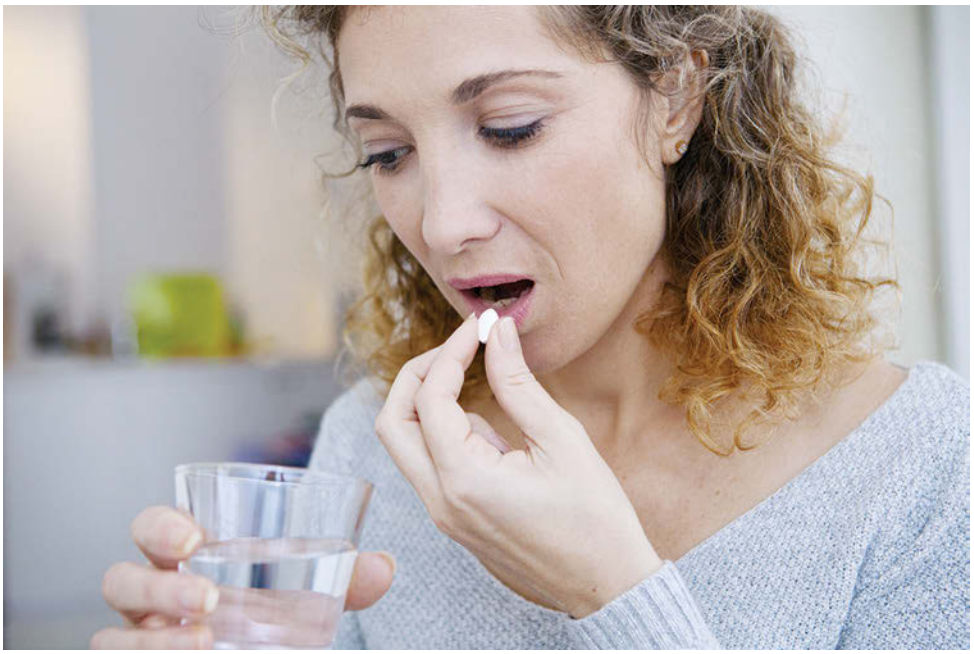
PETRINA:

Petrina is mentally healthy so she should be placed towards the left of the continuum. She has been challenged by a major stressor (a divorce), however, she has demonstrated a high level of resilience and is using a wide variety of effective coping strategies. She is well connected with others and is continuing to function well in the presence of this stressor e.g. she is continuing to go to work each day and be productive and her sleeping and eating patterns have not changed.

ACTIVITY 11.2

Distinguishing between internal and external factors that can influence mental health

Our mental health is influenced by a wide variety of internal and external factors throughout our lifespan. Indicate whether each factor listed on the next page is an internal or external factor by placing a tick in the appropriate column on the right.



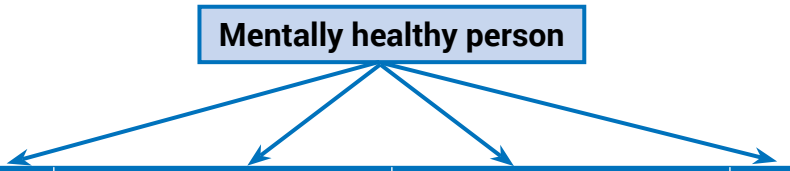
ACTIVITY 11.2 *continued*

Factor	Internal	External
1 genetic predisposition	✔	
2 amount of social support available from family and friends		✔
3 level of self-efficacy (i.e. belief in own abilities to succeed)	✔	
4 reasoning and memory abilities	✔	
5 level of education		✔
6 level of income		✔
7 personality traits	✔	
8 access to health care		✔
9 sex	✔	
10 hormones	✔	
11 exposure to stressors		✔
12 response to medication	✔	
13 environmental/physical conditions		✔
14 exposure to violence		✔
15 immune system functioning	✔	
16 coping style and skills	✔	
17 adequacy of sleep	✔	
18 exposure to social stigma		✔
19 response to stressors	✔	
20 rumination (i.e. repeatedly dwelling on negative thoughts)	✔	
21 substance use	✔	
22 quality of interpersonal relationships		✔
23 employment history		✔
24 brain and nervous system functioning	✔	
25 school results		✔

ACTIVITY 11.3

Summarising characteristics of a mentally healthy person

List a minimum of three dot points under each category in the table.



How do they *function*?	What are they like *socially*?	What are they like *emotionally*?	How do they respond to *life stressors*?
A mentally healthy person typically has a *high level of functioning*. This means that they tend to: Examples: • be able to independently perform and operate at a high level in their environment. • effectively carry out usual everyday tasks well. • demonstrate behaviour considered to be *adaptive* — they are able to meet and 'adapt' to the demands and challenges of daily living e.g. they are able to go to work, look after their physical and	A mentally healthy person typically has a *high level of social wellbeing*. This means that they tend to: Examples: • have satisfying relationships and interactions with others. • establish and maintain positive relationships with others. • interact with people in socially appropriate ways. • have good communication skills. • give and receive social support. • respect and understand other individuals.	A mentally healthy person typically has a *high level of emotional wellbeing*. This means that they tend to: Examples: • have awareness and understanding of their own emotions. • regulate their emotions and exercise control when necessary. • express a range of emotions in a suitable manner. • identify emotions in others and empathise. • manage their stress reactions and use coping skills. • have a positive attitude about emotion, their	A mentally healthy person typically has a *high level of resilience* in response to life stressors. This means that they tend to: Examples: • be able to cope with and adapt well to life stressors. • 'bounce back' by either adjusting to or overcoming life stressors. • have high self-efficacy (i.e. self-belief in capabilities). • have high self-esteem. • approach life stressors with a sense of optimism, opportunity and hope.

How do they *function*?	What are they like *socially*?	What are they like *emotionally*?	How do they respond to *life stressors*?
mental health, take care of household responsibilities, maintain a social life, etc.	• competently resolve conflicts.	experience and expression.	• be adaptable and flexible. • have good problem-solving skills. • have good organisational skills. • recognise if they need to ask others for help when faced with life stressors.

ACTIVITY 11.4

Ethical implications in mental health study and research

Select terms from the shaded panel below to correctly complete the passage about ethical implications in the study of, and research into, mental health. A term should be used only once but not all terms need to be used.

belief	benefits	competence	control group	cost
decision	disorder	effectiveness	Ethical	excellent
expectation	experimental group	explain	improving	fake
information	informed	medication	participant	placebo effect
real	research	risks	statistics	understand
voluntary	vulnerable	worsening	weak	courage

ACTIVITY 11.4 *continued*

The *National Statement on* Ethical *Conduct in Human Research 2007* has a specific section that outlines considerations that must be followed when conducting research with people who have a mental disorder. Two issues that pose particular ethical challenges for researchers studying and conducting research with vulnerable participants who have a mental disorder are informed consent and use of placebo treatments.

A core component of ethical research is informed consent — the process by which a researcher discloses appropriate information to a potential research participant so that the person may make a voluntary and informed choice about whether or not to participate.

Potential participants must be able to understand the proposed research, the nature of their involvement and the associated risks. A participant in mental health research should have the competence to give informed consent. This means that they should have the ability to understand the information relevant to making an informed decision to participate.

Placebo treatments are commonly used in research studies to determine the effectiveness of a new or improved medication or other treatment. The placebo is the substance or treatment that appears real and resembles the actual substance or treatment, but is actually fake. Exposure to a placebo can result in a placebo effect, which is triggered by the person's belief in the treatment and their expectation of relief or feeling better, rather than the specific form the placebo takes.

Some psychologists hold ethical concerns about the use of placebo treatments when testing medications with people who have a mental disorder. For example, in some clinical trials, the placebo control group participants are intentionally denied their usual 'real' treatment for the duration of the study. If they are not permitted to take their prescribed medication, there is the possibility of their symptoms reappearing or worsening.

ACTIVITY 11.5

Evaluation of a mental health research study

A research team conducted a study to investigate predictors of relapse by patients with schizophrenia. Relapse was operationally defined as a 'return to a state of active and severe psychotic symptoms'. The researchers believed that their study could further understanding of schizophrenia and its treatment, especially through the results of the 'drug withdrawal' stage of their study. That information could help establish when and if recent-onset patients could do without medication, and thereby escape unpleasant side effects such as tardive dyskinesia which has symptoms involving involuntary movements that may include facial grimaces, tics, trembling hands and tongue thrusts.

108 participants were recruited to the study. All had been diagnosed with schizophrenia within the past two years and were patients in the psychiatric unit of a major hospital. All would spend time off their prescribed medication and signed an informed consent form which included the following statements:

- I understand that my condition may improve, worsen or remain unchanged.
- I understand that I may benefit from the study by being taken off my medication in a careful way while under close medical supervision.
- If I do show a significant return of symptoms, I understand that clinic staff will use active medication again to improve my condition.

The consent form did not include information about how long participants would be left un-medicated. Nor did the document include other specific details such as what a 'significant return of symptoms' actually meant, that there was an extremely high chance their condition would worsen when taken off their medication, that they could suffer worsening symptoms with each relapse, and that there was a chance that they may never return to their former level of functioning.

The incentive for participation was free treatment at a prestigious medical centre specialising in outpatient care for people with schizophrenia.

The study had three stages. Stage 1 required all participants to take an antipsychotic medication called Prolixin while the researchers tracked their symptoms and tested for factors associated with relapse. Stage 2 involved a procedure described by the researchers as a 'double blind drug crossover and removal'. Participants were randomly allocated to either of two groups. Group 1 were required to take Prolaxin for 12 weeks, then a placebo for 12 weeks. Group 2 were required to take a placebo for 12 weeks, then Prolaxin for 12 weeks. The symptoms of all participants were assessed at the end of Stage 2 by research assistants who were unaware of the condition to which participants had been exposed. The assessments were used to select participants for Stage 3.

Stage 3 involved no medication at all for up to 18 months. However, only 40 participants assessed at the end of Stage 2 as 'clinically appropriate participants and in a relatively stable condition' were included in Stage 3. The assessments also identified 14 participants who had experienced severe relapses. All of these participants were provided with the required treatment while the research continued.

The results at the end of Stage 3 showed that nearly 80% of the participants became worse, suffering psychotic symptoms including hallucinations and severe paranoia. Several experienced very serious relapses. All were prescribed the required medications and monitored for 9 months after the study ended. Three did not return to their pre-study level of functioning and one took his own life.

Source: Adapted from Nuechterlein, K. H. et al. (1992). Developmental processes in schizophrenic disorders: Longitudinal studies of vulnerability and stress. *Schizophrenia Bulletin, 18*(3), 387–425.

Questions

1 The research had a 'double blind drug crossover and removal' stage. What does the term double blind mean in this context? Why was this procedure used?

- double blind: neither the researchers nor the participants knew which participants were taking the real medication (Prolixin) or the placebo at any given time
- why used: to control for potential experimenter effects and for participant expectations

2 What was the purpose of Stage 1?

Collect baseline data for comparison purposes following exposure to experimental treatments.

3 **(a)** In which stage was a repeated measures procedure used?

Stage 2

(b) Explain why it was used in this particular study.

Explanation should demonstrate understanding of counterbalancing with reference to control of potential order effects associated with drug use.

4 Consider the ethical implications of this mental health study.

(a) Under what circumstances can people with schizophrenia give their consent to voluntarily participate in research of this type? Explain your answer.

People with schizophrenia may give their consent to participate in research of this type if (1) consent is based on informed choice and, (2) their competence to do so has been considered e.g. given their symptoms are episodic/irregular, consent must be obtained when their symptoms (including impaired reasoning and decision making skills) do not interfere with their capacity to give informed consent.

(b) Explain whether beneficence was considered when planning the research.

- The ethical value of beneficence was considered when planning the research.
- Explanation should refer to the researchers' beliefs about the potential benefits of the study (e.g. furthering understanding of schizophrenia and its treatment) in relation to potential risks (which were presumably assessed and found to be acceptable and outweighed by the benefits).

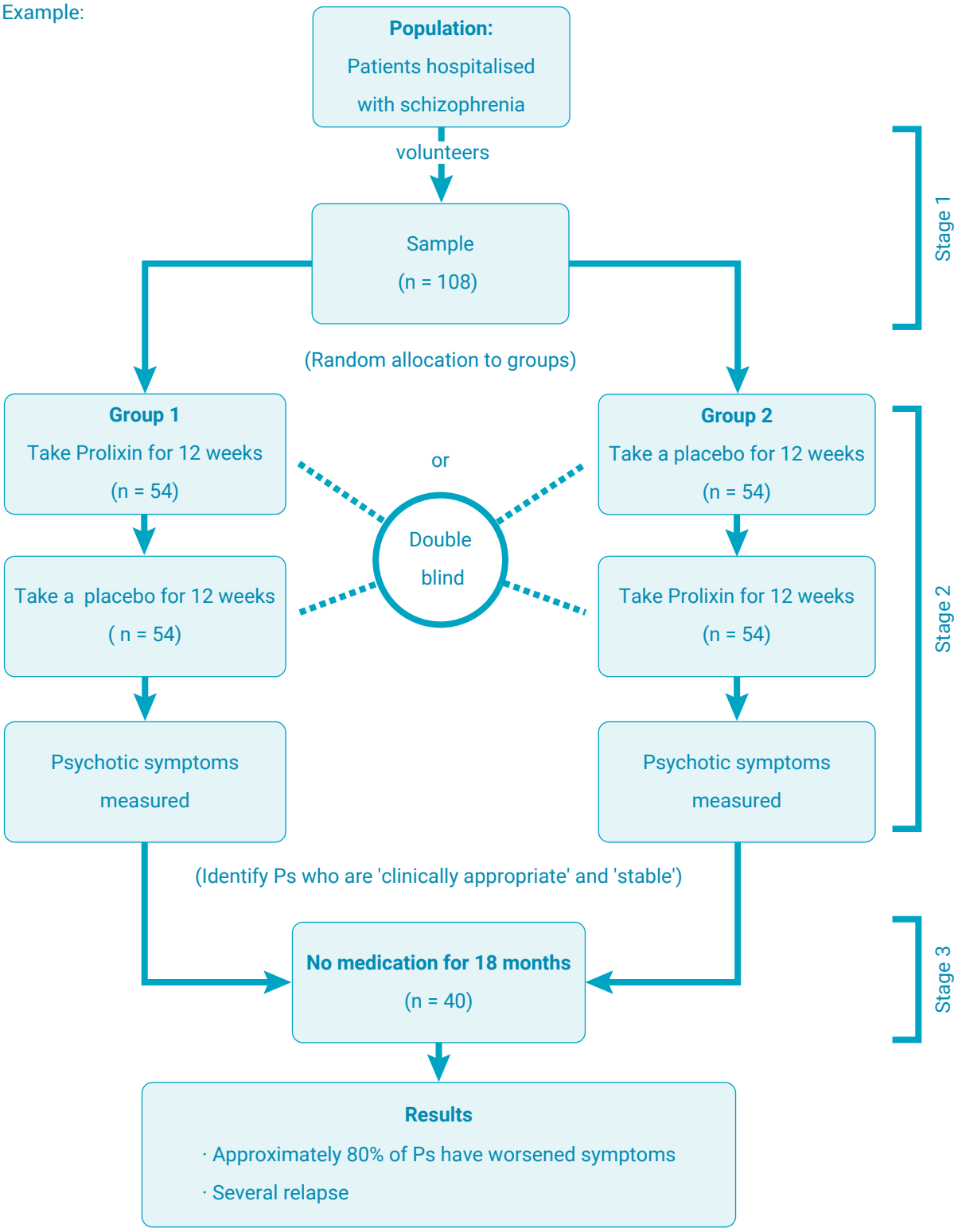
(c) Explain two ethical concerns of relevance to this particular study.

