learnon
www.jacplus.com.au

Adam BYLSMA | Nicole LETCH

WORKBOOK FOR PSYCHOLOGY

VCE UNITS 3 AND 4

EIGHTH EDITION

jacaranda
A Wiley Brand

WORKBOOK FOR PSYCHOLOGY

VCE UNITS 3 AND 4

EIGHTH EDITION

WORKBOOK FOR PSYCHOLOGY

VCE UNITS 3 AND 4

EIGHTH EDITION

Adam BYLSMA

Nicole LETCH

jacaranda
A Wiley Brand

First edition published 2023 by
John Wiley & Sons Australia, Ltd
155 Cremorne Street, Cremorne, Vic 3121

Typeset in 9.5/15 pt Roboto

ISBN: 978-1-1198-8802-4

Cover and internal design images: © Boguslaw Mazur/Shutterstock

Illustrated by diacriTech and Wiley Composition Services

Typeset in India by diacriTech

A catalogue record for this book is available from the National Library of Australia

CONTENTS

UNIT 3

HOW DOES EXPERIENCE AFFECT BEHAVIOUR AND MENTAL PROCESSES?

2 Nervous system functioning 79

3 Stress as an example of a psychobiological process 119

4 Approaches to understand learning 153

5 The psychobiological process of memory 193

UNIT 4

HOW IS MENTAL WELLBEING SUPPORTED AND MAINTAINED?

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 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 topic has a matrix showing the relationship of each activity to key knowledge and skills in the Psychology Study Design (2023–2027). Each activity has an assessment guide specifically designed to support self-assessment. These guides are published separately but easily accessed in learnON by teachers.

ACKNOWLEDGEMENTS

The authors and publisher would like to thank the following copyright holders, organisations and individuals for their assistance and for permission to reproduce copyright material in this book.

Images

Shutterstock: **124 (middle right)**/PopTika; **124 (middle left)**/peterschreiber.media; **124 (top)**/DG-Studio; **125 (bottom right)**/Blanco Mouzo; **125 (top)**/sutadimages; **127**/Twinsterphoto; **139**/gpointstudio; **224 (top right)**/Miriam Doerr Martin Frommherz; **224 (top left)**/Kolonko; **224 (top left)**/Max Morphine; **224 (top left)**/Random Illustrator; **267**/Akos Nagy; **276**/Joe Seer; **277 (left)**/GoodStudio; **277 (right)**/GoodStudio; **308**/Rustle; **309**/Africa Studio; **310**/Vladimir Gjorgiev; **311**/AlexandreNunes; **312**/OSTILL is Franck Camhi; **313**/blvdone; **314 (top)**/Image Point Fr; **314 (bottom)**/Loreanto; **335**/designmaestro; **336**/designmaestro; **337**/designmaestro; **338**/designmaestro; **339**/InesBazdar; **356**/gpointstudio; **361**/Sudowoodo; 363/Monkey Business Images • **110**/Peter Murphy • **126**/Anita Tee • **143**/Dan/CartoonStock • **181**/Hero Images/Hero Images/Adobe Stock • **216**/Adapted from Miles, C., & Hardman, E. (1998). State-dependent memory produced by aerobic exercise. *Ergonomics*, *41*(1), 20–28 • **271**/Dawson, D., Reid, K. (1997). Fatigue, alcohol and performance impairment. *Nature*, *388*, 235 • **298**/Mike Turner/CartoonStock • **331**/Ron Morgan/CartoonStock • **362**/Dr Marny Lishman • **368 (top)**/Dylan Burns/AFL Photos/Getty Images • **368 (bottom)**/Stefan Gosatti/Getty Images

Text

• Selected extracts from the VCAA VCE Psychology Study Design (2023–2027) are copyright Victorian Curriculum and Assessment Authority (VCAA), reproduced by permission. VCE® is a registered trademark of the VCAA. The VCAA does not endorse this product and makes no warranties regarding the correctness or accuracy of its content. To the extent permitted by law, the VCAA excludes all liability for any loss or damage suffered or incurred as a result of accessing, using or relying on the content. Current VCE Study Designs and related content can be accessed directly at www.vcaa.vic.edu.au. Teachers are advised to check the VCAA Bulletin for updates. • **127–8** Vincent Ho, *The Conversation* • **139** Yazdani M, Rezaei S, Pahlavanzadeh S. (2010). The effectiveness of stress management training program on depression, anxiety and stress of the nursing students. Iran J Nurs Midwifery Res.; 154:208–215 • **281** 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 • **301** Bret A. Moore, *Psychology Today* • **340** 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 • **362–3** Dr Marny Lishman

Every effort has been made to trace the ownership of copyright material. Information that will enable the publisher to rectify any error or omission in subsequent reprints will be welcome. In such cases, please contact the Permissions Section of John Wiley & Sons Australia, Ltd.

KEY SCIENCE SKILLS AND RESEARCH METHODS IN PSYCHOLOGY

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	1.20	1.21	1.22	1.23	1.24	1.25	1.26	1.27	1.28
Develop aims and questions, formulate hypotheses and make predictions																												
• identify, research and construct aims and questions for investigation	✓						✓																	✓			✓	
• identify independent, dependent and controlled variables in controlled experiments	✓	✓					✓												✓	✓				✓	✓	✓	✓	
• formulate hypotheses to focus investigations	✓						✓																	✓			✓	
• predict possible outcomes of investigations							✓												✓	✓				✓			✓	
Plan and conduct investigations																												
• determine appropriate investigation methodology: case study; classification and identification; controlled experiment (within subjects, between subjects, mixed design); correlational study; fieldwork; literature review; modelling; product, process or system development; simulation					✓	✓	✓						✓	✓										✓		✓	✓	
• design and conduct investigations; select and use methods appropriate to the investigation, including consideration of sampling technique (random and stratified) and size to achieve representativeness, and consideration of equipment and procedures, taking into account potential sources of error and uncertainty; determine the type and amount of qualitative and/or quantitative data to be generated or collated			✓	✓	✓								✓	✓			✓	✓	✓	✓				✓		✓	✓	

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	1.20	1.21	1.22	1.23	1.24	1.25	1.26	1.27	1.28
• work independently and collaboratively as appropriate and within identified research constraints, adapting or extending processes as required and recording such modifications																												
Comply with safety and ethical guidelines																												
• demonstrate ethical conduct and apply ethical guidelines when undertaking and reporting investigations												✓								✓	✓	✓		✓			✓	
• demonstrate safe laboratory practices when planning and conducting investigations by using risk assessments that are informed by safety data sheets (SDS), and accounting for risks																				✓	✓	✓						
• apply relevant occupational health and safety guidelines while undertaking practical investigations																				✓	✓	✓						
Generate, collate and record data																												
• systematically generate and record primary data, and collate secondary data, appropriate to the investigation																							✓	✓				
• record and summarise both qualitative and quantitative data, including use of a logbook as an authentication of generated or collated data																✓							✓					
• organise and present data in useful and meaningful ways, including tables, bar charts and line graphs																												

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	1.20	1.21	1.22	1.23	1.24	1.25	1.26	1.27	1.28
Analyse and evaluate data and investigation methods																												
• process quantitative data using appropriate mathematical relationships and units, including calculations of percentages, percentage change and measures of central tendencies (mean, median, mode), and demonstrate an understanding of standard deviation as a measure of variability																								✓			✓	
• identify and analyse experimental data qualitatively, applying where appropriate concepts of: accuracy, precision, repeatability, reproducibility and validity; errors; and certainty in data, including effects of sample size on the quality of data obtained							✓		✓	✓	✓	✓	✓											✓	✓		✓	
• identify outliers and contradictory or incomplete data										✓	✓	✓												✓				
• repeat experiments to ensure findings are robust															✓										✓			
• evaluate investigation methods and possible sources of error or uncertainty, and suggest improvements to increase validity and to reduce uncertainty							✓			✓	✓	✓			✓									✓	✓			