Ethical concerns may include:

- informed consent e.g. the researchers did not adequately inform the participants about the true aim of the research (i.e. to assess what happened when they suffered a relapse) nor the possible serious (permanent) risks to their mental and physical health if they participated in the study
- unacceptable risks e.g. no medication during the placebo treatment, no medication for a prolonged period and therefor prolonged exposure to relapse during Stage 3 — it was actually *expected* that many of the participants would suffer severe psychotic relapses (which has a significant impact on a person's mental and physical health and functioning, even potentially life-threatening)
- deception e.g. possibly unjustifiable as the researchers did not fully inform the participants about the true aim of the research and risk details
- voluntary participation e.g. a potential concern as the researchers offered all participants free treatment at a prestigious medical centre, therefore participants with a low socio-economic status/disadvantaged background may have agreed to volunteer for the study only because of the opportunity to receive the free treatment — they may have had no other choice if they wished to maintain treatment for their debilitating mental health condition.

5 Prepare a flow chart summary of the research design.

Example:



ACTIVITY 11.6

Matching exercise on mental health

Match each description with the most appropriate term on the right. Write the letter of the term you select to the left of each description. Each term can be used only once.

(l)	**1** The ability to cope with and adapt well to life stressors and regain positive functioning.	**(a)** social wellbeing
(j)	**2** The ability to control emotions and express them appropriately and comfortably.	**(b)** functioning
(i)	**3** Influences on mental health that originate within a person.	**(c)** informed consent
(n)	**4** A treatment that appears real and resembles the actual treatment but actually has no effect.	**(d)** external factors
(h)	**5** Our sense of how we feel about ourselves and our lives.	**(e)** mental health problem
(d)	**6** Influences on mental health that originate outside a person.	**(f)** mentally healthy
(a)	**7** The ability to have satisfying relationships and interactions with others.	**(g)** ethics
(o)	**8** An explanation of mental health in terms of the interaction of biological, psychological and social factors.	**(h)** wellbeing
(c)	**9** A voluntary agreement to participate in research based on sufficient information and adequate understanding of the associated risks.	**(i)** internal factors
(b)	**10** How well an individual independently performs or operates in their environment.	**(j)** emotional wellbeing
(m)	**11** A condition that causes disturbed thoughts, feelings and behaviour, personal distress, and impairs the ability to function effectively in everyday life.	**(k)** placebo effect
(f)	**12** A positive and productive state of wellbeing.	**(l)** resilience
(e)	**13** A condition that adversely affects the way a person thinks, feel and behaves but that typically resolves in time.	**(m)** mental disorder
(k)	**14** A change in a participant's behaviour or responses due to the belief they received some kind of treatment and they responded in accordance with that belief.	**(n)** placebo treatment
(g)	**15** Standards that guide individuals to identify good, desirable or acceptable conduct.	**(o)** biopsychosocial model

ACTIVITY 11.7

Crossword on concepts and terms in mental health

Across

1 Term used to describe the behaviour of someone with a high level of functioning.
5 A term used to describe our sense of 'wellness'.
6 Mental health is often represented this way.
9 A mental health condition involving thoughts, feelings and behaviour that typically cause personal distress and impact on daily functioning.
11 A capability that a potential participant in mental health research should have in order to provide informed consent.
14 A person is described this way if they are able to make the most of their potential, work productively and cope with the challenges of everyday life.
16 This model describes and explains how factors from three domains combine and interact to influence a person's mental health.
17 A typical characteristic of a mentally healthy person.
18 When permission to participate in research is based on appropriate information.

Down

2 An influence on mental health sourced outside a person.
3 Term used to describe how well an individual independently performs or operates in their environment.
4 A short-lasting and temporary disturbance to mental health from which recovery is likely to occur when the cause passes.
7 A type of wellbeing based on the ability to control feelings and express them appropriately and comfortably.
8 A change in behaviour due to a belief that some kind of treatment has been received.
10 An influence on mental health sourced within a person.
12 An inactive substance or fake treatment which has no known effect.
13 Research guidelines that help ensure participants are not harmed.
15 A type of wellbeing based on the ability to have satisfying relationships and interactions with others.

1 A D A P T I V E
2 E X T I N C T I O N
3 F U N D A M E N T A L
4 M E N T A L H E A L T H
5 W E L L B E I N G
6 C O N S O N A N C E
7 E M O T I O N
8 P L A C E B O
9 M E N T A L I L L N E S S
10 I N T E R N A L
11 C O M P E T E N C E
12 P L A C E B O
13 E N T H U S I A S M
14 M E N T A L I T Y
15 S O C I A L
16 B I O P S Y C H O S O C I A L
17 R E S I L I E N C E
18 I N F O R M E D C O N S E N T

ACTIVITY 11.8

True/False quiz on mental health

Indicate whether each item is true or false by writing T or F in the column on the right.

Statement	T or F
1 Mental health problems are rare.	F
2 Physical health can affect mental health and mental health can affect physical health.	T
3 Personality weakness or character flaws are the most common cause of mental health problems and disorders.	F
4 The behaviour of someone with a 'high level of functioning' is likely to be maladaptive.	F
5 The main difference between having a mental health problem and having a mental disorder is the number of symptoms experienced.	F
6 The placebo effect is triggered by the participant's belief in the treatment they receive rather than the real properties of the placebo.	T
7 External factors are influences on mental health that originate outside a person.	T
8 According to the National Statement on Ethical Conduct in Human Research 2007, use of a placebo treatment is ethically acceptable when all relevant ethical requirements have been addressed.	T
9 Internal factors are influences on mental health that originate inside or within a person.	T
10 In a typical mental health experiment testing a medication, the experimental group receives the placebo treatment and the control group receives the drug treatment.	F
11 One of the characteristics of a high level of social wellbeing is the ability to competently resolve conflicts with others.	T
12 Mental health can be represented on a continuum with 'mentally healthy' at one end and 'mental disorder' at the other.	T
13 Internal influences on mental health can be social in nature.	F
14 It is possible to include a person in mental health research without their consent.	T
15 A person's response to medication is an example of an internal influence on mental health.	T
16 It is not necessary for a researcher to inform an ethics committee about how they will determine the capacity of a person with a mental disorder to give informed consent.	F
17 The terms mental illness and mental disorder may be used interchangeably.	T
18 Children do not experience mental health problems or disorders.	F
19 If a person's mental disorder is episodic or temporary, the researcher should attempt to obtain informed consent at a time when the potential participant's symptoms do not interfere with their capacity to provide it.	T
20 It is not possible to learn how to become more resilient.	F
21 The symptoms of a mental disorder will usually resolve with time or when the source of the problem changes or passes.	F
22 The location of an individual's mental health condition on a mental health continuum may vary and fluctuate over time depending on circumstances.	T

ACTIVITY 11.8 *continued*

Statement	T or F
23 Having a mental disorder does not necessarily mean an individual is incapable of giving informed consent.	T
24 In the event that a potential research participant is unable to give informed consent, then their legal guardian is not permitted to give informed consent on their behalf.	F
25 It is impossible to prevent the development of most mental disorders so preventive strategies are basically a waste of time.	F

CHAPTER 12

Mental disorder

	Activities							
Key knowledge	12.1	12.2	12.3	12.4	12.5	12.6	12.7	12.8
• the distinction between predisposing risk factors (increase susceptibility), precipitating risk factors (increase susceptibility and contribute to occurrence), perpetuating risk factors (inhibit recovery) and protective factors (prevent occurrence or re-occurrence)	✔					✔	✔	✔
• the influence of biological risk factors including genetic vulnerability to specific disorders, poor response to medication due to genetic factors, poor sleep and substance use		✔				✔	✔	✔
• the influence of psychological risk factors including rumination, impaired reasoning and memory, stress and poor self-efficacy			✔			✔	✔	✔
• the influence of social risk factors including disorganised attachment, loss of a significant relationship and the role of stigma as a barrier to accessing treatment				✔		✔	✔	✔
• the concept of cumulative risk.					✔	✔	✔	✔
Key science skills					✔	✔	✔	✔

Source: VCE Psychology Study Design extracts © VCAA; reproduced by permission.

ACTIVITY 12.1

Distinguishing between mental health risk and protective factors

The 4P factor model describes 4 influences on mental health and occurrence or re-occurrence of a mental health disorder.

1 Define each of the types of influences.

Predisposing	Increases susceptibility to a specific mental disorder.
Precipitating	Increases susceptibility to and contributes to the occurrence of a specific mental disorder.
Perpetuating	Maintains or prolongs the occurrence of a specific mental disorder and inhibits recovery.
Protective	Helps prevent the occurrence or re-occurrence of a mental disorder.

2 Categorise each of the examples in the shaded panel below as either predisposing, precipitating, perpetuating or protective by writing them in the correct column of Table 1 on the next page.

adequate diet	adequate sleep	cognitive behaviour strategies
disorganised attachment	genetic vulnerability	impaired reasoning and memory
loss of a significant relationship	poor response to medication due to genetic factors	poor self-efficacy
poor sleep	rumination	stigma as a barrier to accessing treatment
stress	substance use/misuse	support from family, friends and the community

Table 1

Predisposing risk factors	Precipitating risk factors
• disorganised attachment	• loss of a significant relationship
• poor self-efficacy	• poor sleep
• genetic vulnerability	• stress
	• substance use/misuse
Perpetuating risk factors	**Protective factors**
• impaired reasoning and memory	• adequate diet
• poor response to medication due to genetic factors	• adequate sleep
• rumination	• cognitive behaviour strategies
• stigma (as a barrier to accessing treatment)	• support from family, friends and the community

3 Categorise each of the examples in the green panel as biological, psychological or social by writing them in the correct column of Table 2.

Table 2

Biological	Psychological	Social
• adequate diet	• cognitive behaviour strategies	• disorganised attachment
• adequate sleep	• impaired reasoning and memory	• loss of a significant relationship
• genetic vulnerability	• poor self-efficacy	• stigma
• poor response to medication due to genetic factors	• rumination	• support from family, friends and community
• poor sleep	• stress	
• substance use/misuse		

ACTIVITY 12.2

Applying understanding of biological risk factors

Read the three scenarios and answer the question that follows each.

Scenario 1 A query posted on a website for people who are adopted

Dear Reconnect,

I have been suffering from depression off and on since I was about 20 years old. To the point that I have been hospitalised twice.

My adoptive parents always told me my birth parents loved me but could not look after me due to their mental illness, so they gave me up for adoption so I could have a better life.

I recently saw a TV ad for Ancestry DNA kits. It got me thinking whether I should try to find my birth mother because the 'Medical and Health Family History' section of my adoption papers was left blank. I'm wondering if my depression is just all my fault and caused by my weak personality?

Thanks from C.H.

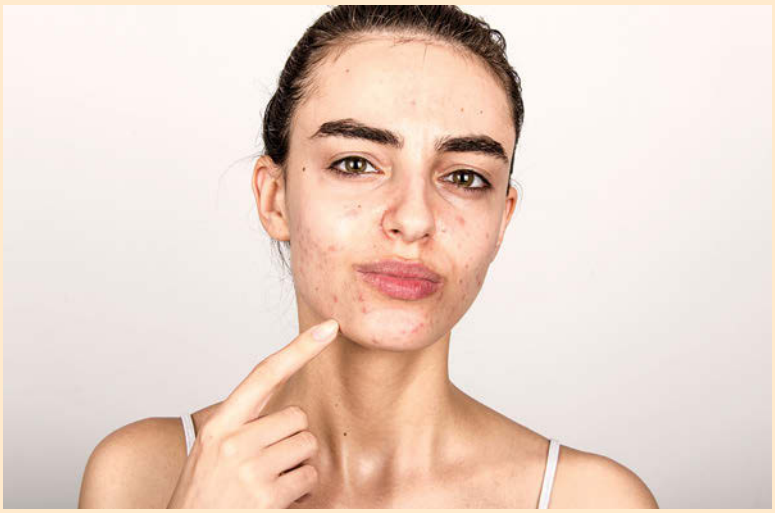
Write a brief reply to C.H's question, with reference to genetic vulnerability as a biological risk factor for developing a mental disorder.

The reply should demonstrate understanding that:

- a genetic vulnerability to a mental disorder means having a risk for developing a specific mental disorder due to one or more factors associated with genetic inheritance
- having a genetic vulnerability places a person at a higher risk than that of the general population, but it does not mean that they will definitely develop the disorder
- the degree of risk depends on the degree of biological relationship
- non-genetically determined influences (i.e. environmental factors) may also contribute to the development or onset of a mental disorder
- in C.H's case, if it is found that there is a family history of depression, then her depression may be at least partly explained by genetic inheritance over which C.H. has no control rather than being entirely due to ('caused by') personality factors.

Scenario 2 Medical advice from a celebrity

A celebrity 'influencer' posted a photo of herself on social media with a bottle of prescription medication for acne. In the post she wrote, 'Remember how bad my skin was? I talked to my doctor and she prescribed me Acoff. My spots have gone and my confidence has returned! If you have problem skin, ask your doctor about Acoff.'



Will all people with acne achieve the same positive outcome as the celebrity if they use her recommended medication? Explain your answer with reference to genetic factors that may influence how people respond to medication.

Explanation should demonstrate understanding that:

- different people can respond in different ways to the same medication
- many factors contribute to these differences in how people respond to the same medication, including age, other medications they may be taking, ethnicity, diet, body weight, etc.
- a significant biological factor involves genetics i.e. some genes are responsible for how our body absorbs, distributes, metabolises and eliminates medications. This means that due to genetic factors, people may need different doses of a particular medication to achieve the same effect, some people may experience side-effects that another may not, or some medications just might not be as effective (if at all) for one person as they are for another.

Scenario 3 A case study

William had always seemed a bit strange to his friends and family. But he liked being different, so he didn't mind being thought of as 'a bit of weirdo'. William's parents and only sister died in a horrific road accident when he was 17, leaving him alone as all other relatives lived interstate.

William left school soon after the accident and found work as a waiter, but it was hard trying to support himself because he had trouble keeping a steady job. After a while the bills started to pile up. The stress was often overwhelming. William started hearing voices telling him that 'things were hopeless' and that he was 'a bad person'. He was also beginning to suspect that he was under surveillance by the Australian Federal Police because they had gotten a tip that he was keeping a dog in his room without telling the landlord. Furthermore, he believed that they were behind him getting fired from his last two jobs.

William was chronically 'on edge' and felt very stressed throughout each day. The voices in his head were loud and constantly there. It was impossible to ignore them. He was getting very little sleep and started drinking excessive amounts of alcohol to 'help with sleep'. When under the influence of alcohol, he also felt less stressed, but each time he passed out, he got some relief from the voices as he couldn't hear them anymore.

Explain how William's substance use (or misuse) and poor sleep may have contributed to the development, onset and/or maintenance of his mental disorder.

Explanation should demonstrate understanding of:

- substance use, i.e. substance use and mental disorder often co-exist and there may be a 'two-way' relationship; William was showing signs of a mental disorder (schizophrenia) first and this seemed to trigger the development of a substance use problem (alcohol misuse); William may have started to misuse alcohol to cope with his distressing mental health symptoms (i.e. hearing voices) and to help relieve stress and poor sleep; however, misusing alcohol is not an appropriate way for William to cope with his mental health symptoms. It will typically worsen symptoms in the long term and could lead to two disorders requiring treatment — schizophrenia and alcohol addiction.
- poor sleep, i.e. chronic/persistent poor sleep (quantity and/or quality) and mental disorder often co-exist and there may be a two-way relationship; William's persistent poor sleep may adversely affect his physical and mental health, contributing to development of a mental health disorder, and also exacerbate the experience of his existing disorder; William's drinking is also affecting his sleep. Excessive alcohol can help people fall asleep faster but it disrupts normal sleep patterns and can lead to sleep problems that worsen waking time experience.

ACTIVITY 12.3

Summarising psychological risk factors

Cross out the incorrect term in the bracketed pairs to correctly summarise the passage about psychological risk factors that may contribute to the development of a mental disorder.

Psychological risk factors for mental disorders either originate or develop within the **(~~body~~/ mind)**, which means there is often the potential to exert some control over their occurrence or influence.

Rumination involves repeatedly thinking about or dwelling on **(~~desirable~~/ undesirable)** thoughts and emotions without acting to change them. It can be described as a kind of **(negative /~~positive~~)** thinking. When we ruminate, we **(continuously/~~occasionally~~)** think about aspects of **(~~positive~~/ negative)** situations such as their potential **(causes/ ~~benefits~~)**, but do nothing to change anything. Rumination is a risk factor for developing a mental disorder because it **(impedes /~~assists~~)** a person's **(~~creative~~/ problem-solving)** abilities. In addition, researchers have found that rumination is a significant risk factor for the development of **(depression /~~anxiety~~)** in particular.

Impaired reasoning and memory are two of the many **(~~emotional/~~ cognitive)** problems that can contribute to the development and progression of mental disorders. Impaired reasoning involves difficulties with goal-directed **(~~emotions~~/ thinking)**, particularly when drawing conclusions from known **(~~people~~/ information)**. Impaired memory associated with most disorders primarily involves difficulties with **(~~implicit~~/explicit)** memories. For example, an impairment with **(episodic/~~semantic~~)** memory would affect the ability to recall personal histories with reference to events, times, places and even the emotions felt during events, which can contribute to an individual's **(personal/~~social~~)** distress.

Stress has long been recognised as a risk factor for the development and progression for a wide range of mental disorders. According to the stress-**(~~propensity~~/ vulnerability)** model, all people have some level of predisposition for any given mental disorder and the risk of developing the disorder varies in relation to the combined effect of an individual's level of predisposition, their level of **(~~intelligence~~/ stress)** and their **(~~reasoning~~/ coping)** abilities.

ACTIVITY 12.3 *continued*

Self-efficacy refers to an individual's **(~~acceptance~~/ belief)** about their capacity to execute behaviours necessary to succeed in a specific situation or accomplish a specific task. It can be described as a state of **(~~emotion~~/ mind)** about our **(~~appearance~~/ competence)** that affects how we approach or react to challenges that arise in everyday life. Self-efficacy **(~~is~~/ is not)** considered to be the same as self-esteem. Having **(poor /~~good~~)** self-efficacy makes us more vulnerable to mental disorder and therefore **(~~decreases~~/ increases)** the chance of developing a mental disorder and its persistence.

ACTIVITY 12.4

Summarising social risk factors

Social risk factors for mental disorders originate or develop in the external environment and interact with biological and psychological factors in influencing our mental health.

State whether each of the following social risk factors is a predisposing, precipitating, or perpetuating risk factor, briefly describe each specific factor, then explain *how* each of the specific factors can influence the development and progression of mental disorders.

Disorganised attachment

Type of risk factor: predisposing

Definition/description: a type of child-caregiver attachment characterised by inconsistent or contradictory behaviour by the child in the presence of the caregiver

Explanation of influence:

- Early attachment experiences form an important foundation for our later social and emotional development and our mental health.

Loss of a significant relationship

Type of risk factor: precipitating

Definition/description: loss of a relationship considered important

Explanation of influence:

- Loss of a significant relationship can have serious or devastating consequences for the person experiencing that loss.

Stigma

Type of risk factor: perpetuating

Definition/description: a sign of shame, disgrace or disapproval associated with a particular characteristic that sets a person apart

Explanation of influence:

- Stereotyping, prejudice and discrimination associated with stigma may exacerbate distress and symptoms, and be a barrier to seeking treatment.

Explanation of influence:

- Disorganised attachment increases the risk of behaviour problems in children and predisposes a person to developing mental disorders later in life.
- A person's attachment style often stays with them into adulthood.
- Having a disorganised attachment does not necessarily mean a person will definitely develop a mental disorder, but it can present challenges to a person's mental health e.g. low self-esteem, difficulties developing trusting relationships, difficulties controlling emotions and impulses can significantly influence the development and progression of a mental disorder.

Explanation of influence:

- Loss by a vulnerable person in particular may precipitate depression or a substance use disorder in the same way as another major stressor.
- It may also influence relapse or perpetuation of symptoms.
- How loss of a significant relationship can influence the development and progression of mental disorders can vary from person to person.

Explanation of influence:

- Not accessing an evidence-based treatment for a mental disorder due to stigma only serves to maintain or prolong (perpetuate) the person's symptoms. If left untreated, there is also a significant chance the person's mental health will actually deteriorate and worsen.

ACTIVITY 12.5

Evaluation of research on risk factors for mental health in adolescence

A researcher investigated the effect of exposure to risk factors early in life on mental health in adolescence. The participants were 1106 middle school students with a mean age of 15.6 years who were born and residing in Reykjavik, the capital of Iceland, in the year 2000. All were randomly selected from the city council's population data base.

The researchers assessed the mental health status of each student using the World Health Organization's Adolescent Mental Health Status questionnaire, which yields scores ranging from 0–100. Generally, the higher the score, the better is mental health, and vice versa. Scores in the range of 60–100 indicate good mental health and scores less than 60 are associated with a recommendation for intervention by a mental health professional.

The researchers also used data that had been collected by the Reykjavik council from each student's mother during their pregnancy. This data was derived from lifestyle questionnaires completed for community planning purposes and was used by the researchers to identify the 10 risk factors listed below. Each risk factor was assessed as either present (1) or absent (0).

- *smoking status:* 1 = yes, smoker; 0 = no
- *age:* 1 = < 19 years; 0 = > 19 years
- *number of other children in the household:* 1 = > 3; 0 = < 3
- *income:* 1 = low; 0 = income > high
- *marital status:* 1 = married; 0 = not married
- *disability status:* 1 = either parent registered as disabled; 0 = neither parent registered as disabled
- *alcohol consumption:* 1 = > 5 glasses per week; 0 = < 5
- *anxiety*: 1 = self-report rating between 6–10 on a 10-point scale; 0 = self-report rating of 0–5
- *sleep quality:* 1 = self-report rating between 0–3 on a 10-point scale; 0 = self-report rating of 4–10
- *life satisfaction:* 1 = self-report rating between 0–3; 0 = self-report rating of 4–10.

The results of this analysis of risk factors are shown in the following table.

	Number of maternal risk factors										
	0	1	2	3	4	5	6	7	8	9	10
Number of children exposed	32	41	94	232	380	160	68	45	42	12	0
Mental health score ($\bar{x}$)	91	89	88	85	82	78	76	70	68	66	-

Questions

1 Identify the research method.

cross-sectional study

2 Identify the type of data used by the researchers.

primary, quantitative data

3 Formulate a research hypothesis for this study.

Example: The higher the number of risk factors to which children are exposed in early life, the poorer their mental health status in adolescence.

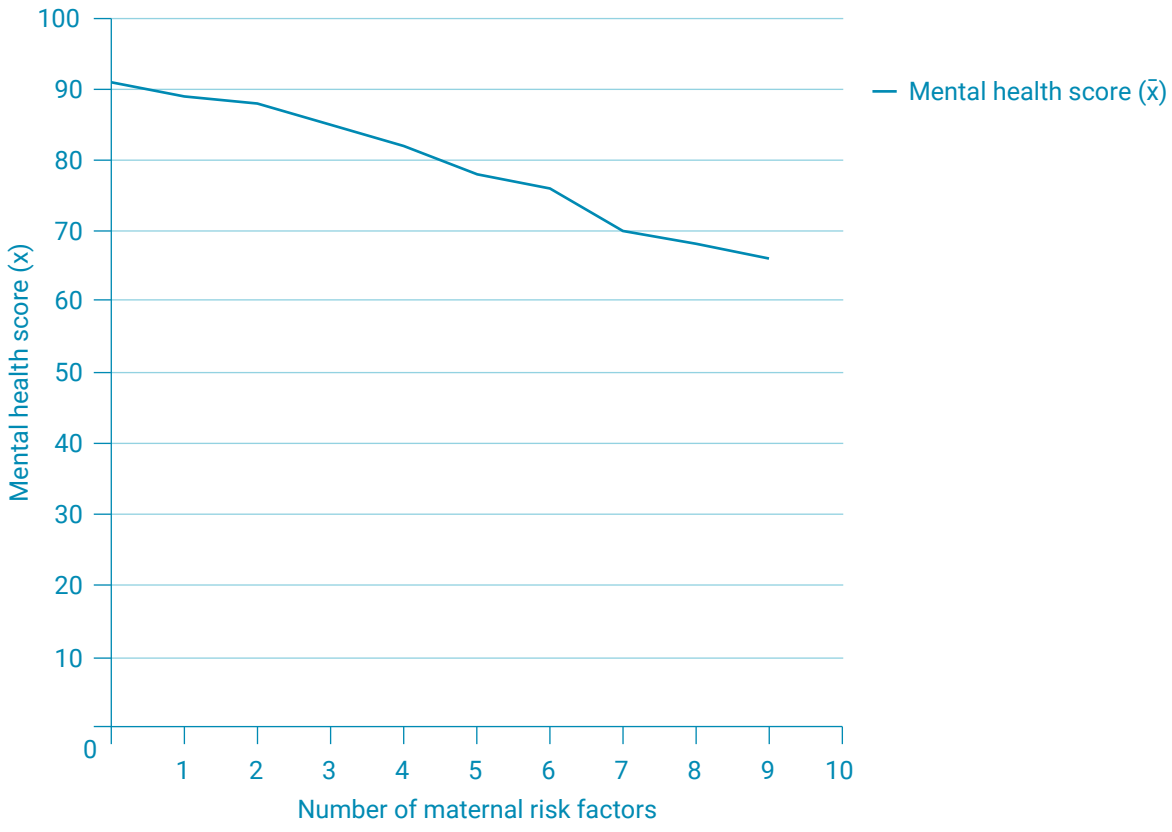
4 Identify the operationalised independent and dependent variables.

independent variable: number of risk factors

dependent variable: score on the WHO Adolescent Mental Health Status questionnaire

5 Construct a graph to show the relevant results.

Example:



6 What conclusion can be drawn from the results? In your response, refer to the number of maternal risk factors and mental health status of adolescents.

The results show a relationship between the number of risk factors to which children are exposed early in life and their mental health status in adolescence. The more risk factors a child is exposed to, the lower their mental health score in adolescence.

7 Does this study support an additive or threshold model of cumulative risk? Explain your answer.

- additive model
- Explanation: The results show a linear relationship between the number of risk factors and mental health status. The more risk factors a child is exposed to, the lower their mental health score in adolescence, with the addition of each risk factor contributing to further decline in mental health status.

8 Explain three possible limitations of this study.

Possible limitations may include

- The cross-sectional study cannot establish a cause–effect relationship between number of risk factors and mental health.
- Risk factors are limited to the data available from the council rather than guided by evidence-based psychological research; some may not be relevant to mental health, either in isolation or as part of a cumulative effect; some exclude potential paternal (father) influences.
- The mental health questionnaire may have been culturally biased e.g. possibly dependent on English language skills, may not adequately allow for thoughts, feelings and/or behaviours considered culturally appropriate in Iceland.
- Sample bias e.g. the sample is limited to individuals born and residing in a capital city and is therefore not representative of the general population; gender differences not reported so possible gender bias.

9 Explain whether the study is likely to have internal and external validity.

Explanation should demonstrate understanding of the concepts of internal and external validity and that the study probably has low internal validity due to possible limitations relating to risk factors and the mental health questionnaire, and therefore low external validity because internal validity is a precondition of external validity.

ACTIVITY 12.6

Matching exercise on mental disorder

Match each description with the most appropriate term on the right. Write the letter of the term you select to the left of the description. Each term can be used only once.

(g)	**1** The aggregate risk to mental health from the combined effects of exposure to multiple biopsychosocial risk factors.	**(a)** genetic vulnerability
(k)	**2** An individual's belief in their capacity to execute behaviours necessary to succeed in a specific situation or accomplish a specific task.	**(b)** protective factor
(e)	**3** A sign of shame, disgrace or disapproval typically associated with a particular characteristic or attribute that sets the person apart from others.	**(c)** rumination
(f)	**4** Any characteristic or event that increases the likelihood that a mental disorder will develop, or increase in severity when it occurs, or will hinder recovery from a disorder.	**(d)** precipitating factor
(c)	**5** Repeatedly thinking about or dwelling on undesirable thoughts and feelings without acting to change them.	**(e)** stigma
(d)	**6** A 4P Factor that increases susceptibility to and contributes to the occurrence of a specific mental disorder.	**(f)** risk factor
(a)	**7** Having a risk for developing a specific mental disorder due to one or more factors associated with genetic inheritance.	**(g)** cumulative risk
(b)	**8** A 4P Factor that prevents the occurrence or re-occurrence of a mental disorder.	**(h)** perpetuating factor
(h)	**9** A 4P Factor that maintains or prolongs the occurrence of a specific mental disorder and inhibits recovery.	**(j)** predisposing factor
(j)	**10** A 4P Factor that increases susceptibility to a specific mental disorder.	**(k)** self-efficacy

ACTIVITY 12.7

Crossword on concepts and terms in mental disorder

Across

1 A psychological risk factor for developing a mental disorder.
4 Dwelling on negative thoughts and feelings but doing nothing to change them.
5 A normal, natural response to the loss of a significant relationship.
8 An emotional bond that forms between an infant and another person.
9 If an individual has an impairment in this cognitive skill, they have an increased tendency to 'jump to conclusions'.
11 The 4P factor that increases susceptibility to a specific mental disorder.
13 A type of attachment characterised by inconsistent or contradictory behaviour patterns by a child in the presence of a primary caregiver.
15 An individual's belief in their capacity to do whatever is required to succeed in a specific situation or accomplish a specific task.
16 A term used to describe the nature of the relationship between poor sleep and mental disorders.
17 The 4P factor that reduces the likelihood of the occurrence or recurrence of a mental disorder.

Down

2 An impairment in this type of memory affects an individual's ability to recall personal experiences.
3 A sign of shame, disgrace or disapproval typically associated with a particular characteristic or attribute that sets a person apart from others.
6 The 4P factor that increases susceptibility to and contributes to the occurrence of a specific mental disorder.
7 The 4P factor that maintains or prolongs the occurrence of a specific mental disorder and inhibits recovery.
10 This can cause differences in how people absorb and metabolise prescribed medication.
12 A term that describes the use or consumption of legal or illegal drugs or other products.
14 The aggregate risk to mental health from the combined effects of exposure to multiple biopsychosocial risk factors.

1 S T R E S S
2 E P I S O D I C
3 S T I M U L U S
4 R U M I N A T I O N
5 G R I E F
6 P R E C I P I T A T I O N
7 P R E P A R E D
8 A T T A C H M E N T
9 R E A S O N I N G
10 G E N E T I C S
11 P R E D I S P O S I N G
12 S U B S T A N T I A L
13 D I S O R G A N I S E D
14 C U M U L A T I V E
15 S E L F E F F I C A C Y
16 B I D I R E C T I O N A L
17 P R O T E C T I V E

ACTIVITY 12.8

True/False quiz on mental disorder

Indicate whether each item is true or false by writing T or F in the column on the right.