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	1.20	1.21	1.22	1.23	1.24	1.25	1.26	1.27	1.28
Construct evidence-based arguments and draw conclusions																												
• distinguish between opinion, anecdote and evidence, and scientific and non-scientific ideas														✓														
• evaluate data to determine the degree to which the evidence supports the aim of the investigation, and make recommendations, as appropriate, for modifying or extending the investigation							✓	✓	✓	✓														✓				
• evaluate data to determine the degree to which the evidence supports or refutes the initial prediction or hypothesis							✓	✓	✓															✓				
• use reasoning to construct scientific arguments, and to draw and justify conclusions consistent with evidence base 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, including appropriateness and application of data to different cultural groups and cultural biases in data and conclusions							✓																	✓				

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	1.20	1.21	1.22	1.23	1.24	1.25	1.26	1.27	1.28
Analyse, evaluate and communicate scientific ideas																												
• use appropriate psychological terminology, representations and conventions, including standard abbreviations, graphing conventions and units of measurement								✓																			✓	
• discuss relevant psychological information, ideas, concepts, theories and models and the connections between them							✓						✓														✓	
• analyse and explain how models and theories are used to organise and understand observed phenomena and concepts related to psychology, identifying limitations of selected models/ theories																												
• critically evaluate and interpret a range of scientific and media texts (including journal articles, mass media communications, opinions, policy documents and reports in the public domain), processes, claims and conclusions related to psychology by considering the quality of available evidence																												
• analyse and evaluate psychological issues using relevant ethical concepts and guidelines, including the influence of social, economic, legal and political factors relevant to the selected issue													✓															

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	1.20	1.21	1.22	1.23	1.24	1.25	1.26	1.27	1.28
• use clear, coherent and concise expression to communicate to specific audiences and for specific purposes in appropriate scientific genres, including scientific reports and posters																✓										✓	✓	
• acknowledge sources of information and assistance, and use standard scientific referencing conventions																												

Source: © VCAA, *VCE Psychology Study Design: 2023–2027*. pp. 12–13.

Note: Although convenience sampling is not specified in the 2023–2027 Psychology Study Design, it has been included in this topic to help inform students. This is the most common type of sampling used by students when completing VCE Psychology research tasks.

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: type of revision program (self-directed or teacher-led)

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 that 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

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: percentage of subjects entering into a deep trance

ACTIVITY 1.2

Identifying and operationalising independent, dependent and controlled 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*
Controlled variables	Examples: background relationships, diet, level of job satisfaction, age, gender, socioeconomic status etc.	

1 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)

2 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)

3 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)

4 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 8-hour shift (e.g. in a factory workplace)

5 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

6 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

7 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*

8 Will using this workbook improve VCE Psychology results?

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

ACTIVITY 1.3

Population, sample and sampling

Select terms from the shaded panel below to correctly complete the passage. A term should be used only once.

generalise	sample	equal	target	bias
population	strata	selected	researcher	complex
efficient	measurable	frame	larger	representative
randomising	stratified	proportionally	subgroup	gender
accurately	attributes	participant	errors	identified

When planning an investigation, a researcher needs to decide who or what they wish to focus on. This group is known as the research population or target population. A population can be people, animals or other measurable objects or events, such as government health programs. The population refers to the entire group to which the researcher will seek to generalise the results of their investigation. Once the population is identified, the sample can be selected. The sample is a subset of the population and is always smaller in size. Ideally, the sample should accurately reflect the research population but this is not always possible. Sampling processes should avoid bias. Unrepresentative samples can arise from participant related variables such as personal characteristics or other sources, such as sampling bias. When a researcher successfully selects a sample that accurately mirrors the target population this is called a representative sample. Statistically, larger sample sizes more accurately represent populations than smaller ones. This is because, as the sample size increases, the attributes of the sample will more closely reflect the attributes of the population from which it is drawn. Larger sample sizes also decrease the influence of sampling errors. Random sampling ensures every member of the target population has an equal chance of being selected. This is an efficient sampling process that is achieved by compiling a complete list of all members in the population called a sampling frame and then applying

a randomising or lottery process to blindly choose random participants. Stratified sampling is a more complex process of selecting a sample from a population. This process forms subgroups in such a way that each subgroup identified in the population is proportionally represented in the sample. These subgroups, which are also known as strata, can be based on factors such as age, gender, income level, language spoken, cultural backgrounds, etc. Stratified sampling, although more time-consuming, ensures a more representative sample is formed compared to random sampling.

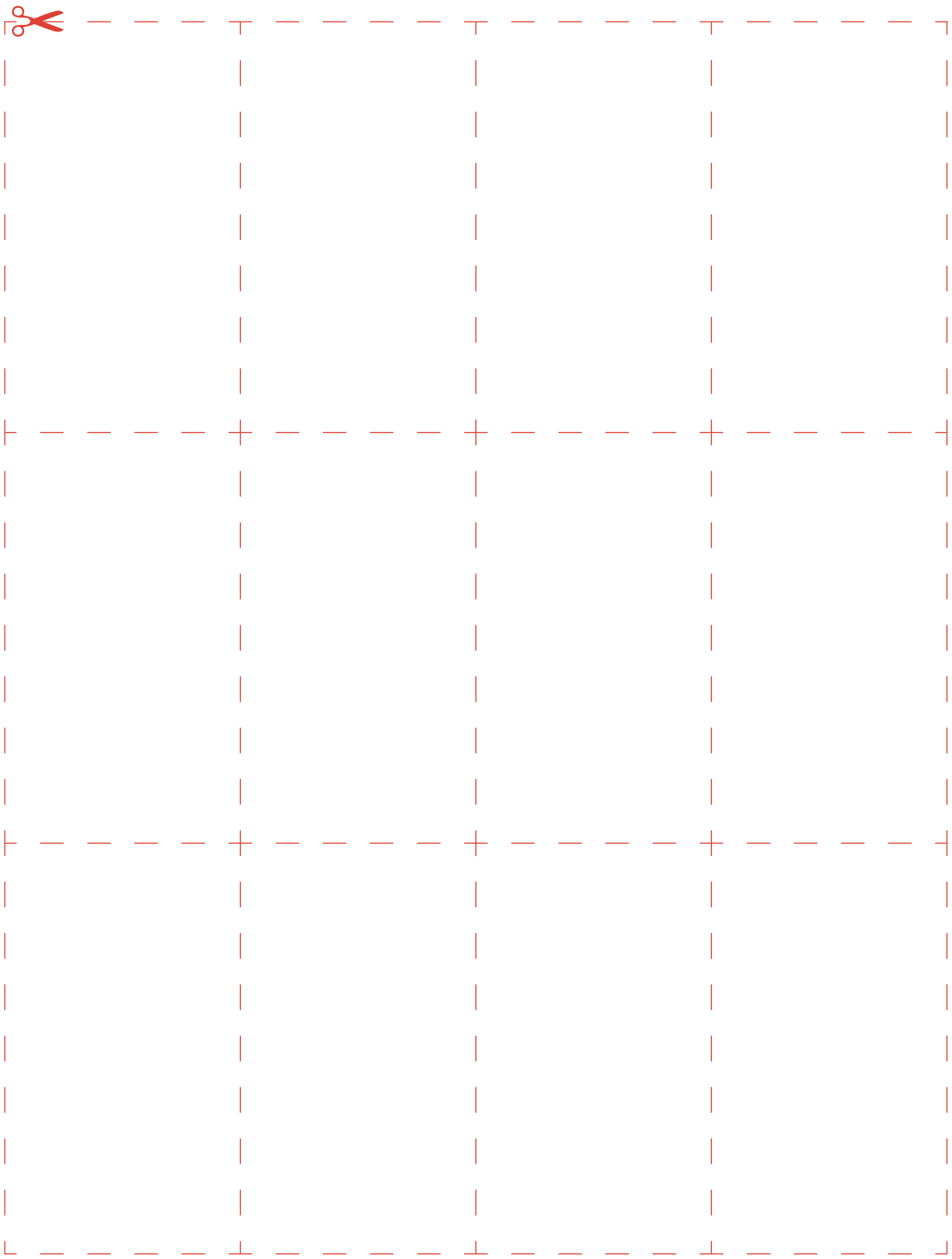
ACTIVITY 1.4

Comparing sampling procedures

Complete the following table by cutting out the relevant sections on the next page and pasting them into the correct 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.	A relatively simple way to 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 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