Statement	T or F
1 A protective factor helps prevent the occurrence or re-occurrence of a mental disorder.	T
2 Research evidence shows that a family history of mental disorder does not genetically predispose a person to developing the disorder.	F
3 Disorganised attachment is more likely to occur during infancy when the main caregiver does not provide consistent care and emotional support.	T
4 People with a mental disorder who experience stigma are more likely to seek treatment.	F
5 Loss of a significant relationship may contribute to the perpetuation of a mental disorder but not precipitate its onset.	F
6 The relationship between an individual's poor sleep and their mental disorder is often found to be bi-directional or 'two-way'.	T
7 A predisposing factor increases susceptibility to a specific mental disorder.	T
8 Research evidence shows that genetic variations can cause different people to respond in different ways to the same medication.	T
9 A precipitating factor maintains or prolongs the occurrence of a specific mental disorder and inhibits recovery.	F
10 Rumination is a social risk factor for the development of a mental disorder.	F
11 The concept of cumulative risk suggests that the greater the number of risk factors to which we are exposed, the greater our vulnerability to developing a mental disorder.	T
12 A person with poor self-efficacy is likely to approach a difficult task with strong motivational effort and as a challenge to be mastered.	F
13 Memory impairment is a psychological risk factor for the development of a mental disorder.	T
14 Stress is a predisposing risk factor in the development of a mental disorder.	F
15 The stress-vulnerability model explains why some people may develop a mental disorder when they experience stress and others do not.	T
16 An individual with a mental disorder may accept stigmatising attitudes and beliefs held by others and internalise and apply them to themself.	T
17 Adequate sleep is a biological factor that may be a protective factor for development of a mental disorder.	T
18 Disorganised attachment early in life can impact on emotional and social wellbeing later in life.	T
19 It is not possible to increase a person's level of self-efficacy.	F
20 All substance use predisposes a person to developing a mental disorder.	F

CHAPTER 13

Specific phobia

	Activities											
Key knowledge	**13.1**	**13.2**	**13.3**	**13.4**	**13.5**	**13.6**	**13.7**	**13.8**	**13.9**	**13.10**	**13.11**	**13.12**
• the distinctions between stress, phobia and anxiety; variation for individuals with stress, phobia and anxiety on a mental health continuum	✔									✔	✔	✔
• the relative influences of contributing factors to the development of specifc phobia with reference to: gamma amino butyric acid (GABA) dysfunction, the role of stress response and long-term potentiation (biological); behavioural models involving precipitation by classical conditioning and perpetuation by operant conditioning, cognitive bias including memory bias and catastrophic thinking (psychological); specific environmental triggers and stigma around seeking treatment (social)		✔	✔					✔		✔	✔	✔
• evidence-based interventions and their use for specific phobia with reference to: the use of short-acting anti-anxiety benzodiazepine agents (gamma amino butyric acid [GABA] agonists) in the management of phobic anxiety and relaxation techniques including breathing retraining and exercise (biological); the use of cognitive behavioural therapy (CBT) and systematic desensitisation as psychotherapeutic treatments of phobia (psychological); psychoeducation for families/ supporters with reference to challenging unrealistic or anxious thoughts and not encouraging avoidance behaviours (social).				✔	✔	✔	✔		✔	✔	✔	✔
Key science skills								✔				

ACTIVITY 13.1

Comparing stress, anxiety and phobia

For each of the statements, tick whether it is applicable to stress, anxiety or a phobia. A statement may be given more than one tick.

Statement	stress	anxiety	phobia
1 May involve eustress or distress.	✓		
2 Can be experienced in response to a wide range of stimuli.	✓	✓	✓
3 Accompanied by physiological changes and may involve fight–flight–freeze.	✓	✓	✓
4 Considered 'normal' to experience in certain situations and experienced by everyone at some time.	✓	✓	
5 Characterised by avoidance of certain objects or situations.			✓
6 Can impact on a person's functioning if not managed.	✓	✓	✓
7 A diagnoseable mental disorder.			✓
8 Not considered adaptive or helpful at any time.			✓
9 Source is not always apparent.		✓	
10 Influenced by biological, psychological and social factors.	✓	✓	✓
11 Involves distress only.		✓	✓
12 Mild amounts can be adaptive and helpful.	✓	✓	
13 Source is usually known.	✓		✓
14 Not considered 'normal'.			✓
15 Can develop into a mental disorder if not managed.	✓	✓	

ACTIVITY 13.2

Summarising factors contributing to the development of a specific phobia

Cross out the incorrect term in the bracketed pairs to correctly summarise the passage about factors contributing to the development of a specific phobia.

A specific phobia is a mental health **(~~problem~~/disorder)** characterised by excessive or **(~~reasonable~~/unreasonable)** fear or anxiety about a specific object or situation, often leading to **(~~attention-seeking~~/avoidance)** behaviour. The first symptoms of a specific phobia usually arise in **(childhood/~~adulthood~~)**. The **(~~psychobiological~~/biopsychosocial)** model describes factors from three domains that are individually and collectively viewed as potential **(~~causal~~/contributing)** factors.

Biological factors

Several neurotransmitters have been identified as playing a role in the experience of anxiety and one of these is GABA. Gamma-amino butyric acid (GABA) is the primary **(inhibitory/~~excitatory~~)** neurotransmitter in the **(~~peripheral~~/central)** nervous system. It works throughout the brain to make the **(~~pre~~/post)** synaptic neurons **(less/~~more~~)** likely to be activated. There is evidence that some people experience the anxiety associated with phobias because the neurotransmission of GABA becomes dysfunctional. GABA dysfunction can result in **(low/~~high~~)** levels of GABA in the brain as shown by studies of people with a specific phobia who are more likely to have a significantly **(lower/~~higher~~)** GABA level than control group **(~~experimental~~/placebo)** participants with no specific phobia.

Psychological factors

According to behavioural models, phobias can be learned through experience and may be precipitated through **(classical/~~operant~~)** conditioning. The development of a specific phobia in this way is essentially the process by which a stimulus with no particular significance (i.e. a/an **(~~conditioned~~/unconditioned)** stimulus) becomes, by association, a sign of impending threat, danger or some other unpleasant event (i.e. a/an **(conditioned/~~unconditioned~~)** stimulus). The innate, naturally occurring **(~~conditioned~~/unconditioned)** fear response eventually becomes a **(conditioned/~~unconditioned~~)** fear response. In addition, stimulus **(~~discrimination~~/generalisation)** may be applied to other similar objects or situations.

ACTIVITY 13.2 *continued*

Social factors

Many people diagnosed with a specific phobia report having a direct, **(~~positive~~/negative)** experience with a particular phobic stimulus at some time in the past and attribute this encounter as the cause of their phobia. The term 'specific **(environmental/~~situational~~)** trigger' is used to describe this type of social factor contributing to the development of a phobia. Often, if a phobia is developed in this way, **(~~operant~~/classical)** conditioning processes are thought to have played a role. Research findings indicate that the **(~~less~~/more)** severe the trauma associated with an unpleasant or harmful initial fear experience, the **(~~less~~/more)** likely it is that a phobia could develop in this way.

ACTIVITY 13.3

Psychological factors perpetuating specific phobias

Various psychological factors can perpetuate, or maintain, a specific phobia once developed. These primarily involve negative or other inappropriate thoughts that also influence behaviour.

Suppose for example that you have a specific phobia of heights and are on your way to a job interview in the Melbourne CBD. On arrival at the address, you realise that your interview is on the twelfth floor. What might you start thinking? How might these thoughts affect you physically? What might you do? How might this behaviour affect your thinking?

Using the situation in the example above, complete the cycle of activity as if you have a specific phobia of elevators.

Situation Approaching an elevator

1. Thoughts
'I'm going to suffocate/I'll become trapped'

2. Physiological sensations
Heart races, body trembles, sweating, breathlessness

3. Behaviour
Avoid the elevator and take the stairs

(fear remains unchallenged)

4. Thoughts
'I avoided disaster by taking the stairs/I would not have coped had I taken the elevator' (fear remains)

ACTIVITY 13.4

Matching exercise on biological interventions for a specific phobia

Match each description with the most appropriate term on the right. Write the letter of the term you select to the left of each description. Each term can be used only once.

(f)	**1** A drug that targets GABA receptors in the brain.	**(a)** long-acting
(h)	**2** Breathing faster and deeper than necessary, thereby disturbing the balance of oxygen and carbon dioxide in the blood.	**(b)** antagonist
(e)	**3** A symptom of a low carbon dioxide level in the blood.	**(c)** exercise
(j)	**4** A drug that has a relatively brief period of effectiveness.	**(d)** agonist
(b)	**5** A type of drug that inhibits a neurotransmitter's activity.	**(e)** dizziness
(g)	**6** An intervention that involves teaching someone how to equalise oxygen and carbon dioxide levels in their blood.	**(f)** benzodiazepine
(c)	**7** An intervention that can provide 'time out' from anxiety symptoms.	**(g)** breathing retraining
(a)	**8** A drug that has a relatively long period of effectiveness.	**(h)** hyperventilation
(d)	**9** A type of drug that stimulates a neurotransmitter's activity.	**(i)** addiction
(i)	**10** A potential side-effect of long-term benzodiazepine use.	**(j)** short-acting

ACTIVITY 13.5

Media response/analysis

Consider the following cartoon about a specific phobia and then answer the following questions.

Source: CartoonStock

1 What specific type of intervention does the cartoon suggest the psychologist is using to treat his client's phobia of bugs?

cognitive behavioural therapy (CBT)

2 What would this intervention aim to achieve?

To assist the individual to develop a new understanding that almost all their feared bugs are unlikely to be dangerous so their avoidance and safety behaviours are unnecessary and unhelpful in the long term.

3 How might this be achieved using the intervention?

Generally, CBT would involve the psychologist helping the man to first identify, then challenge his unhelpful thinking patterns (particularly catastrophic thoughts) about his feared object (in this case bugs) and replace them with more realistic and helpful thoughts.

4 By saying what he did, what is the psychologist attempting to do to help his client overcome his phobia?

The psychologist is attempting to *challenge* his client's catastrophic/unrealistic thoughts about the potential harm bugs actually pose to him by pointing out that he is physically much bigger than they are. So therefore, logically, bugs can't possibly harm him and his fear of them is unfounded.

5 Name and describe two evidence-based interventions, other than the intervention described for questions 1 to 3, that the psychologist could use to treat his client's phobia of bugs.

Other evidence-based interventions specified in the study design are:

- systematic desensitisation, breathing retraining, psychoeducation and exercise. The descriptions of how they would be used should be relevant to the client's bug phobia; for example, breathing retraining: Teaching the client how to control his breathing/maintain correct breathing habits if he began to hyperventilate when *anticipating* being exposed to, or *actually* being exposed to, a bug.

ACTIVITY 13.6

Sequencing phobic stimuli in fear hierarchies

A fear (or anxiety) hierarchy is a list of feared objects or situations ranked from least to most anxiety provoking. It is used as part of systematic desensitisation in the treatment of specific phobias. For each of the following sample fear hierarchies, rearrange the items on the left into the correct order on the right from the *least anxiety provoking* (at the bottom) to the *most anxiety provoking* (at the top), as a person with that particular fear would rank them.

Fear of dogs

Standing 3 metres away from a dog on a leash	
Holding a dog	
Looking at dogs in a park from the edge of the park	
Looking at photos of dogs	
Watching a video with dogs in it	
Standing beside, but not touching, a dog on a leash	
Looking at dogs in a park from across the street	
Touching a dog that someone is holding	
Standing 5 metres away from a dog on a leash	

Holding a dog
Touching a dog that someone is holding
Standing beside, but not touching, a dog on a leash
Standing 3 metres away from a dog on a leash
Standing 5 metres away from a dog on a leash
Looking at dogs in a park from the edge of the park
Looking at dogs in a park from across the street
Watching a video with dogs in it
Looking at photos of dogs

Fear of needles

Looking at a picture of a needle	
Having blood drawn from a vein	
Watching someone else get a needle	
Rubbing an alcohol swab against your skin	
Resting a needle against your vein	
Holding a needle	
Slightly pricking your skin with a needle	
Having a needle in your upper arm	
Watching a video of someone getting a needle	
Resting a needle against your skin	

Having blood drawn from a vein
Having a needle in your upper arm
Slightly pricking your skin with a needle
Watching someone else get a needle
Resting a needle against your vein
Resting a needle against your skin
Rubbing an alcohol swab against your skin
Holding a needle
Watching a video of someone getting a needle
Looking at a picture of a needle

Fear of driving

Drive down major road alone in light traffic	Drive into the city alone
Stand on footpath by a busy road and listen to traffic	Drive into busy intersection alone
Drive into the city alone	Drive into busy intersection with partner present
Drive up and down driveway	Drive down major road in heavy traffic
Drive around the block alone	Drive down major road alone in light traffic
Ride as a passenger around a quiet neighbourhood	Drive down major road with partner
Drive into busy intersection alone	Ride as a passenger around a quiet neighbourhood
Drive into busy intersection with partner present	Drive around the block alone
Drive down major road in heavy traffic	Drive up and down driveway
Drive down a major road with partner	Stand on footpath by a busy road and listen to traffic

Fear of baked beans

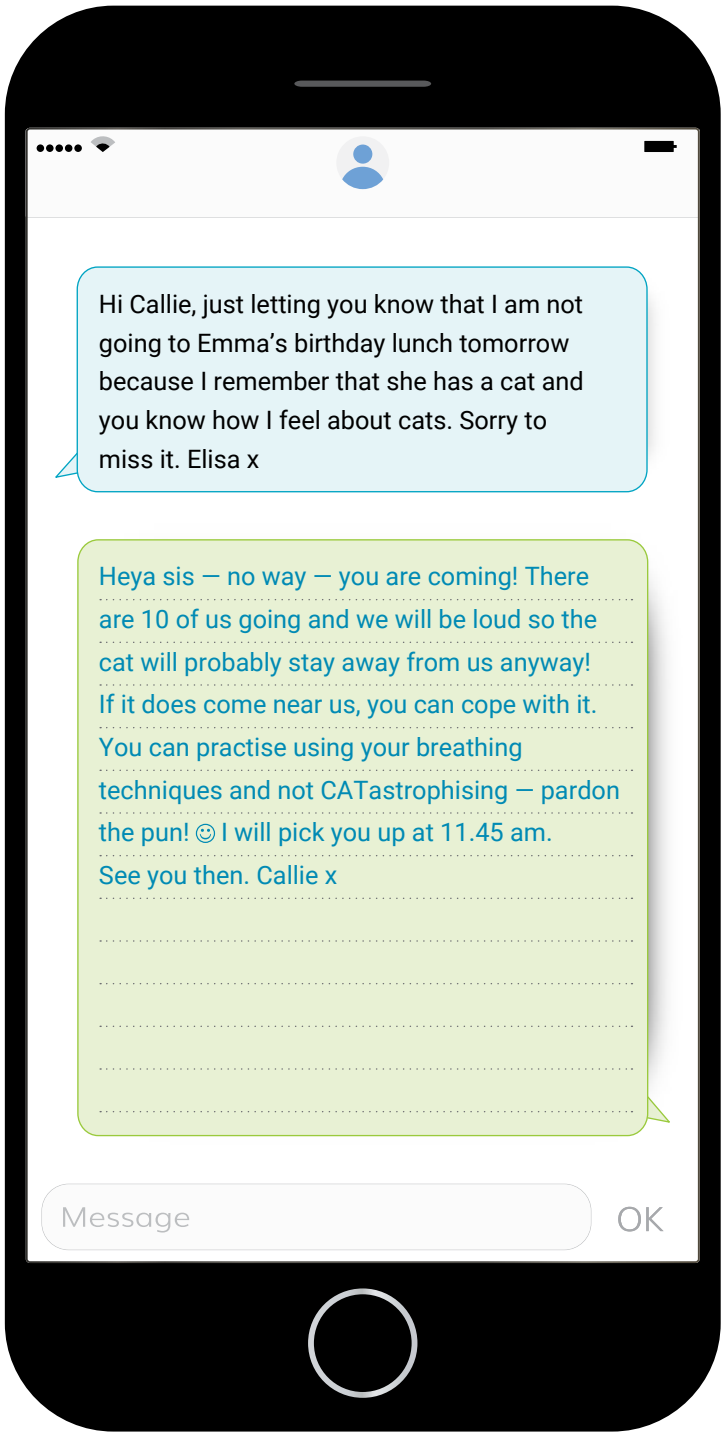
Holding a bowl of baked beans an arm's length away	Eating a spoonful of baked beans
Looking at a photo of a tin of baked beans	Eating one baked bean
Holding an open tin of baked beans	Touching a spoonful of baked bean to your lips
Looking closely at a bowlful of baked beans	Smelling a bowl of baked beans
Holding a closed tin of baked beans	Looking closely at a bowlful of baked beans
Touching a spoonful of baked bean to your lips	Holding a bowl of baked beans an arm's length away
Eating one baked bean	Holding an open tin of baked beans
Eating a spoonful of baked beans	Holding a closed tin of baked beans
Smelling a bowl of baked beans	Looking at a photo of a tin of baked beans

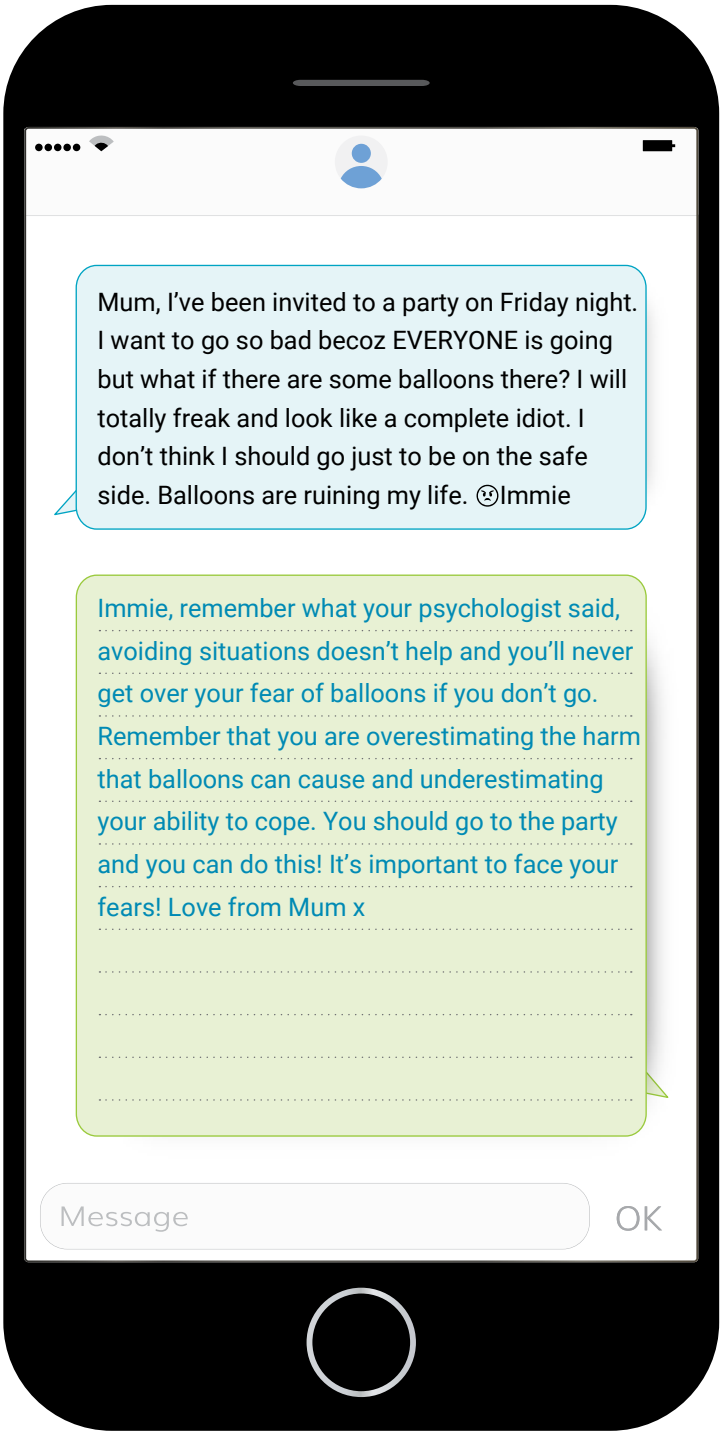
ACTIVITY 13.7

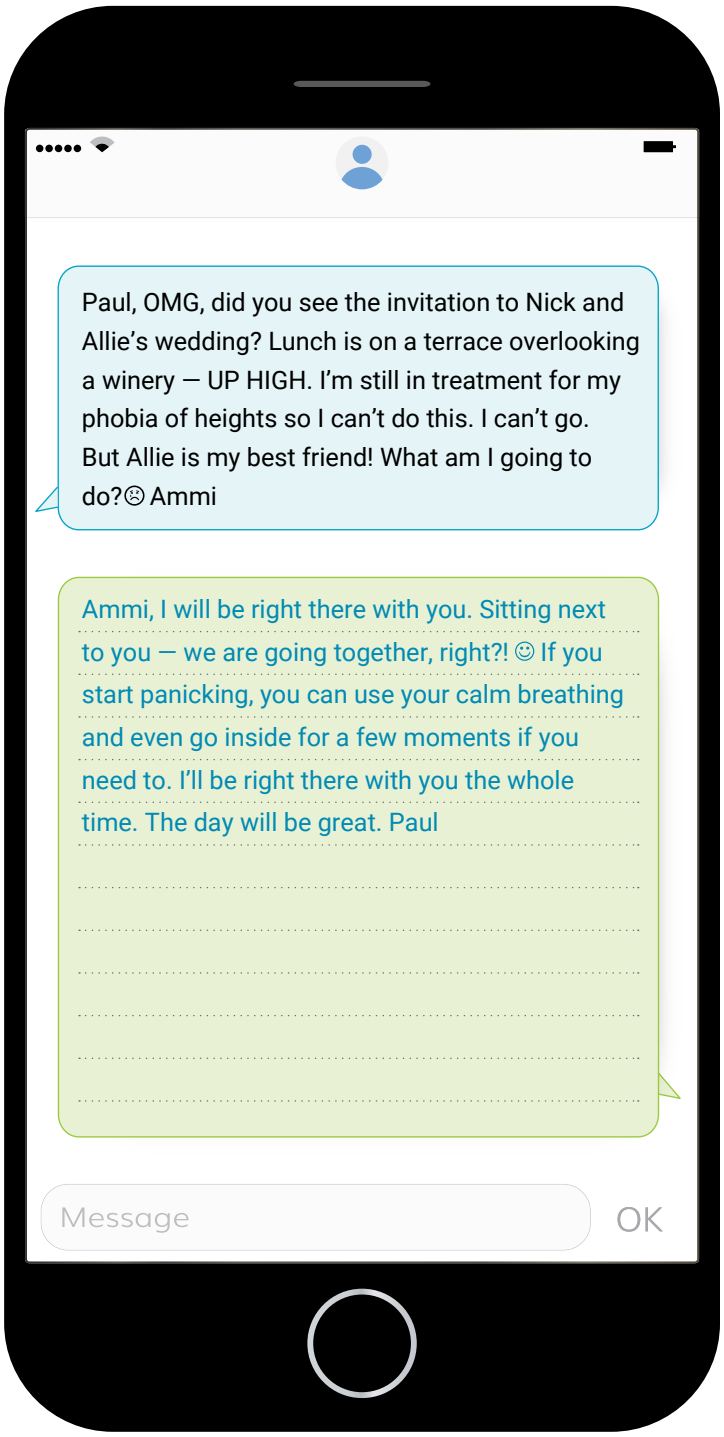
Evidence-based social interventions for specific phobias

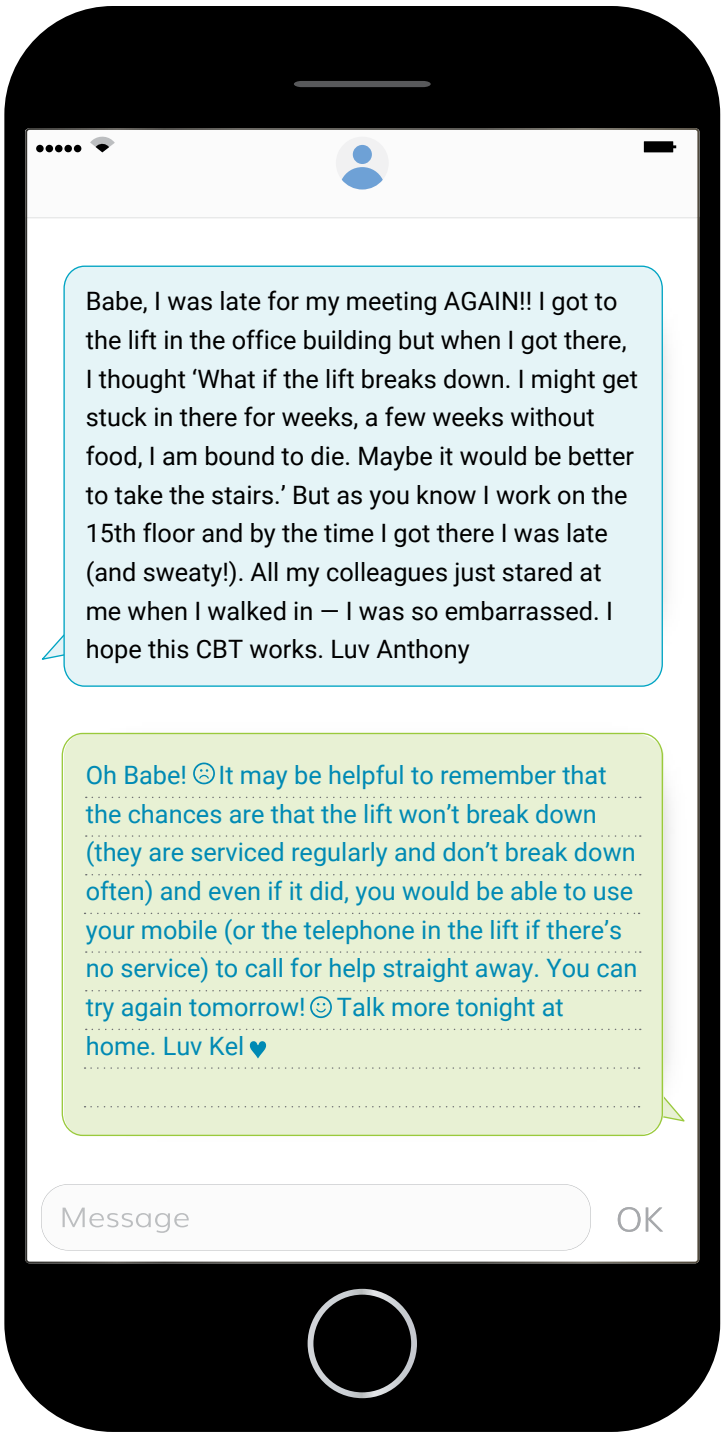
Suppose that you have a close relationship with a person who has a specific phobia and are therefore part of their social support network. In the spaces provided in the 'mobile phones', write a reply to each of the text messages consistent with information that would have been given to you as part of the psychoeducation process.

Your reply does not necessarily have to be expressed formally.




Mum, I've been invited to a party on Friday night. I want to go so bad becoz EVERYONE is going but what if there are some balloons there? I will totally freak and look like a complete idiot. I don't think I should go just to be on the safe side. Balloons are ruining my life. 😢Immie
Immie, remember what your psychologist said, avoiding situations doesn't help and you'll never get over your fear of balloons if you don't go. Remember that you are overestimating the harm that balloons can cause and underestimating your ability to cope. You should go to the party and you can do this! It's important to face your fears! Love from Mum x
Message
OK




Babe, I was late for my meeting AGAIN!! I got to the lift in the office building but when I got there, I thought 'What if the lift breaks down. I might get stuck in there for weeks, a few weeks without food, I am bound to die. Maybe it would be better to take the stairs.' But as you know I work on the 15th floor and by the time I got there I was late (and sweaty!). All my colleagues just stared at me when I walked in — I was so embarrassed. I hope this CBT works. Luv Anthony
Oh Babe! ☹ It may be helpful to remember that the chances are that the lift won't break down (they are serviced regularly and don't break down often) and even if it did, you would be able to use your mobile (or the telephone in the lift if there's no service) to call for help straight away. You can try again tomorrow! ☺ Talk more tonight at home. Luv Kel ♥
Message
OK

ACTIVITY 13.8

Evaluation of research on emetophobia — a specific phobia of vomiting

Virtually everyone has experienced vomiting at some time. It is usually unpleasant but serves an important function of expelling toxins from the stomach. Some people develop a specific phobia of vomiting (SPOV), moreso women as they are four times more likely to develop it than men. The specific phobia can significantly interfere with a person's everyday life as they avoid situations or activities that they believe might increase the risk of vomiting or contact with vomit. For example, they may avoid places and situations from which they fear they may be exposed to vomit or cannot quickly escape if they feel sick and might vomit, such as shops, concerts, public transport, aeroplane travel, visiting sick people and attending medical appointments. They may also restrict their food intake to reduce the risk of vomiting. Some women with the phobia have avoided a desired pregnancy due to their fear of suffering from morning sickness or concern about their ability to care for a sick child who vomits.

A research team decided to investigate whether memories and associations of vomiting influenced the development of SPOV. A secondary aim was to determine if the number of memories of vomiting was influenced by the phobia.

There were 184 participants in the study. Group 1 consisted of 88 females and 6 males who had been diagnosed with SPOV. All were members of an internet support group for SPOV and volunteered to participate. Anyone who volunteered was accepted into the study following confirmation that they had SPOV. Their mean age was 32.3 years and the mean age of onset of SPOV was 15.7 years. Group 2 consisted of 87 female and 3 male volunteers from a database of community members 'willing to participate in research' that was maintained by the psychology department at the university where the researchers worked. Their mean age was 32.5 years. The researchers attempted to match the Group 2 participants with Group 1 participants for age and gender, and included only those participants who had not been diagnosed with SPOV or any other mental disorder at some time in the past.

Both groups were asked to complete a self-report questionnaire assessing their lifetime memories of both their own vomiting and vomiting by others. The researchers contacted participants recruited from the internet support group to administer the questionnaire over the phone. All other participants were interviewed face to face.

The results are shown in tables 1 and 2.

ACTIVITY 13.8 *continued*

Table 1 Memories of own vomiting

	Group 1	Group 2
Variable	Mean	Mean
Age of earliest memory of own vomiting	6.0	7.0*
No. of memories of own vomiting in lifetime	4.0	6.0*
No. of memories of own vomiting before onset of phobia	2.0	2.0
No. of memories of own vomiting after onset of phobia	1.0	3.0*
Most distressing memory of own vomiting (rated 0–10)	9.0	4.0*

* A statistically significant difference of $p < 0.05$

Table 2 Memories of others vomiting

	Group 1	Group 2
Variable	Mean	Mean
Age of earliest memory of others vomiting	7.0	26.0*
No. of memories of others vomiting	3.0	0.0*
No. of memories of others vomiting before onset of phobia	2.0	0.0*
No. of memories of others vomiting after onset of phobia	2.0	0.0*
Most distressing memory of others vomiting (rated 0–10)	10.0	2.0*

* A statistically significant difference of $p < 0.05$

Source: Adapted from Veale, D., Murphy, P., Ellison, N. Kanakam., N. & Costa. A. (2013). Autobiographical memories of vomiting in people with a specific phobia of vomiting (emetophobia). *Journal of Behaviour Therapy and Experimental Psychiatry, 44*, 14–20.