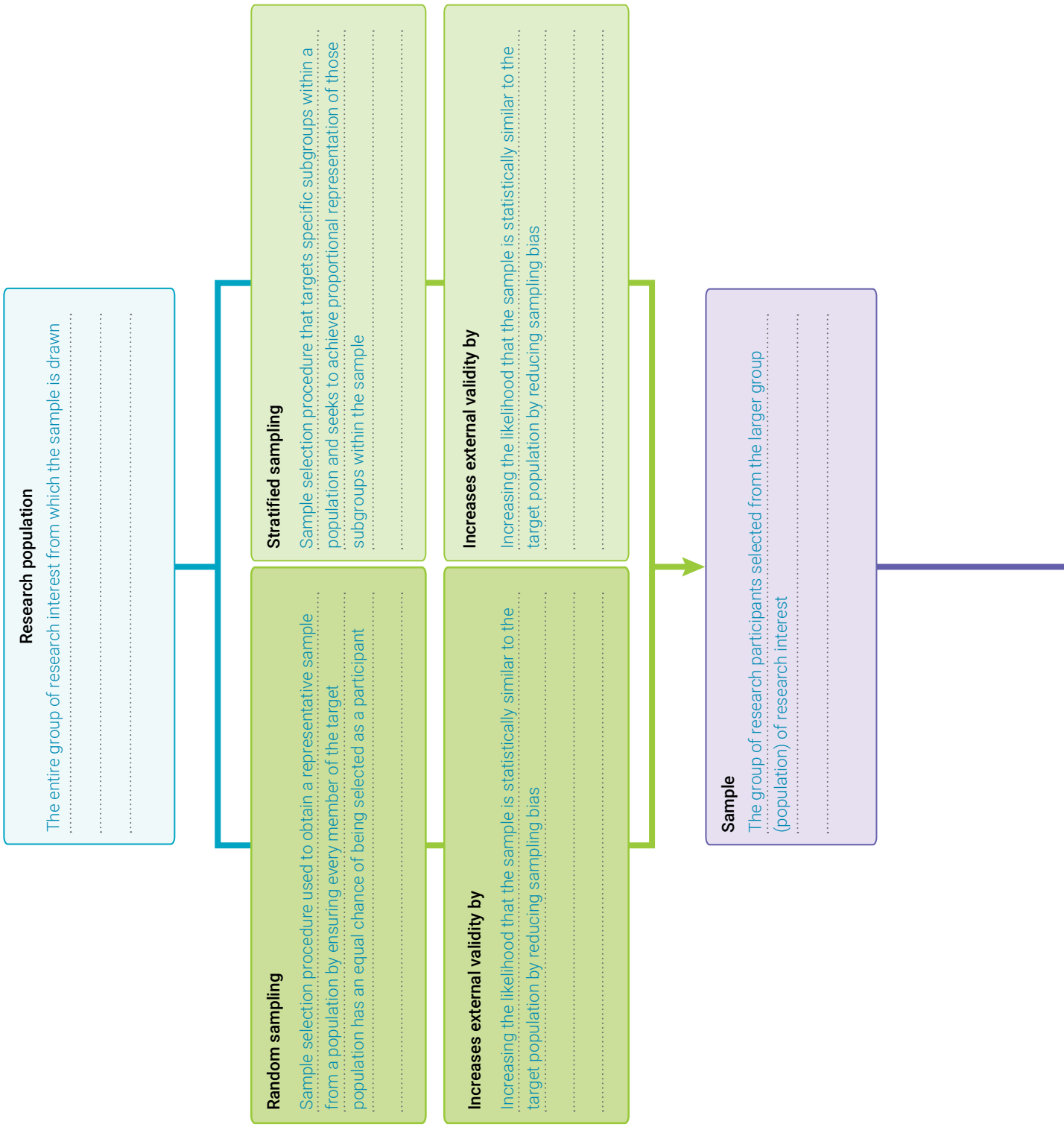


ACTIVITY 1.5

Designing controlled experiments

Part A

Complete the following flow chart relating to designing a controlled 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)

Increases internal validity by

Ensuring the participants are randomly allocated in order to make the experimental and control groups as similar to each other as possible (equivalent) prior to manipulation of the IV

Test group 1

Subgroup of sample randomly allocated to be exposed to a predetermined level of the IV to determine its effect on the DV

Control group

Subgroup of sample randomly allocated to be exposed to the same conditions as the test groups except that the IV exposure is set to zero (no exposure). Forms the baseline level for later comparison.

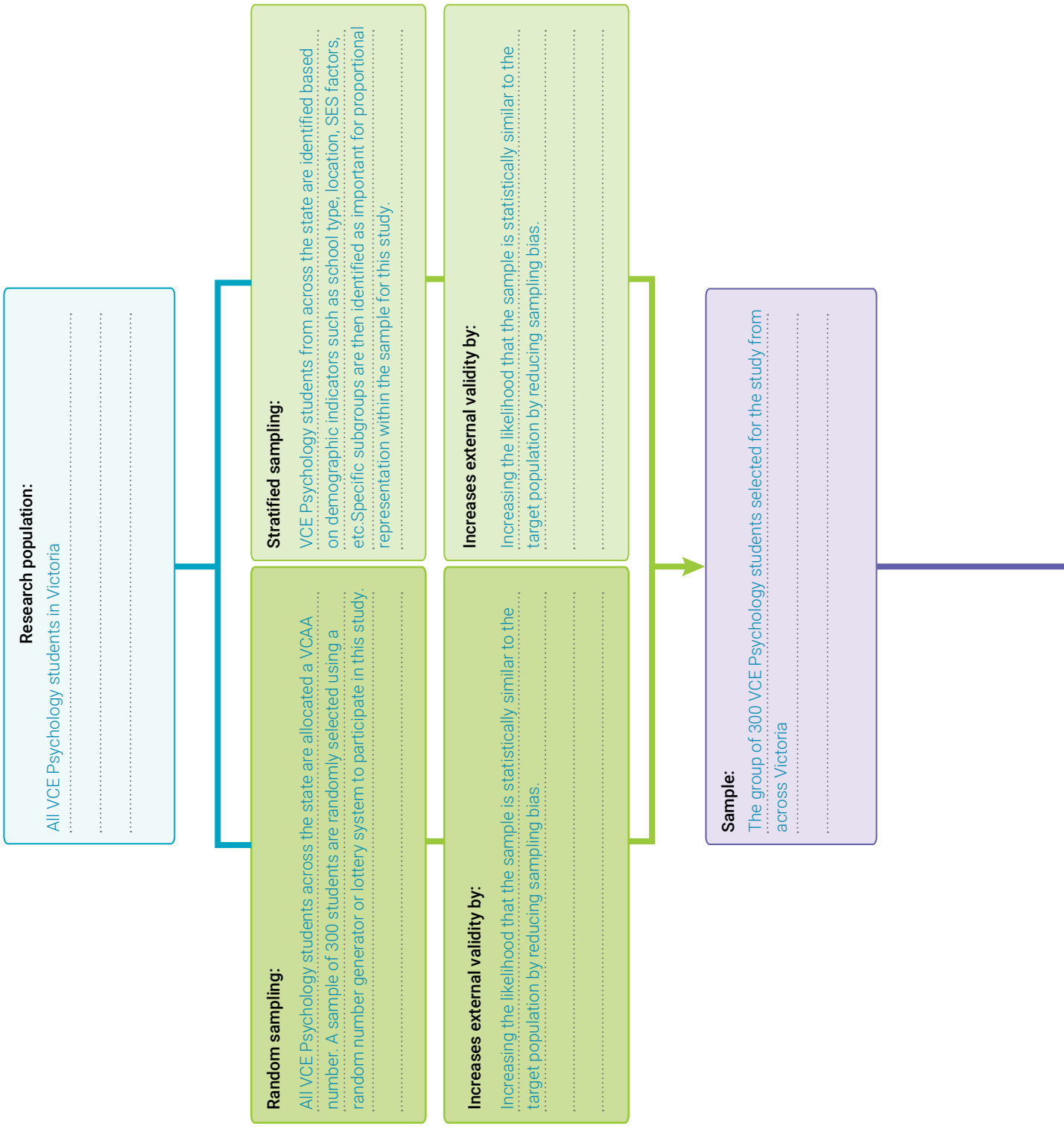
Test group 2

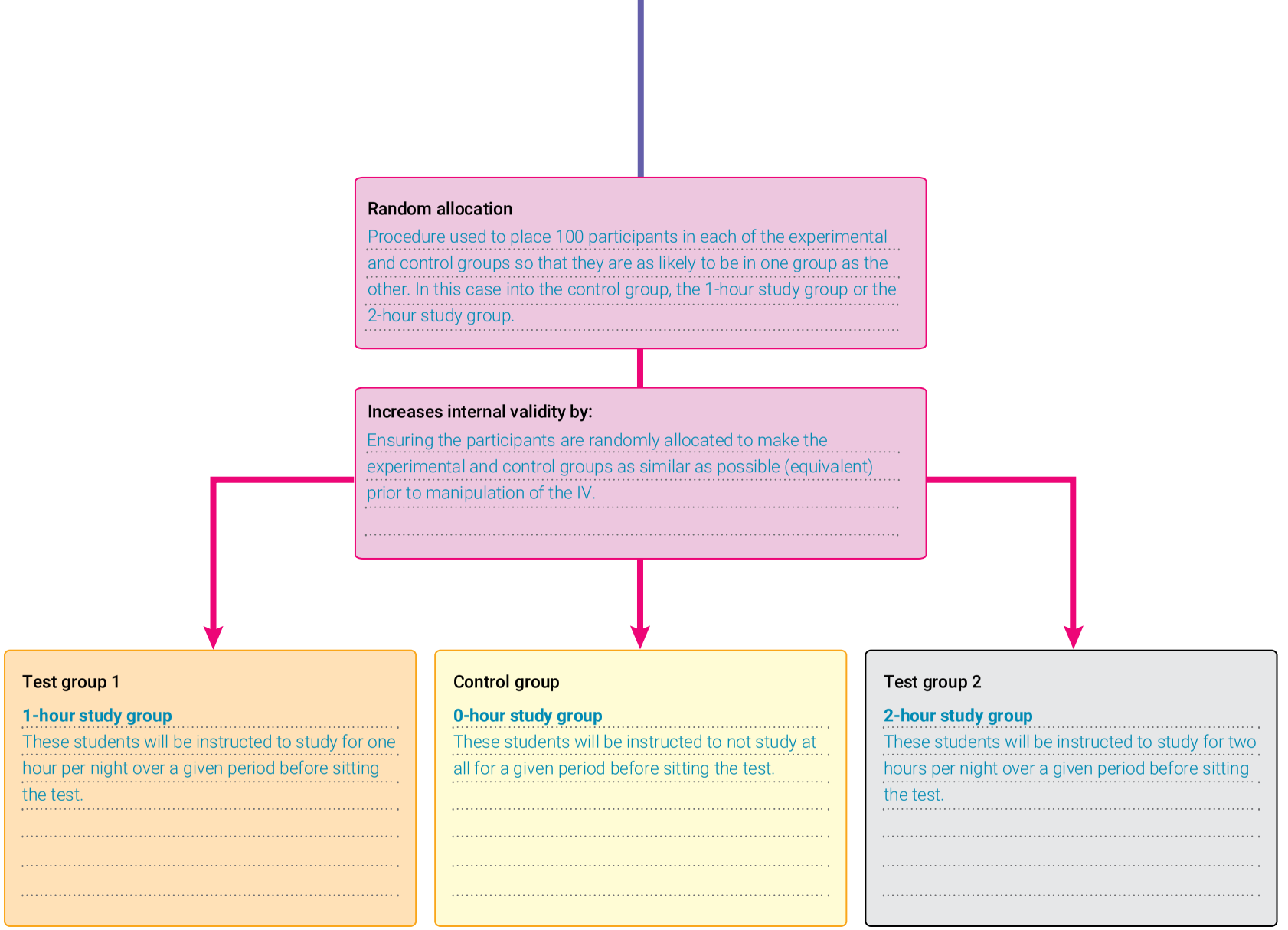
Subgroup of sample randomly allocated to be exposed to a predetermined level of the IV to determine its effect on the DV

Note: There can be multiple test groups within a single experiment.

Part B

Outline how you would design a controlled experiment using the flow chart provided, to test the effect of study (one or two hours per night) on VCE Psychology test performance.




Random allocation
Procedure used to place 100 participants in each of the experimental and control groups so that they are as likely to be in one group as the other. In this case into the control group, the 1-hour study group or the 2-hour study group.
Increases internal validity by:
Ensuring the participants are randomly allocated to make the experimental and control groups as similar as possible (equivalent) prior to manipulation of the IV.
Test group 1
1-hour study group
These students will be instructed to study for one hour per night over a given period before sitting the test.
Control group
0-hour study group
These students will be instructed to not study at all for a given period before sitting the test.
Test group 2
2-hour study group
These students will be instructed to study for two hours per night over a given period before sitting the test.

ACTIVITY 1.6

Comparing experimental research designs

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

Between subjects design

Key features:

Each participant is randomly allocated to one of the test groups or the control group if present.

Each participant is allocated to one group only.

Example:

Many answers are possible and should demonstrate that different groups are exposed to different experimental conditions.

Strengths of the design:

Because each participant is only allocated to one group, the experiment can usually be completed on one occasion so is time efficient.

Less likelihood for carry-over or order effects between conditions, such as boredom or fatigue, to influence subjects because subjects are only assigned to one group

Generally less participant attrition because experiment occurs within shorter time periods

Limitations of the design:

Generally requires a larger number of participants to help ensure the spread of participant variables within the sample will match the distribution within the population

Less control over participant variables than in other designs, especially when a small sample is used

Within subjects design

Each participant is used in all experimental conditions as well as the control if present. This means all of the groups are identical (same test subjects in each).

Example:

Many answers are possible and should demonstrate that the same group of test subjects is exposed to the different experimental conditions (repeated measures).

Strengths of the design:	**Limitations of the design:**
Can effectively control the unwanted influence of variables arising from individual participant differences	Susceptible to order effects because subjects are used repeatedly in all experimental groups
Requires a smaller number of participants compared to other designs because the same participants are used across all groups	Does not control for all participant-related variables, such as when test subjects 'guess' the aim of an experiment
	Participant attrition due to longer tie periods of involvement in the study

Mixed design

Key features:

Combines key features of both a between subjects design and a within subjects design.

Subjects are assigned to all experimental groups as well as the control group if it is present. This means each is exposed a level of the IV forming the between subjects component.

Subjects are also tested multiple times using a different test exploring a different IV. All subjects receive the same test regardless of which group. This forms the within subjects component of the design.

Example:

Many answers are possible but should demonstrate understanding that test subjects are exposed to different treatment conditions (between groups) but may also all be tested against another variable at different times (within groups).

Strengths of the design:

The researcher can capitalise on the strengths of both designs, using fewer participants but also providing a richer and more precise data set that can potentially explore the effects of two independent variables simultaneously with a single experiment.

Limitations of the design:

More complex design to design and execute.

Does not control for all participant-related variables, such as when test subjects 'guess' the aim of an experiment.

ACTIVITY 1.7

Analysing the features of a research design

A researcher decides to investigate the effect of caffeine ingestion on reaction time. She randomly selects 90 participants from a target population of people aged 18–50 years. She then allocates the participants into three equal test groups. Group 1 will ingest 300 mg of caffeine, Group 2 will ingest 600 mg of caffeine and Group 3 will be the control group and will ingest a placebo drink containing no caffeine. The researcher is also interested in how long the effects of caffeine last, regardless of the amount ingested. She decides as part of her experiment to test reaction times more than once. All subjects will be tested every 20 minutes following ingestion of caffeine over a duration of two hours. Her results are shown below:

	Time of reaction test	0 min	20 min	40 min	60 min	80 min	100 min	120 min
Test condition (average reaction time in milliseconds)	**0 mg caffeine group**	20	20	21	22	21	22	24
	300 mg caffeine group	20	17	16	17	18	20	22
	600 mg caffeine group	19	15	12	14	15	19	22

1 Identify the main independent and dependent variables in this experiment.

IV: Amount of caffeine ingested (mg)

DV: Reaction time (ms)

2 Write a suitable hypothesis for this experiment.

Subjects who consume higher concentrations of caffeine will have faster reaction times for a certain time period compared to subjects who consume less.