1 Formulate a research hypothesis for this study.

Examples:

- People with SPOV will recall more memories of their own and others' vomiting experiences compared to people without SPOV.
- People with SPOV compared to a control group will recall more memories of their own and others' vomiting experiences.

2 Identify the experimental research design.

matched participants (i.e. for gender and age)

3 Identify the sampling procedure.

convenience sampling

4 Identify the experimental and control groups.

experimental group: Group 1 (i.e. with SPOV)

control group: Group 2 (i.e. without SPOV)

5 Identify the operationalised independent and dependent variables.

independent variable: having a diagnosis of SPOV

dependent variable: scores on a questionnaire assessing lifetime memories of own vomiting and vomiting by others

6 Why was Group 2 matched for gender and age?

gender: Due to the higher proportion of women with SPOV there was a need to counterbalance the potential effect of gender in particular.

age: Considered a potential extraneous or confounding variable that could influence questionnaire responses in addition to having or not having SPOV.

7 Which type of statistics were used to:

(a) construct the tables?

descriptive statistics

(b) calculate 'a statistically significant difference of $p < 0.05$'?

inferential statistics

8 What are two differences between Group 1 and Group 2 that are evident in the results?

Examples:

- People with SPOV (Group 1) recalled the memories of their own *and* others vomiting experiences from an earlier age and rated them as significantly more distressing than the control group (Group 2).
- The SPOV group (Group 1) recalled more memories of others vomiting *before* the onset of the problem than did the control group (Group 2).
- After the age at which the phobia became a problem, the SPOV group (Group 1) recalled fewer memories of their *own* vomiting and more memories of *others* vomiting than the control group (Group 2).

Note. The above are based on conclusions drawn by the researchers.

ACTIVITY 13.8 *continued*

9 On which type of long-term memory is the study dependent for its data?

episodic, explicit

10 Explain two possible limitations of the research.

Limitations may refer to:

- the study is reliant on memories so there may be memory bias in responses e.g. people with SPOV may unintentionally misrepresent memories or not recall certain experiences due to distress and/or anxiety associated with those memories
- experimental group participants have SPOV but may also have another anxiety disorder (which is not uncommon for people with a phobia) so their responses may not be specific to SPOV (and therefore influenced by their other anxiety disorder)
- using convenience samples has provided detailed and potentially useful information but they may be biased samples
- different data collection for each group i.e. phone interview for Group 1 (SPOV) and face-to-face interview for Group 2 (controls).
- participants with SPOV may have been trying to give 'meaning' to the development of their phobia and may therefore have positively endorsed a significant number of items on the questionnaire.

ACTIVITY 13.9

Summarising evidence-based interventions

Helena has a specific phobia of flying. She informs her sister that there is a '90% chance' that she will die if she goes on a plane. Helena cites all the planes that have crashed and/or gone missing recently as evidence to support her belief. Helena experiences intense physical symptoms of panic whenever she even thinks about having to go on a plane. She has not been on a plane for 23 years. However, she would like to go to her cousin's wedding in Bali next year.

In each of the columns below, classify the type of intervention as biological, psychological or social, define the intervention, and then briefly describe how it could be used to treat Helena's specific phobia.

Breathing retraining	Cognitive behavioural therapy	Exercise
Type of intervention: biological	**Type of intervention:** psychological	**Type of intervention:** biological
Definition: An anxiety management technique involving teaching how to use correct breathing patterns when anticipating or exposed to a phobic stimulus	**Definition:** A type of psychotherapy based on the assumption that the way people feel and behave is largely a product of the way they think	**Definition:** Regular physical activity
Description: Helena's psychologist would educate her about the role of hyperventilation, the importance of oxygen (O_2) and carbon dioxide (CO_2) levels being in balance and how to restore CO_2 levels in her blood if she starts hyperventilating or panicking by using controlled breathing techniques. Maintaining	**Description:** Helena's psychologist would help her recognise and change thoughts and behaviour that perpetuate her phobia and to improve coping skills. For example, the psychologist would help Helena identify and challenge some of her cognitive biases about flying. At present, Helena is focusing only on the planes that crash and	**Description:** Helena's psychologist would encourage her to engage in regular physical exercise and to keep physically active, after assessing her exercise preferences and taking account of her physical health status. The exercise may promote relaxation, relief/distraction/time out from anxiety symptoms, stress

correct breathing or correcting breathing patterns when experiencing or anticipating a phobic stimulus will help reduce anxiety-related symptoms.	go missing but she is not taking into consideration the millions of planes that fly every day and safely arrive at their destinations without incident. Moreover, believing that she has a '90% chance of dying' is unrealistic and needs to be gently challenged.	management, increased tolerance of fear and anxiety-related symptoms, and metabolisation of stress hormones.
Psychoeducation	**Systematic desensitisation**	**Use of a benzodiazepine agent**
Type of intervention: social	**Type of intervention:** psychological	**Type of intervention:** biologial
Definition: The provision and explanation of information about a mental disorder to individuals diagnosed with the disorder (and possibly their family and/or friends) to increase knowledge and understanding of the disorder and its treatment.	**Definition:** Gradually exposing a person to their feared stimulus and replacing an anxiety response with a relaxation response.	**Definition:** Use of a GABA agonist medication to alleviate anxiety symptoms by acting selectively on the GABA receptors in the brain to increase GABA's inhibitory effects and make post-synaptic neurons more resistant to excitation.

Description: Helena's psychologist would educate Helena about such elements as: symptoms of the flight phobia, the role of avoidance (and not encouraging); the importance of challenging unrealistic or anxious thoughts, treatment options, services available and recovery patterns to help ensure interventions are appropriate and thereby enhance treatment and enable Helena to cope more effectively herself.	**Description:** Firstly, give Helena training in a relaxation technique. She would then create a fear hierarchy and gradually make her way through the hierarchy with the support of her psychologist. She would not move up to the next step on the fear hierarchy until she was able to be completely relaxed at each step. e.g. step 1 might simply be to visit an airport while practicing a breathing technique learned through breathing retraining.	**Description:** Helena could be prescribed a benzodiazepine agent (such as Valium) by a medical doctor (or psychiatrist). She would take the prescribed dose about an hour before boarding to help tolerate anxiety during the flight. Benzodiazepines have the potential to become addictive so this is not a long-term solution for Helena's specific phobia of flying, but it would enable her to attend her cousin's wedding in Bali.

ACTIVITY 13.10

Sentence completion on specific phobia

Use the terms in the shaded panel to complete the sentences below. A term should be used only once and not all terms will be used.

agonist	antagonist	arousal	avoidance	biological
classical conditioning	cognitive	conditioned response	fear	high
hyperventilate	low	memory	neural pathways	operant conditioning
psychoeducation	psychological	social	stigma	strengthen
stress response	systematic desensitisation	think	unconditioned response	weaken

1 Stress, anxiety and specific phobias all involve a change in ..... arousal .....

2 The predominant symptoms of a specific phobia include excessive ..... fear ....., anxiety and ..... avoidance ..... behaviours.

3 The stress response is a ..... biological ..... contributory factor for specific phobias.

4 A benzodiazepine agent is a GABA ..... agonist ..... which targets this neurotransmitter's activity because it is often found to be at a relatively ..... low ..... level in the brains of people with a specific phobia.

5 One reason why people with a specific phobia may not seek treatment is the ..... stigma ..... around seeking treatment.

6 Explanations of specific phobias from a cognitive model perspective emphasise how people process information and ..... think ..... about a phobic stimulus and its context.

7 The behaviour therapy called ..... systematic desensitisation ..... aims to replace an anxiety response with a relaxation response.

8 Breathing retraining is an effective anxiety management technique because when exposed to a phobic stimulus, people with a specific phobia often ..... hyperventilate ..... and this can worsen their symptoms.

ACTIVITY 13.10 *continued*

9 The process of psychoeducation involves provision of information about a specific phobia, its treatment and mental health services.

10 According to behavioural models, classical conditioning can precipitate a specific phobia, whereas operant conditioning can perpetuate the phobia after its acquisition.

11 Someone who is overestimating, exaggerating or magnifying the amount of harm an object or situation poses is demonstrating a type of cognitive bias.

12 A stress response involving fight–flight–freeze when exposed to a phobic stimulus may heighten the anxiety that is experienced or even become a/an conditioned response to a phobic stimulus.

13 Specific environmental triggers are considered to be social contributing factors to the development of a specific phobia.

14 Long-term potentiation can strengthen synaptic connections in neural pathways that form when phobic stimuli are learnt and remembered.

15 Tom was bitten by a dog and now has a specific phobia of dogs. When he recalls the story about the incident, he describes the dog as being much bigger and vicious than it actually was. This is an example of a type of bias called memory bias.

ACTIVITY 13.11

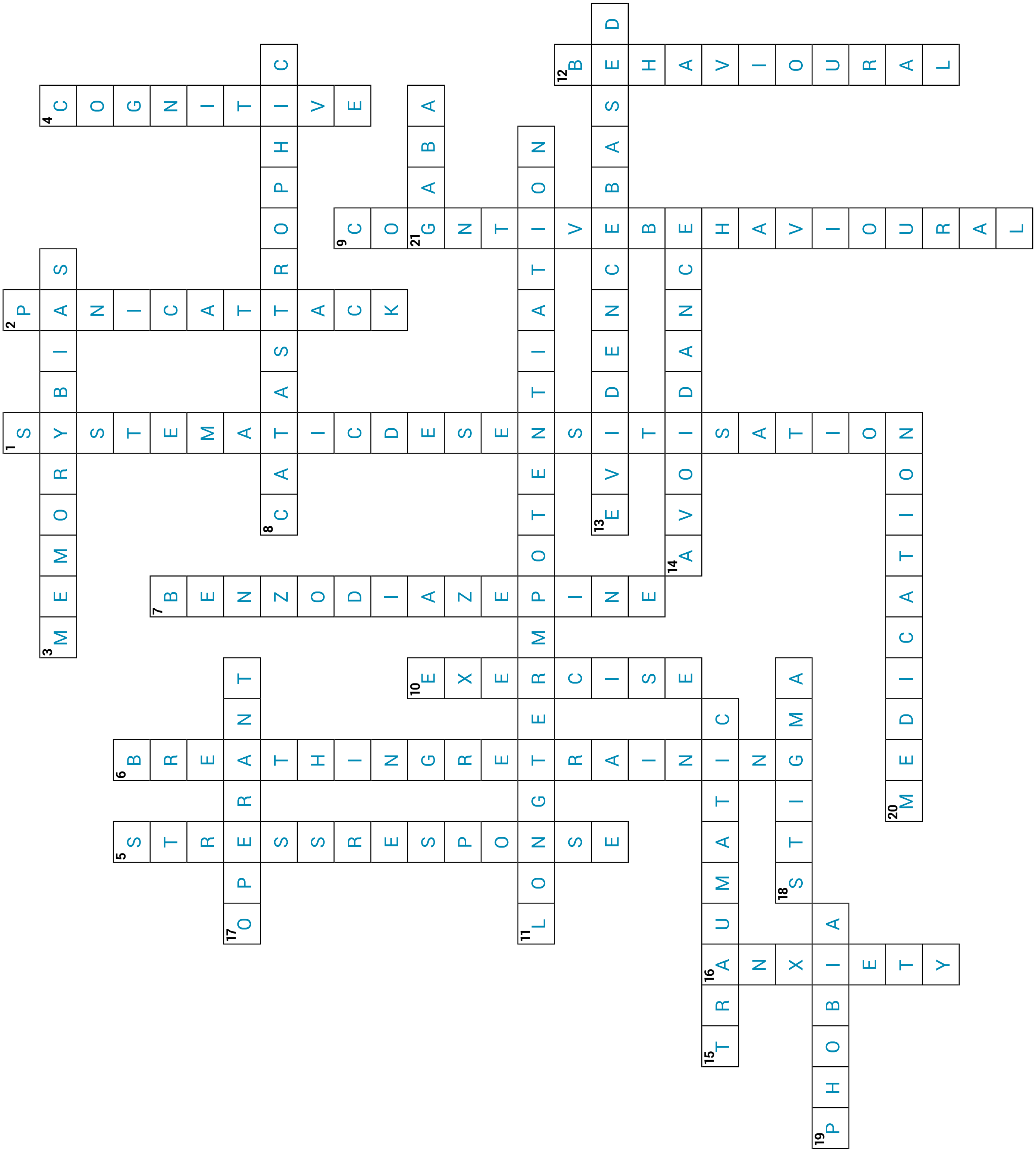
Crossword on concepts and terms in specific phobia

Across

3 The tendency to reconstruct and recall a phobic experience more negatively than it actually was.
8 A type of thinking that involves predicting the worst possible outcome.
11 Activity at the synapse that may neurologically strengthen the association between a phobic stimulus and a fear or anxiety response
13 Any treatment for phobia found to be valid on the basis of sound scientific research.
14 A type of behaviour typical of all specific phobias.
15 This type of experience with a particular object or situation can contribute to the development of a specific phobia.
17 A type of conditioning that may perpetuate a phobia.
18 A known barrier to seeking treatment for people with a specific phobia.
19 A mental disorder characterised by excessive fear, anxiety and avoidance behaviour.
20 Treats the symptoms but not the cause of anxiety induced by a phobic stimulus.
21 Counterbalances the excitatory activity of neurotransmitters that contribute to arousal and anxiety

Down

1 A behavioural intervention for phobia involving a graduated exposure technique.
2 An experience involving sudden onset of intense fear or terror typically accompanied by shortness of breath, a racing heart and dizziness
4 Models that explain phobias in terms of flawed information processing.
5 Activation of fight–flight–freeze when exposed to a phobic stimulus.
6 An intervention for phobia treatment that targets breathing patterns.
7 An agent used in medications that targets inhibitory receptors in the brain.
9 A psychotherapy that targets thoughts and behaviours that are perpetuating a phobia.
10 A biological intervention that may provide relief from anxiety.
12 Models that explain phobias in terms of learning processes.
16 A feeling of worry, uneasiness or apprehension.



1 SYSTEMATICDESENSITISATION
2 PANICATTACK
3 MEMORYBIAS
4 COGNITIVE
5 STRESSRESPONSE
6 BREATHINGRETRAINING
7 BENZODIAZEPINE
8 CATASTROPHIC
9 COGNITIVEBEHAVIOURAL
10 EXERCISE
11 LONGTERMPOTENTIATION
12 BEHAVIOURAL
13 EVIDENCEBASED
14 AVOIDANCE
15 TRAUMATIC
16 ANXIETY
17 OPERANT
18 STIGMA
19 PHOBIA
20 MEDICATION
21 GABA

ACTIVITY 13.12

True/False quiz on specific phobia

Indicate whether each item is true or false by writing T or F in the column at the right.