3 Identify the control group. Justify your response.

Control group: 0 mg caffeine group. This is the control group because they are not exposed to any level of ingestion of caffeine, which is the IV in this research.

4 Identify a secondary independent variable being investigated in this research and explain why it is considered a secondary independent variable.

Time after ingestion of caffeine. This is being applied to all test subjects and is not being manipulated by the researcher.

5 Identify the experimental design being used. Justify your response.

Mixed experimental design because it has both a between groups variable (level of caffeine) as well as a within groups variable (time since caffeine ingestion) being applied.

6 What aspect of the design is between groups? Justify your response.

The researcher has split the sample into three groups based on amount of caffeine consumed. Each of these groups is experiencing a different experimental condition so differences between them can be compared.

7 What aspect of the design is within groups? Justify your response.

Each group is tested against the IV (time since caffeine was ingested). This is a within groups design because it is focused on effects occurring within each group (using repeated measures).

8 What two factors might explain the increase in reaction time over the two hours for all groups?

It could be due to the level of caffeine wearing off for the caffeine ingestion groups but it may also be due to experimental fatigue or boredom.

9 Which group showed the strongest effect of caffeine on reaction time?

The 600 mg group.

10 Write a suitable conclusion for this experiment based on these results.

The results suggest that caffeine can decrease reaction times within an hour of ingestion. This decrease in reaction time appears to be more prevalent when higher doses of caffeine are consumed (600 mg compared to 300 mg). However, this effect appears short-lived. In this study this improvement appears to peak between 40–60 minutes but then increases in time. After two hours the improvement from caffeine appears to be completely negated and matches the control group.

Correlational studies

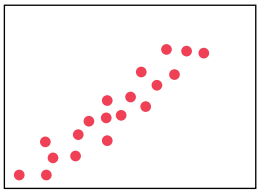
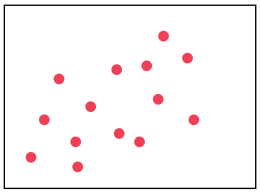
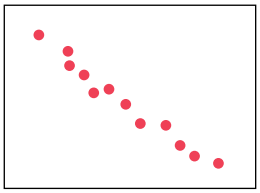
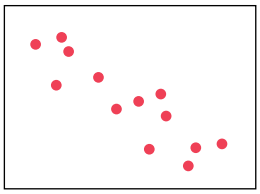
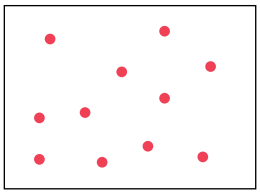
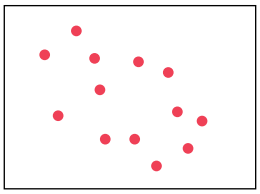
1 Complete the paragraph about correlational studies by filling in the missing words from the shaded panel.

volume	numeric	strength	primary
pattern	correlational coefficient	variables	positive
relationship	scores	investigate	causation
controlled	directly	height	evidence
control	direction	decimal	scatter plot

A correlational study is used to investigate the relationship between variables without any control over the setting in which the relationship occurs or any manipulation by the researcher. The researcher may collect primary data or analyse secondary data that already exists so long as they have a sufficient volume of data points that can then be mapped into a scatter plot. A scatter plot represents two different numeric values that correspond to two different variables of interest, such as height and body weight. A researcher can then examine the pattern or trend within the scatter plot to determine if there is evidence of a relationship. The strength of this relationship can be calculated using a statistical process that generates a correlational coefficient (*r* value). When calculated, this is expressed as a decimal number that can range from +1.00 to −1.00. The plus or minus sign describes the direction of the relationship between the two variables. A correlation coefficient with a plus (+) sign indicates a positive correlation. This means that high scores for one variable tend to go with high scores on the other, middle scores with middle scores, and low scores with low scores. A correlation close to 0.00 suggests no relationship exists between the variables. Correlations, however, do not show causation. They only indicate that a relationship may exist. Further controlled experiments are required to determine if one variable directly effects the other. Variables can increase or decrease together as a result of a third

variable influencing them both. For example, height and body weight might both increase or decrease in response to level of human growth hormone produced over a given time.

2 For each of the following scatter plots, decide if the degree of correlation is none, weak positive, weak negative, moderate positive, moderate negative, strong positive or strong negative.

 Strong positive	 Weak positive	 Strong negative
 Moderate negative	 None	 Weak negative

3 Explain why correlational studies can be very useful even though they do not show cause–effect relationships between variables.

They can be used to rule out variables or to identify other variables of research interest that might be involved.

They can help researchers to make predictions about possible relationships that *may* exist.

ACTIVITY 1.9

True/False quiz on correlational studies

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

	Statement	T/F
1	A correlational study is used to investigate relationships that exist between variables.	T
2	The researcher manipulates an IV to determine the effect on the DV.	F
3	The researcher cannot assign subjects to different experimental conditions.	T
4	Correlational studies often rely on previously gathered data but apply a different type of analysis to what may have been originally used.	T
5	Correlational studies cannot be based on primary data generated by the researcher.	F
6	Correlational studies provide only poor-quality evidence for researchers.	F
7	Correlational studies can be particularly useful when an experiment is impractical or unethical to perform.	T
8	Correlational studies are considered a non-experimental method.	T
9	A correlational study cannot confirm whether one variable causes a change in another variable.	T
10	In any correlational study there are only two possible relationships that can be detected.	F
11	It is possible to have a zero correlation (no relationship).	T
12	A positive correlation coefficient means that as one variable increased the other variable of interest decreased.	F
13	A correlation coefficient can be expressed as any value between −1 to +1.	T
14	A correlation coefficient value of −0.95 would indicate a very strong relationship exists.	T
15	A correlation value of 0.2 would suggest a fairly weak relationship between two variables.	T
16	A strong correlation might suggest there is a cause-and-effect relationship between two variables but it cannot prove that it in any way.	T
17	Many variables that appear correlated are in fact linked to a third variable the researcher may not have contemplated.	T
18	A correlational study can rule out some variables that are not of influence.	T
19	Correlations can help researchers form accurate predictions about relationships between variables.	T
20	Correlational studies cannot indicate patterns or trends in data.	F

ACTIVITY 1.10

Identifying key features of some types of self-reports

For each statement relating to types of self-reports, tick the boxes that apply. More than one box may be ticked for any statement.

	Statement	Structured interview	Unstructured interview	Questionnaire	Focus group
1	These are the most commonly used self-report methods.	✔		✔	
2	Involves a small set of people who share characteristics and are selected to discuss a topic				✔
3	A research tool used when responses are required from a large number of people			✔	
4	More like a discussion where questions may be generated spontaneously		✔		
5	A leader will guide the discussion but still allow free-flowing conversation		✔		
6	The questions may require participants to rank something by selecting from a number of items			✔	
7	Uses fixed-response type questions	✔		✔	
8	Participants are encouraged to share points of view and personal experiences and to comment on each other's opinions				✔
9	This tool often uses a Likert scale to apply a numerical scale to levels of response			✔	
10	The conversation is highly flexible and may even be led by the participant		✔		
11	A written set of questions designed to draw out self-reported information			✔	
12	A key factor relating to this type of information gathering is the emphasis on people interacting in a group situation.				✔
13	A facilitator will deliberately use open-ended questions to promote more free flowing, broader responses.	✔	✔		✔
14	Participants are asked specific, pre-determined questions that limit their response choice.	✔			
15	Sessions tend to be relaxed, in comfortable surrounds and may last for hours				✔

ACTIVITY 1.10 *continued*

	Statement	Structured interview	Unstructured interview	Questionnaire	Focus group
16	Often used as part of a survey with a particular research focus			✔	
17	These groups are generally easy to organise and provide a rich source of relevant information.				✔
18	Being asked, 'Do you have a driver's license?' would be an example of this.	✔		✔	
19	A highly efficient way of gathering and summarising data from a large group of respondents			✔	
20	Information gathered this way is likely to be rich in detail but more difficult to analyse.		✔		

ACTIVITY 1.11

Describing the key considerations of conducting observational studies

Complete the following graphic to describe the considerations of conducting observational studies.