Statement	T or F
1 Virtually any object or situation can become the focus of a person's phobia.	T
2 Phobias are basically overrated fears.	F
3 Benzodiazepines are gamma-amino butyric acid antagonists.	F
4 Systematic desensitisation is often found to be an effective biological intervention in the treatment of phobias.	F
5 If a person wants to overcome their phobia, it is vital that they go to whatever lengths necessary to avoid feared objects or situations.	F
6 Physical exercise is considered an effective evidence-based intervention for people with a phobia.	T
7 Cognitive behavioural therapy is based on an assumption that how we think, how we feel and how we act all interact.	T
8 Long-term potentiation may contribute to the development and maintenance of a phobia by reducing the excitability of neurons, thereby having a calming effect on many brain functions.	F
9 Psychoeducation is an evidence-based social intervention in the treatment of a phobia.	T
10 Learning to challenge their unhelpful thoughts is an important step for someone to overcome their phobia.	T
11 Individuals with a low level of GABA in the brain tend to be more vulnerable to anxiety.	T
12 Adults with a phobia are often aware that their fears are exaggerated or irrational, but believe that their anxious reaction is uncontrollable.	T
13 Systematic desensitisation involves replacing a relaxation response with a fear response by gradually working through a fear hierarchy.	F
14 Concern about experiencing stigma can prevent a person with a phobia seeking help from a mental health professional.	T
15 Phobias and their treatment are best understood from a biopsychosocial perspective.	T
16 Stress and anxiety differ from phobias in that both stress and anxiety involve eustress and distress, whereas phobias involve distress only.	F
17 Evidence-based interventions should only be used to treat a phobia because they have been found to be effective on the basis of valid and reliable research studies.	T
18 The use of medications in the treatment of a phobia is a type of psychosurgery.	F
19 Memory bias is considered to be a social contributory factor that influences development of a phobia.	F
20 Breathing retraining can teach a person with a phobia how to slow their respiration rate when hyperventilating.	T

ACTIVITY 13.12 *continued*

Statement	T or F
21 Children will always develop their parents' phobias.	F
22 If a person has a fear reaction whenever they see a dog, but do not avoid coming into contact with dogs, they are unlikely to have a specific phobia of dogs.	T
23 The use of a benzodiazepine such as Valium may be considered a relaxation technique for the treatment of a phobia.	F
24 The more that avoidance behaviours of someone with a phobia are challenged, the more attention the phobia gets, the stronger the reinforcement of their behaviours and therefore the more resistant the phobia will become to treatment.	F
25 Behavioural models explain phobias in terms of learning principles.	T

CHAPTER 14

Maintenance of mental health

	Activities								
Key knowledge	**14.1**	**14.2**	**14.3**	**14.4**	**14.5**	**14.6**	**14.7**	**14.8**	**14.9**
• resilience as a positive adaptation to adversity including the relative influence of protective factors with reference to: adequate diet and sleep (biological); cognitive behavioural strategies (psychological); support from family, friends and community (social)	✔	✔	✔	✔			✔	✔	✔
• models of behaviour change with reference to the transtheoretical model including the stages of pre-contemplation, contemplation, preparation, action and maintenance/relapse.					✔	✔	✔	✔	✔
Key science skills		✔							

Source: VCE Psychology Study Design extracts © VCAA; reproduced by permission.

ACTIVITY 14.1

Summarising biological protective factors

Select terms from the shaded panel below to correctly complete the passage about biological protective factors that contribute to good mental health. A term should be used only once but not all terms need to be used.

adversity	bad	balanced	cognitive	debatable
diet	feel	good	hours	individual
involuntary	mental health	mood	NREM	physical
predictor	quality	quantity	ready	REM
resilience	resistance	restored	right	rumination
set	sleep	tasty	variety	voluntary

Everyday life constantly presents us with stressors and other challenges that can make life difficult.

Resilience is the ability to successfully cope with adversity and to 'bounce back' from these challenges and restore positive functioning. Both adequate diet/sleep and an adequate sleep/diet play important roles in our ability to deal with stressors and other challenges.

Having an adequate diet means eating a good amount of a variety of different foods that maintains good health and makes us feel well as a result. One important guideline is that an adequate diet needs to be balanced. This means a diet with minimal amounts of the bad things (e.g. junk food) and more of the good things (e.g. fruits, vegetables, grains and plenty of water). Most people know that eating well is vital to good physical health and contributes to an overall healthier lifestyle. However, research also shows that an adequate diet can have a positive impact on our mental health, including how energetic we feel and our mood state. We tend to generally feel better and have an overall sense of positive wellbeing when we eat well.

ACTIVITY 14.1 *continued*

Sleep is an essential, naturally occurring, involuntary process, without which we cannot function at our best. The way we think, feel and behave while awake depends in part on what happens while we sleep. We all need to make sure we get the right amount of sleep, and enough good quality sleep. There is no set amount of sleep time that is appropriate for everyone. The amount of sleep time people need is a highly individual matter and varies in relation to age, lifestyle, sleep habits and many other factors.

Good quality sleep tends to be the result of spending enough uninterrupted time in both NREM/REM and REM/NREM sleep. It also depends on whether we are sleeping at a time when our body is prepared and ready to sleep. Inadequate or poor sleep can adversely affect mental health by impairing affective, behavioural and cognitive functioning. Overall, adequate sleep tends to be more about waking up feeling rested, restored and ready for the day and feeling positive about ourselves and our abilities, rather than getting a certain number of hours.

ACTIVITY 14.2

Research evaluation on how diet may affect anxiety

A researcher watched a television documentary that promoted a belief that what we eat affects how we feel and if we have anxiety, what we eat affects the severity of our anxiety. The documentary was well-received by many viewers so the researcher decided to test the belief by investigating whether highly anxious people could benefit from making dietary changes.

Sixty-seven adult participants (37 females and 30 males) who replied to an internet advertisement were recruited for the study. All participants met the following criteria: (a) aged 18 years or older, (b) self-reported a high level of anxiety throughout the past week, (c) a score of 10 or higher on the researcher's new, self-created, online anxiety test comprising 15 rating scale items on how anxiety affects their physical, emotional and social wellbeing, and (d) a score of 65 or less, out of a possible 100, on an online version of the Diet Screener Assessment (DSA) modified for Australian food products. The DSA was completed to confirm 'poor' dietary quality; that is, that all participants had a low intake of good foods such as dietary fibre, lean meats and fruit and vegetables and a high intake of bad foods such as sweets, processed meats and salty snacks.

Participants were then randomly allocated to receive a monthly treatment of either dietary support or social support across a 12-week period. The 33 participants in the dietary support group received three individual support sessions of approximately 60 minutes each, delivered by one of three dieticians. The dietary intervention comprised personalised dietary advice and nutritional counselling support, including goal setting and mindful eating. The focus was on increasing diet quality by supporting the consumption of all key food groups. The 34 participants in the social support group had the same number of support sessions and of the same duration as the dietary support group. These were also held at the same time and location as the dietary group, except in different rooms. The social support intervention consisted of suitably trained personnel discussing neutral topics with the participant, such as sport, news or music, or in cases where the participant found the conversation difficult, engaging in alternative activities such as playing cards or board games.

At the end of the 12-week period, all participants remaining in the study completed the online anxiety test again. There were 31 participants remaining in the dietary support group and 25 in the social support group who had complete data at 12 weeks. The results are shown below. The difference in the mean scores was found to be statistically significant and therefore not attributable to chance.

Time of assessment	Dietary support group (mean anxiety score)	Social support group (mean anxiety score)
Baseline	10	10
At 12 weeks	7	9

ACTIVITY 14.2 *continued*

1 Formulate a research hypothesis for this study.

Examples:

- Dietary support will be superior to social support in reducing anxiety symptoms.
- Highly anxious people will experience fewer anxiety symptoms following dietary support compared to highly anxious people who do not receive dietary support.

2 Identify the research method and design.

experimental research method; independent groups

3 Identify the sampling procedure.

convenience sampling

4 Identify the experimental and control groups.

experimental group: dietary support

control group: social support

5 Identify the operationalised independent and dependent variables.

independent variable: type of intervention received

dependent variable: score on anxiety test/number of anxiety symptoms

6 Identify a random allocation procedure that could have been used by the researcher and explain its purpose in this particular investigation.

- random allocation procedure: Any procedure that ensures every participant has an equal chance of being selected for either group e.g. use of a random number generator, lottery method, coin tossing.
- purpose: Ensure uniform distribution of individual participant differences in both the experimental and control groups, especially in relation to the four assessment criteria.

7 Did the researcher use a single or double blind procedure? Explain why it was used in this particular investigation.

- procedure: single blind
- explanation: ensure participants were not aware of the condition of the experiment to which they were allocated and therefore the experimental treatment (the IV), thereby controlling beliefs and expectations that may have influenced the results in an unwanted way

8 Give three examples of the use of standardised instructions and procedures in the investigation.

Examples include:

- use of the same tests for all participants e.g. anxiety and dietary assessment tools
- all participants completed the tests online
- same number of support sessions for all participants
- all appointments/support sessions for all participants held at the same location
- all appointments for all participants at the same time
- all appointments for all participants of the same duration
- all support/interventions provided individually
- all support personnel were qualified/suitably trained

9 What was the baseline assessment and what was its purpose in this investigation?

- baseline assessment: participant scores/data before receiving any intervention/treatment
- purpose: collect anxiety data for comparison purposes following exposure or non-exposure to the IV so that the level of change (if any) in anxiety symptoms due to dietary intervention could be measured

10 Draw a conclusion based on the results of this study.

Example: The results of this study show that dietary improvements can be an effective treatment strategy for anxiety in adults.

11 Explain whether the conclusion is valid.

Explanation should demonstrate understanding that the conclusion is unlikely to be valid due to a minimum of two potential limitations such as:

the anxiety assessment tool devised and used by the researcher is not a valid and reliable anxiety measure e.g. it is not a 'standardised' test that was devised using scientifically appropriate procedures; unknown whether participant anxiety is temporary or chronic e.g. use of a diagnostic criterion involving a self-reported high level of anxiety for one week only; unknown how chronic the anxiety reported by participants may be e.g. age is an important variable, but participant age data is limited to 18+ years so cannot determine specific age groups and therefore the total number of years for which anxiety has been experienced by people of different ages; 12 weeks is a limited period of time — no follow-up study, so evidence for long-term effects of change on symptoms or of numbers who actually persist with dietary change; validity of the dietary advice/qualifications of the dieticians unknown e.g. whether the dieticians are qualified/registered, recently qualified (if at all); use of different dieticians, e.g. potential non-standardised delivery.

12 Explain the relevance of debriefing to this particular study.

- Explanation should demonstrate understanding of what debriefing may involve and apply it to this specific investigation. Example: A purpose of debriefing is to check the wellbeing of participants following experimental intervention. Consequently, the researcher must consider that dietary change may affect participant physical and/or mental wellbeing in an unwanted way that is presently unknown or unexpected and therefore ensure that (1) all participants, including those who withdrew, are aware of this possibility; (2) a procedure is used for participants to access information or advice post-study if required; and (3) a procedure is used for the researcher to monitor participant health and wellbeing post-study.

ACTIVITY 14.3

Changing unhelpful thoughts as a psychological protective factor

When using cognitive behavioural strategies, individuals identify, assess and correct faulty patterns of thinking or problem behaviours that may be affecting their mental health and wellbeing. One such strategy, cognitive restructuring or re-framing, involves identifying, then replacing unhelpful thoughts with more helpful ones, which in turn, results in positive changes in a person's feelings and behaviours. Thinking in helpful ways is an important means of enhancing resilience and maintaining mental health.

For each of the following unhelpful thoughts below, write a more helpful alternative. The first is completed as an example.

UNHELPFUL THOUGHT	HELPFUL ALTERNATIVE
1 They ignored me — they don't like me.	*Maybe they didn't see me. I wonder if there was something wrong? I'll ask them.*
2 I bet I lose my job because of this mistake.	I don't know that for sure. I need to wait and see what my supervisor actually says.
3 I am going to fail at this.	Even if I fail, it's not the end of the world. It's only one small part of my life.
4 Nobody likes me.	I know there are people who care about me. It doesn't matter if I'm not liked by everybody.
5 I'm no good at any anything.	I might not do everything well, but I'm still a good person. There are lots of other things I am good at. Nobody is perfect.
6 I have no control over my life.	Stuff happens — but at least I can control how I think about things and how I respond.
7 Everything is just too hard, so why bother?	Yes, life can sometimes be tough, but it can be tough for everyone. That's normal. Other people can help me if I talk to them.
8 Things will never get better.	Bad times don't last. Things always get better. I just need to stay optimistic.

ACTIVITY 14.4

Analysing social support as a social protective factor

Many studies show that having caring and supportive relationships within and/or outside the family can protect and maintain our mental health. Complete the following diagram.

Mental health benefits of social support include:

enhanced resilience; alleviating stress; decreased feelings of loneliness/isolation; opportunity to discuss/share problems; elicits 'time-out' and/or distraction from negative events

Individuals, groups or organisations who could provide social support include:

family members; friends; peers; trusted teachers; work colleagues; professionals; other members or leaders of groups to which we belong; online support groups/forums or chat rooms

Social support is:

the assistance, care or empathy provided by people to each other.

Barriers that may prevent a person from accessing social support include:

stigma; language and/or cultural barriers; socio-economic barriers; geographical location; having a physical or intellectual disability or impairment; having a mental disorder, shyness

Ways a person could build their social support include:

increase community involvement e.g. join an interest group, sports team, etc.; work on and prioritise existing relationships, e.g. reach out to family and friends and prioritise spending time with them; use professional support; be friendly, positive and approachable

ACTIVITY 14.5

Applying the transtheoretical model of behaviour change

The transtheoretical model of behaviour change is a stage-based model that describes and explains how people intentionally change their problem behaviour to achieve a health-related goal. There are five 'stages of change', each with its own set of characteristic thoughts and behaviours.

Part A: Thoughts

Read each person's thoughts about behaviour change in the column on the left. In the column on the right, write which 'stage of change' the thought indicates the person is in. Ensure you include the number and name of the relevant stage.

Thoughts	Stage of change
1 I might change.	Stage 2 — contemplation
2 Yes, there's a problem and I am going to change it.	Stage 3 — preparation
3 I will change sometime in the next month.	Stage 3 — preparation
4 That problem is a thing of the past.	Stage 5 — maintenance
5 I am changing.	Stage 4 — action
6 I have changed.	Stage 5 — maintenance
7 Maybe I need to change, but I'm not sure what to do.	Stage 2 — contemplation
8 I don't have a problem that needs changing.	Stage 1 — pre-contemplation
9 I am doing something about my problem.	Stage 4 — action
10 There's no problem here.	Stage 1 — pre-contemplation
11 It feels good to be changing.	Stage 4 — action
12 I am going to change and will do something about it soon.	Stage 3 — preparation
13 I will continue with these changes long term.	Stage 5 — maintenance
14 It might be a good idea to change, but I'm not sure.	Stage 2 — contemplation
15 There's nothing that I really need to change.	Stage 1 — pre-contemplation
16 I am really working hard to change.	Stage 4 — action
17 I am trying to prevent myself from having a relapse of my problem.	Stage 4 — action or Stage 5 — maintenance
18 I have a problem and wonder if I should work on it.	Stage 2 — contemplation

Part B : Behaviours

Give an example of overt behaviour a person may exhibit in each of the five stages of change.