Observational studies
Definition
The collection of data by carefully watching and recording behaviour as it occurs without any intervention or manipulation of the behaviour being observed

Data collection

Structured

When a prepared system, such as checklist of specific behaviours to look for, is used

Unstructured

When observations are made without any predetermined format in mind

Settings

Natural

When the researcher watches and records behaviour in a real life environment without any controls or artificial manipulations

Contrived

When the researcher creates a specific controlled environment for the purpose of observation, such as a laboratory or other artificial setting

Observations (sampling types)

Event

When a researcher focusses on one or more specific types of behaviour only

Time

When observations are made for a given time taken at regular intervals

Individual

When a researcher focusses on a single individual or group while ignoring all others during a given time period.

Researcher participation

As participant

When the researcher studies a group by joining it as a member. This may be done overtly or covertly.

As non-participant

When the researcher tries to conceal their presence so that their observations are made in an entirely inconspicuous manner.

Strengths of observational studies:

- Can make observations about natural behaviours without the need for interventions or variable manipulations
- Less likely to produce demand effects than laboratory experiments
- Information gathered can be more accurate than in contrived settings or when gathered through self-reports
- Can study behaviours that would otherwise be considered unethical or impractical in any other circumstance

Limitations of observational studies:

- Can be time-consuming waiting for specific examples of target behaviour to occur
- Can raise the issue of informed consent because it may be impossible to obtain in naturalistic observational studies
- Cause of behaviour cannot be established because of lack of controlled variables
- Sampling can be unrepresentative due to the nature of the setting and who is present, limiting how widely the results can be generalised
- Possible observer bias due to researchers unconsciously distorting what they see so that it resembles what they hope to see

ACTIVITY 1.12

Thinking about case studies

1 Define 'case study'.

An intensive, in-depth investigation of some behaviour, activity, event or problem of interest in a single individual, group, organisation or situation

2 For each of the following different types of case studies, provide a brief description and an example either from psychology research or that you invent yourself.

Type of case study (provide a description)	Example (provide an illustrative example)
Focus on one person The study of a single individual, compiling information from a variety of sources	e.g. Study of Henry Molaison focused on memory loss linked to brain injury
Focus on a group The study of a single distinctive set of people, such as a family or small group	e.g. Study of a group of carers who are looking after a family member suffering mental illness, focusing on the impacts to their lives
Focus on an organisation The study of a single organisation or company and the way that people act within it	e.g. Study of cult such as Jonestown focusing on how it formed and factors that led to obedience

Type of case study (provide a description)	Example (provide an illustrative example)
Focus on an activity The study of the process or program or initiative in a group or organisation	e.g. Study of the effectiveness of a drug intervention program that seeks to help prevent young people from being harmed
Focus on a problem The study of particular issue or problem facing a group, community or organisation	e.g. Study of homelessness within a particular local area focusing on its causes and possible interventions
Focus on an event The study of a particular event. These could be social, a natural disaster, an organised event, etc.	e.g. Study of people involved in the NSW flooding in 2021 focusing on community resilience, etc.
Focus on a location The study of a particular place and the way that it is being used, etc.	e.g. Study of how a local park is currently being used and how local people feel it could be improved in the future

3 Outline the strengths and weaknesses of case studies.

Strengths of case studies:

Permit studies that would be unethical in a laboratory situation; avoid artificiality; can be conducted over time to observe changes that occur slowly; can be a valuable source of hypothesis for future research; can provide highly detailed information

Weaknesses of case studies:

Cannot be used to establish cause-effect relationships; do not use controls so do not allow for manipulation of an IV; difficult to generalise due to small sample size and often sampled by convenience; data can be difficult to analyse and report because much of it can be qualitative in nature; can rely on self-reported data, which is less objective than experimental data

ACTIVITY 1.13

Simulation studies

Select terms from the shaded panel below to correctly complete the passage. A term should be used only once.

ethically	similar	access	behave	realistic
physiological	observed	actions	harm	obedience
resemble	situations	unethical	reproduce	dangerous
artificiality	cost-effective	test	lack	generalising
mental	virtual reality	computer	heart-rate	features

A simulation study involves reproducing ..situations.. of research interest in a ..realistic.. way to investigate the behaviour and ..mental.. processes of individuals in that environment. This is done when a researcher cannot gain ..access.. to a particular setting or because it may be too risky, ..dangerous.. or ..ethically.. unacceptable. Examples of such settings can include jury rooms, aircraft cockpits facing distress, prison environments and surgical wards.

In a simulation study, the ..test.. situation is set up to ..reproduce.. as closely as possible all of the ..features.. that would exist if it were real. Participants are then asked to ..behave.. as authentically the same as they believe they would in a ..similar.. real situation. Participants are then ..observed.. carefully during the simulation period. These observations can include behavioural, ..physiological.. and psychological measures such as breathing rate, ..heart-rate.., decision-making and ..actions.. taken.

ACTIVITY 1.13 *continued*

Modern simulations can employ computer and camera technology as well as virtual reality to artificially recreate situations that closely resemble real experiences without subjecting participants to any form of harm. Several classic psychological experiments such as Stanley Milgram's obedience experiments of the 1960s have been recreated using VR technology.

The main advantage of simulation studies is they can be used to conduct cost-effective experiments in environments researchers would normally be unable to access. They can also facilitate virtual experiments that would otherwise be unethical or unsafe. This enables researchers to run investigations that would ordinarily be impossible.

The main disadvantage of simulation studies is they can lack realism. This means the extraneous variable of artificiality can make generalising the results more difficult to the real world.

ACTIVITY 1.14

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 is used only once.

case study	correlational study	laboratory experiment	observational study
self-report	between subjects	within subjects	mixed design
focus group	simulation study		

Example study	Research method used
1 A group of teenagers are asked to talk to marketing researchers about their leisure preferences on weekends.	focus group
2 A shopper is sent a text message asking them to fill in a survey about their satisfaction with a store they purchased from.	self-report
3 A group of young children are carefully observed at an early learning centre to study how often they talk to each other. An observer sits quietly recording the interactions in her notebook.	observational study
4 A researcher data on voting preferences with residential areas to look for patterns in voting behaviours.	correlational study
5 Subjects are divided into three different groups. Group 1 are given a placebo treatment. Group 2 are given a 100 mg dose of a medication. Group 3 are given a 300 mg dose of the same medication. All subjects are then monitored for improvement in health.	between subjects

ACTIVITY 1.14 *continued*

Example study	Research method used
6 Subjects are given three levels of treatment over three days. One level is given to all subjects each day. On day 1 they are given a placebo treatment. On day 2 they are given a 100 mg dose of a medication. On day 3 they are given a 300 mg dose of the same medication. On each day, the subjects were monitored for improvement in health.	within subjects
7 A person who is recovering form a specific brain injury that damaged her frontal lobe consents for a researcher to test her on a range of cognitive abilities including decision making and problem solving.	case study
8 A pilot is re-trained to fly a new aircraft using virtual reality software.	simulation study
9 An independent variable (amount of daily exercise) is carefully measured against a dependent variable (resting heart rate) over a period of 6 months with a group of 50-year-old adults. Other relevant variable are controlled.	laboratory experiment
10 Subjects are divided into three different groups. Group 1 are given a placebo treatment. Group 2 are given a 100 mg dose of a medication. Group 3 are given a 300 mg dose of the same medication. All subjects are then monitored for improvement in health. In each group, the researcher made sure there was an even balance of males and females. This meant that, as well as observing the affect of the dose on health benefits, he could also examine if there were any gender differences in the level of effect.	mixed design

ACTIVITY 1.15

Types of error

Complete the concept diagram relating to types of error in research by filling in the boxes.

Error in research

Definition of error:
The difference between the observed or calculated value and the perceived true or expected value

Different types

Random
Definition:
Error caused by chance factors or the influence of uncontrolled or participant-related variables

Examples:
personality type, health status, motivation, mood, alertness, education, etc.