Stage of change	Example of behaviour
Pre-contemplation	• No observable change in problem behaviour (or intention to change) • May defend the problem behaviour, change the subject, tune out or even get annoyed if family or friends try to talk with them about
Contemplation	• No observable change in problem behaviour (nor commitment to any action) • May start seeking information on negative effects of their problem behaviour and strategies for changing (to support contemplation)
Preparation	• Some small changes in problem behaviour may be observed e.g. reduced frequency, more restrained • Activities associated with action planning for behaviour change may be observed e.g. if weight is the problem behaviour, searching the internet for a gym that could be joined, buying a recipe book with low calorie/healthier meals

ACTIVITY 14.5 *continued*

Action	• Observable change in problem behaviour (including reduced frequency, more restrained) e.g. tends to be most visible and externally recognised • Implementing their action plan so engaged in overt attempts to change or abandon the problem behaviour e.g. they are at the gym, out for a run, buying healthy food, or eating a salad instead of a burger • Responding to social support e.g. to positive performance feedback • Original problem behaviour may be observed due to relapse.
Maintenance	• Behaviour change is observed, particularly no problem behaviour if termination is reached e.g. the person is going to the gym regularly, eating healthily, not smoking any cigarettes, etc. • Relapse may occur any time in this stage so original problem behaviour may be observed

ACTIVITY 14.6

Media analysis/response

Read the media item about the transtheoretical model and then answer the following questions.

Understanding change: If you want to succeed you need to accept you may initially fail

Dr Suzy Green

You are probably going to fail. Well, not fail exactly, but it's unlikely you will achieve your goal in the way you envisage.

This may not sound very encouraging. It's vital you understand this when you decide to make a change to your life, like when you've made a new year's resolution.

But it does not mean you won't achieve your goal. There is good news — we know a lot about change and how to make it stick.

When you understand a bit more about the stages of change, and where you are up to, you are much more likely to reach your goals.

In the last several decades researchers have studied people going through the change process and have found certain things improve a person's chances of successfully making changes.

Initially this research focused on how people progress through change when giving up 'bad habits', such as cigarettes, drugs or alcohol.

More recently positive psychology researchers identified techniques that could support each one of us to be our best possible selves.

One of the most important things we've learnt from this research is that 'relapse' is a part of the process, particularly the first time we try to make a change.

For example, evidence shows on average people attempt to give up smoking seven to ten times before they are able to.

This may all sound fairly academic, but it's worth understanding the change process and the stages you pass through on your journey, because doing the wrong things at the wrong stage means you're less likely to succeed and more likely to give up.

Stages of change

Imagine your goal is to get fit. Let's see how you might move through the stages of change.

Pre-contemplation: If you're at this stage you're not really thinking about making changes to your fitness.

In fact, you're pretty certain that you don't need to worry about exercise. You wish your family and friends, who tell you [you] need to get up off the couch and do something active, would just chill out.

Contemplation: You think you'd benefit from regular exercise and trying to get fitter, but you just don't know how you are going to squeeze it in with all the other things you have to do.

Also, there are so many confusing messages about what type of exercise you need to be doing.

At this stage you might want to focus on the reasons for change rather than the reasons not to change. Now is a good time to identify your personal values and work out how to link those to more specific goals. An easy place to start is a list of the pros and cons of getting fit.

Preparation: Now you know you are ready to get fit. You don't need any more convincing, but you do need a plan.

Make a genuine commitment to being a fitter and healthier person and focus on how good you'll feel when you are.

Don't rush into deciding exactly how you're going to get fit. Now is a good time to keep a log of your daily fitness-related activities — include things like walking to the shops, taking the dog for a walk or a stroll on the beach.

Small steps and recognising daily progress are key tools here. If you're not confident you can go it alone then you might want to get some professional coaching or help, rather than assuming you can 'stay strong'.

Action: So you've been getting up for a walk three mornings a week and taking some gym classes. Great work. Keep busy and focused on action and activity.

Use both short-term and long-term goals, and keep track of your progress using a journal or checklist.

At this stage you may want to set yourself more demanding goals, maybe you can register for a fun run or invest [in] a gym membership (if you think that would be helpful) or find someone to buddy-up with.

Avoid complacency and reward and congratulate yourself at regular intervals.

Maintenance: You've been getting regularly exercise for about six months. Recognise that maintaining the fitness you've got is a long-term, ongoing process, but it is easier than starting all over again from scratch.

Now you can set yourself more demanding goals. Think about taking yourself to the next level. So if you've done your fun run, why not sign up for a half marathon. Enjoy your success and build on it.

Relapse: Life got in the way and it's been a while since you were able to do any exercise. That's OK, relapsing into old behaviours is normal.

Learn from your past mistakes. Recognise what went wrong and get back into action as soon as possible.

You haven't been running for a week, or even a month. That's OK, put on your shoes and head out for one this afternoon. This is also the time to think about the things that were working well (the Saturday morning runs with friends) and get this back on track.

So the big question is — are you really ready for change?

You may believe you're ready, research suggests you may be only contemplating change, which is only the second stage of the process and at this stage you'll still be weighing up the pros and cons of change.

Source: https://www.abc.net.au/news/health/2016-01-15/goal-setting-failure-and-new-year-resolutions/7090482, 4 February 2016.

Questions

1 State the behaviour change goal addressed by the article and complete the following table with information from the article.

Goal: to get fit

Stage of change	Example of thoughts, feelings and behaviours
Pre-contemplation	You're not really thinking about making changes to your fitness. You're pretty certain that you don't need to worry about exercise. You feel frustrated/annoyed and wish everyone else would 'get off your back' about it. You do nothing about your fitness and stay on the couch.
Contemplation	You think you'd benefit from regular exercise and trying to get fitter but aren't sure how you'd fit it in around all your other commitments. You're also not sure what type of exercise you should be doing. You start considering the 'pros and cons' of getting fit but don't actually do anything about it.
Preparation	You have made a decision and are ready to get fit. You've made a genuine commitment to being a fitter and healthier person. You've decided what activities you will do to help reach your goal e.g. walking to the shops, taking the dog for a walk or a stroll on the beach. But you don't do any of them – YET.

Action	You have been taking action towards achieving your goal to get fit e.g. you've been getting up for a walk three mornings a week and taking some gym classes. It might be helpful to register for a fun run or sign up for a gym membership to keep your motivation up. It's important to keep busy and focused on action and activity and to reward yourself at regular intervals.
Maintenance	You've been exercising regularly for about six months. You may consider taking your fitness up the next level and set more demanding goals e.g. you've done the fun run, so why not sign up for a half marathon?
Relapse	It's been a while since you were able to do any exercise. That's OK, relapsing into old behaviours is a completely normal part of the behaviour change process. Put on your shoes and head out for a run this afternoon. This is the time to think about the things that were working well (the Saturday morning runs with friends) and get this back on track.

2 Comment on the accuracy of the article's description of the transtheoretical model of behaviour change.

Comment should demonstrate understanding that the names of the five stages are all correct and in the correct order, as are the descriptions of thoughts, feelings and behaviours occurring in each stage.

It is unclear whether relapse is included as a distinct sixth stage. If so, this is consistent with the views of some psychologists, whereas others do not describe it as a separate stage, instead considering it as occurring in the action or maintenance stages.

ACTIVITY 14.7

Matching exercise on maintenance of mental health

Match each description with the most appropriate term on the right. Write the letter of the term you select to the left of each description. Each term can be used only once.

(f)	**1** Eating a good amount of a variety of different foods that maintain good health.	**(a)** resilience
(d)	**2** The assistance, care or empathy provided by people to each other.	**(b)** cognitive behavioural strategies
(i)	**3** In the transactional model, the stage of behaviour change in which people are not ready to change.	**(c)** lapse
(g)	**4** In the transactional model, the stage of behaviour change in which a person has successfully sustained the changed behaviour over a relatively long period of time.	**(d)** social support
(b)	**5** Techniques used to improve mental health drawn from CBT.	**(e)** adequate sleep
(j)	**6** In the transactional model, the stage of behaviour change characterised by overt attempts to change or abandon the problem behaviour.	**(f)** adequate diet
(e)	**7** The right amount and quality of sleep needed each night for optimal functioning.	**(g)** maintenance
(a)	**8** The process of adapting well in the face of adversity and 'bouncing back' from difficult experiences.	**(h)** preparation
(h)	**9** In the transactional model, the stage of behaviour change when the individual is ready to change their problem behaviour.	**(i)** pre-contemplation
(l)	**10** In the transactional model, when there is a full-blown return to the original problem behaviour.	**(j)** action
(k)	**11** In the transactional model, the stage of behaviour change in which people think about the possibility of changing their problem behaviour.	**(k)** contemplation
(c)	**12** In the transactional model, when there is a 'slip up' with changed behaviour but a quick return to action or maintenance.	**(l)** relapse

ACTIVITY 14.8

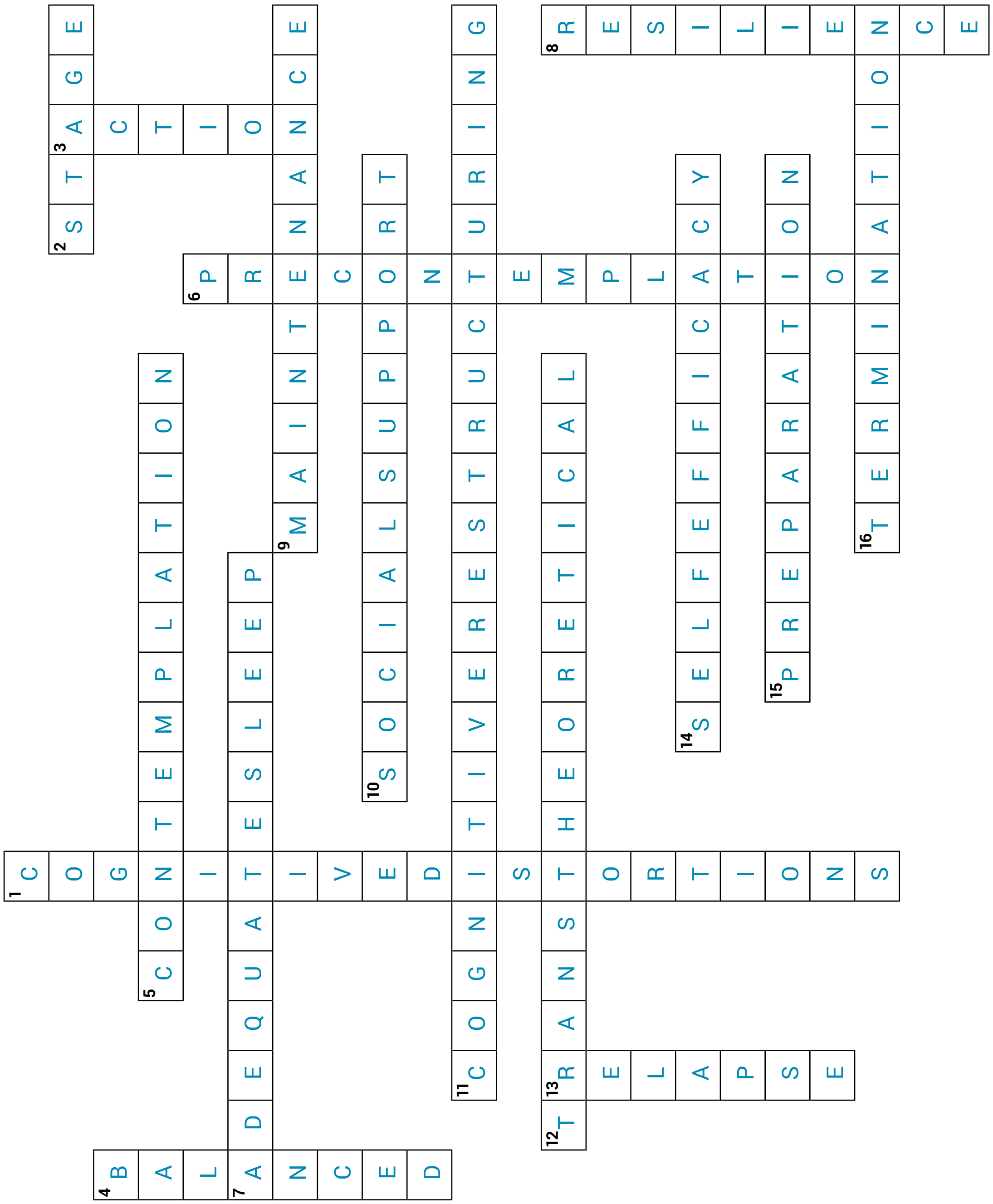
Crossword on concepts and terms in maintenance of mental health

Across

2 A phase that people go through in the transactional model as they try to change their behaviour.
5 Second stage of the transtheoretical model.
7 A protective factor for mental health that is usually achievable without support from a professional.
9 Fifth stage of the transtheoretical model.
10 Support from family, friends and others.
11 This protective psychological strategy aims to replace unhelpful thoughts with more helpful ones.
12 This model describes and explains how people intentionally change their problem behaviour to achieve a health-related goal.
14 A personal belief that influences transition from one stage of the transtheoretical model to another.
15 The stage of the transtheoretical model that is likely to follow contemplation if potential gains far outweigh losses.
16 Sometimes described as a sixth stage in the transtheoretical model, this is said to be reached when it is believed that the problem behaviour will never return.

Down

1 These habitual ways of thinking can adversely impact on mental health.
3 Fourth stage of the transtheoretical model.
4 Another word to describe an adequate diet.
6 First stage of the transtheoretical model.
8 Maintaining mental health through a positive adaption to adversity.
13 A full-blown return to problem behaviour following a period of positive change.


1 COGNITIVE DISTORTIONS
2 STAGE
3 ACTION
4 BALANCED
5 CONTEMPLATION
6 PRECONTEMPLATION
7 ADEQUATE SLEEP
8 RESILIENCE
9 MAINTENANCE
10 SOCIAL SUPPORT
11 COGNITIVE RESTRUCTURING
12 TRANSTHEORETICAL
13 RELAPSE
14 SELF EFFICACY
15 PREPARATION
16 TERMINATION

ACTIVITY 14.9

True/False quiz on maintenance of mental health

Indicate whether each item is true or false by writing T or F in the column on the right.

Statement	T or F
1 Anyone can develop a mental disorder.	T
2 You can't protect yourself against developing a mental disorder.	F
3 Mental disorders are incurable and lifelong.	F
4 Resilience is a type of mental toughness	F
5 You either have resilience or you don't.	F
6 Support from family and friends is considered important for maintaining mental health.	T
7 Having trouble with your sleep means that you have a mental health problem.	F
8 Adequate sleep and diet can help you 'snap out' of most mental health problems and disorders.	F
9 According to the transtheoretical model, changing health-related problem behaviour is a single, 'one-off' event rather than a process that takes time.	F
10 What we eat may affect not just our physical health, but also our mental health and wellbeing.	T
11 Using cognitive behavioural strategies involves identifying and correcting unhelpful thinking patterns that may be affecting our mental health and wellbeing.	T
12 An individual can use cognitive behavioural strategies to maintain their mental health without the need for specialist intervention.	T
13 Cognitive behavioural strategies are a social factor that can 'protect' against the development of a mental disorder.	F
14 A person may be resilient in some situations and with some type of stressors, but not with other stressors.	T
15 Being resilient means you do not ask others for help.	F
16 According to the transtheoretical model, people always move through each stage in a linear order, where one stage is reached after another in a straightforward way.	F
17 The transtheoretical model allows for minor and significant setbacks when changing problem behaviour.	T
18 According to the transtheoretical model, the 'maintenance' stage is said to be reached when people have successfully sustained the changed behaviour for one month without relapse.	F
19 Someone in the pre-contemplation stage of the transtheoretical model has no intention to change a problem behaviour.	T
20 'Preparation' is the third stage of the transtheoretical model of behaviour change.	T
21 Resilience prevents stressful and adverse situations in everyday life.	F

ACTIVITY 14.9 *continued*

Statement	T or F
22 You can 'snap out' of any mental health problem or disorder if you try hard enough.	F
23 There are no good foods or bad foods, only good and bad diets.	F
24 There is a relationship between poor quality sleep and/or insufficient sleep with a variety of mental health problems and disorders.	T
25 I can't help a person with a mental health problem or disorder.	F