Influence can be minimised by:
Setting up better control of anticipated extraneous variables, using random allocation or taking more measurements

Reported in research? Yes/No
Yes

Personal
Definition:
Human error caused by carelessness, mistakes or miscalculations made by the researcher

Examples:
calculating incorrectly, misreading a score, using the wrong formula to calculate a score, running late or out of time, etc.

Influence can be minimised by:
Repeating measurements and taking greater care or by adopting data logging techniques to reduce human error

Reported in research? Yes/No
No

Systematic
Definition:
Error caused by flaws in the research design or equipment or due to sampling bias

Examples:
sampling bias, poorly calibrated equipment, allocation error, order effects, etc.

Influence can be minimised by:
Trying to identify and predict the source of the bias (e.g. human, equipment calibration or sampling) and then rectifying it by adjustment or change of procedure

Reported in research? Yes/No
Yes

ACTIVITY 1.16

Understanding the difference between concepts relating to experimental analysis

For each of the following, explain the difference between the two concepts.

What is the difference between…
. . . systematic and random error? Systematic error is caused by flaws in the research design or equipment, or by sampling bias, whereas random error is caused by chance factors or the influence of uncontrolled or participant related variables.
. . . error and uncertainty? Error refers to the difference between the observed or calculated value and the perceived true or expected value, whereas uncertainty is an indication of the range of values the researcher expects the true value to lie within based on how certain they are of their methods of measurement.
. . . precision and accuracy? Precision refers to how closely a set of measurement values agree with each other without regard to how close the measurements are to the believed true value, whereas accuracy relates to how close the researcher believes their value is to the believed 'true' value of the quantity being measured.

. . . correlation and causation?

A correlation indicates the strength of a relationship between two variables based on how much they vary with each other. Causation refers to the level of effect one variable has on another variable (i.e. to what extent it 'causes' the change).

. . . an experiment and a simulation?

An experiment is when an independent variable is systematically changed to determine its effect on a dependent variable under controlled conditions, whereas a simulation involves reproducing a situation of research interest in a realistic way to investigate the effects of that situation on psychological and behavioural processes.

. . . an observational study and a case study?

An observational study involves collection of data by carefully watching and recording behaviour as it occurs without any intervention or manipulation of the behaviour being observed. A case-study is an intensive, in-depth investigation of some behaviour, activity, event or problem of interest in a single individual, group, organisation or situation.

...an extraneous variable and a confounding variable?

An extraneous variable is a variable other than the IV that may cause a change in the DV and therefore may affect the results. A confounding variable is a type of extraneous variable, other than the IV, that has an effect on the DV that cannot be separated from that of the IV. Confounding variables make it difficult for the researcher to make any conclusions about the effect of the IV with confidence.

...particpant variables and situational variables?

Participant variables are any sort personal characteristics that the participants bring to an experiment that can influence their response. These can be biological, psychological or social in nature. Situational variables are external factors (other than the IV) associated with the experimental setting that may influence participant responses and therefore the results. Situational variables can include the physical features of the immediate environment such as its size and lighting conditions, background noise, time of the day, air temperature and presence or absence of other participants.

...single blind procedures and double blind procedures?

Single blind procedures keep participants unaware of the condition of the experiment they have been assigned to. They are unaware of whether they are in the control or experimental condition/s. Double blind procedures keep both the participants as well as the researcher unaware of which participants have been allocated to the control or experimental conditions. This procedure requires a further researcher who is removed from the actual research situation.

ACTIVITY 1.17

Identifying types of error

Consider each error in the left-hand column of the table. Assume the error impacts on the results. For each, tick the column to indicate whether you think it is a systematic, random or personal error. Then, identify your own examples that illustrate each type of error. Compare with a classmate to test each other.

Source of error	Random	Systematic	Personal
A high school student tries to record reaction time by allowing a ruler to drop through their fingers.	✔		
A cheap thermometer is used in a high school chemistry class to measure water temperature.		✔	
A high school student reads the thermometer by looking at the level of red alcohol against a printed scale in degrees Celsius.		✔	✔
Students time how long it takes their friend to run 100 m using a hand-held stopwatch.	✔		
A student realises after completing their experiment that the way they calculated the average was incorrect and included only half of their data set.			✔
A student rushing their experiment using an online speed and accuracy test makes many more mistakes than they should if they took more time to complete the task properly.			✔
A baker measures out how much water to add to her dough mix by using an industrial scale that is calibrated each year.		✔	
The same baker uses a small bucket to scoop the right volume of flour into the cooking mix.	✔		✔
One judge at a swimming carnival seems to give scores consistently lower than the other judges.			✔
A researcher misreads data while typing the entries from a handwritten data sheet.			✔
A heart rate monitor measure pulse through a sensor attached on the end of a finger.	✔	✔	
Example:			
Example:			
Example:			

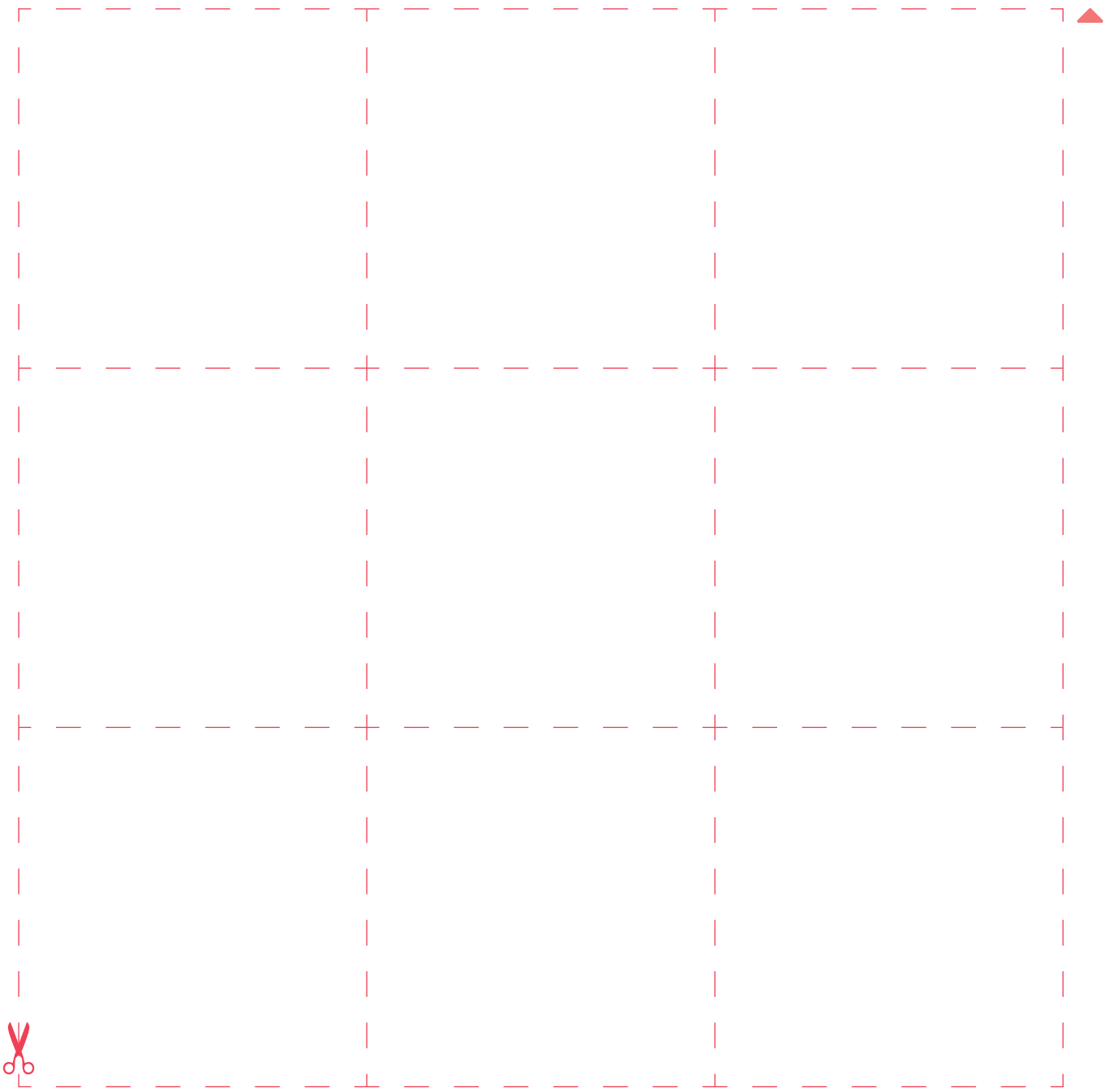
Types of extraneous variables

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

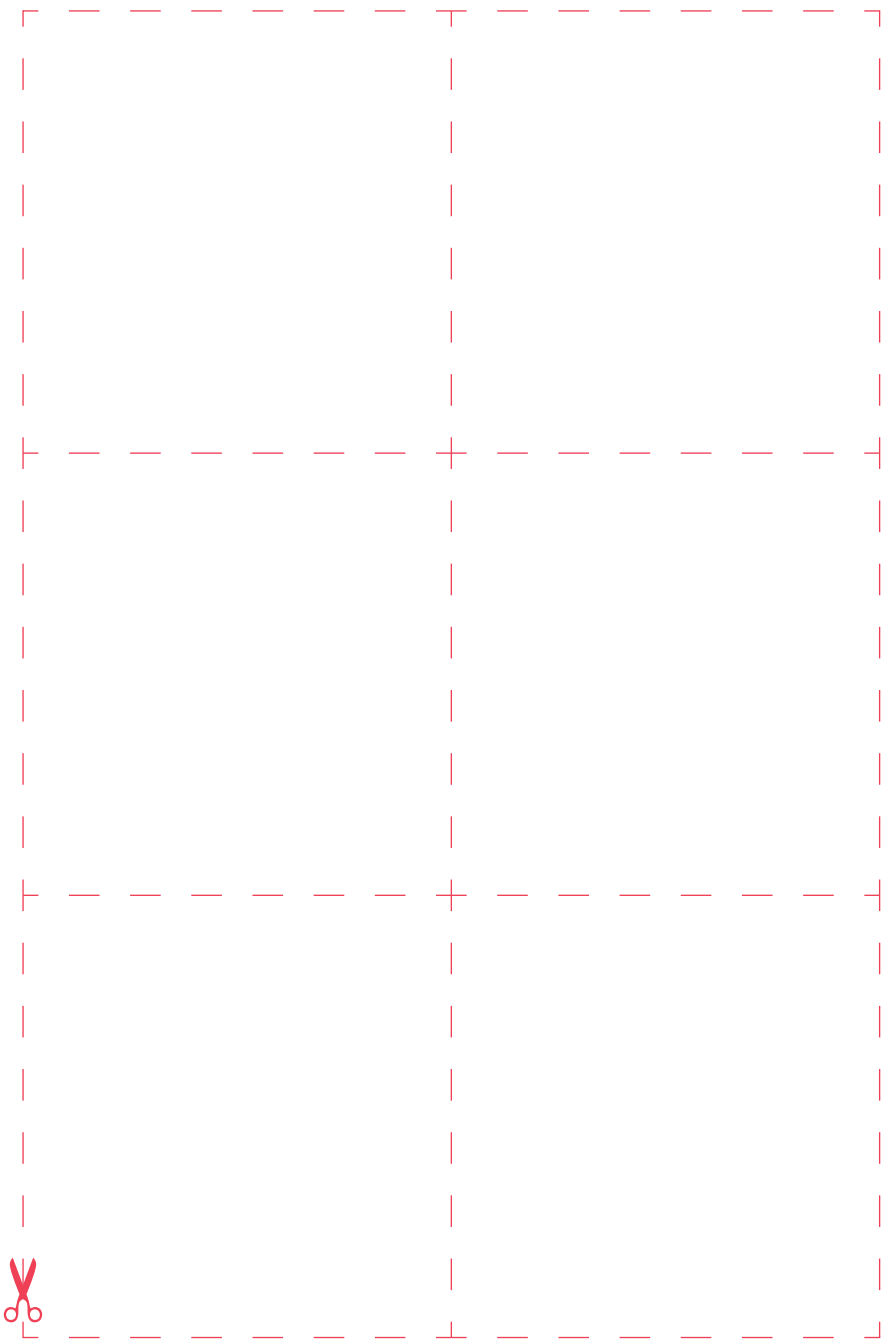
Type of extraneous variable	Description	Example/s	Control/s
Participant variables	The personal characteristics that the individual participants bring to an experiment	Emotional state, level of motivation, level of intelligence, memory, reading skills, gender, age, sleep patterns, etc	Random sampling, random allocation, using a within subject experimental design so that each participant is exposed to all experimental conditions
Situational variables	External factors associated with the experimental setting that can influence participant responses and therefore the results	Physical features of the environment such as lighting, background level of noise, time of day, presence or absence of other participants, presence or absence of the researcher, instructions given to participants, temperature, etc	Try to predict and eliminate as many environmental factors as possible that could influence the results. Holding as many environmental factors as constant as possible. Use randomisation procedures to change the order participant's progress through an experiment. Use counterbalancing in repeated measures (within subject) designs.
Demand characteristics	Cues in an experiment that may influence or bias a participant's response (suggest the response that is expected) thereby distorting the results	Any kind of stimulus, event or object present during an experiment that serves to guide participant behaviour. Examples may include certain background noises, phrases uttered by the experimenter, changes in lighting or gestures by laboratory assistants, etc	Withholding information that helps to prevent test subjects from guessing the true nature of an experiment such as the use of deception. Using single blind or double blind procedures so that participants remain less aware of experimental conditions. Use of standardised procedures.

Type of extraneous variable	Description	Example/s	Control/s
Experimenter effects	Personal characteristics of the experimenter and their specific behaviours during an experiment that can influence how a participant responds or experimental mistakes made after completion of the experiment thereby distorting the results	Includes experimenter interaction with participants, unintentional errors made when making observations or measuring responses or when analysing data. Treating participants differently depending on which experimental group they belong or changes in the body language of the researcher.	The use of single blind or double blind procedures to prevent the experimenter form knowing which experimental group they are interacting with. Also by using automated data collection processes to increase objectivity of recording.
Placebo effect	When there is a change in a participant's behaviour due to their belief that they are receiving some kind of experimental treatment and they respond in accordance with that belief, rather than to the effect of the IV	Participants changing their behaviour or self-reported data because they believe they are in the experimental condition of an experiment. Examples can include improved self-reported health scores due to belief they have been given an active medication treatment.	Controlled by using a placebo group. This means giving the control group a fake treatment that looks and feels exactly the same as the real treatment but has no known effect. Also using a single blind procedure to keep participants unaware of to which experimental condition they belong.

Withholding information that helps to prevent test subjects from guessing the true nature of an experiment such as the use of deception. Using single blind or double blind procedures so that participants remain less aware of experimental conditions. Use of standardised procedures.	Cues in an experiment that may influence or bias a participant's response (suggest the response that is expected) thereby distorting the results
The use of single blind or double blind procedures to prevent the experimenter form knowing which experimental group they are interacting with. Also by using automated data collection processes to increase objectivity of recording.	Participants changing their behaviour or self-reported data because they believe they are in the experimental condition of an experiment. Examples can include improved self-reported health scores due to belief they have been given an active medication treatment.
Physical features of the environment such as lighting, background level of noise, time of day, presence or absence of other participants, presence or absence of the researcher, instructions given to participants, temperature, etc	Emotional state, level of motivation, level of intelligence, memory, reading skills, gender, age, sleep patterns, etc
	Any kind of stimulus, event or object present during an experiment that serves to guide participant behaviour. Examples may include certain background noises, phrases uttered by the experimenter, changes in lighting or gestures by laboratory assistants, etc
	Controlled by using a placebo group. This means giving the control group a fake treatment that looks and feels exactly the same as the real treatment but has no known effect. Also using a single blind procedure to keep participants unaware of to which experimental condition they belong.
	Personal characteristics of the experimenter and their specific behaviours during an experiment that can influence how a participant responds or experimental mistakes made after completion of the experiment thereby distorting the results

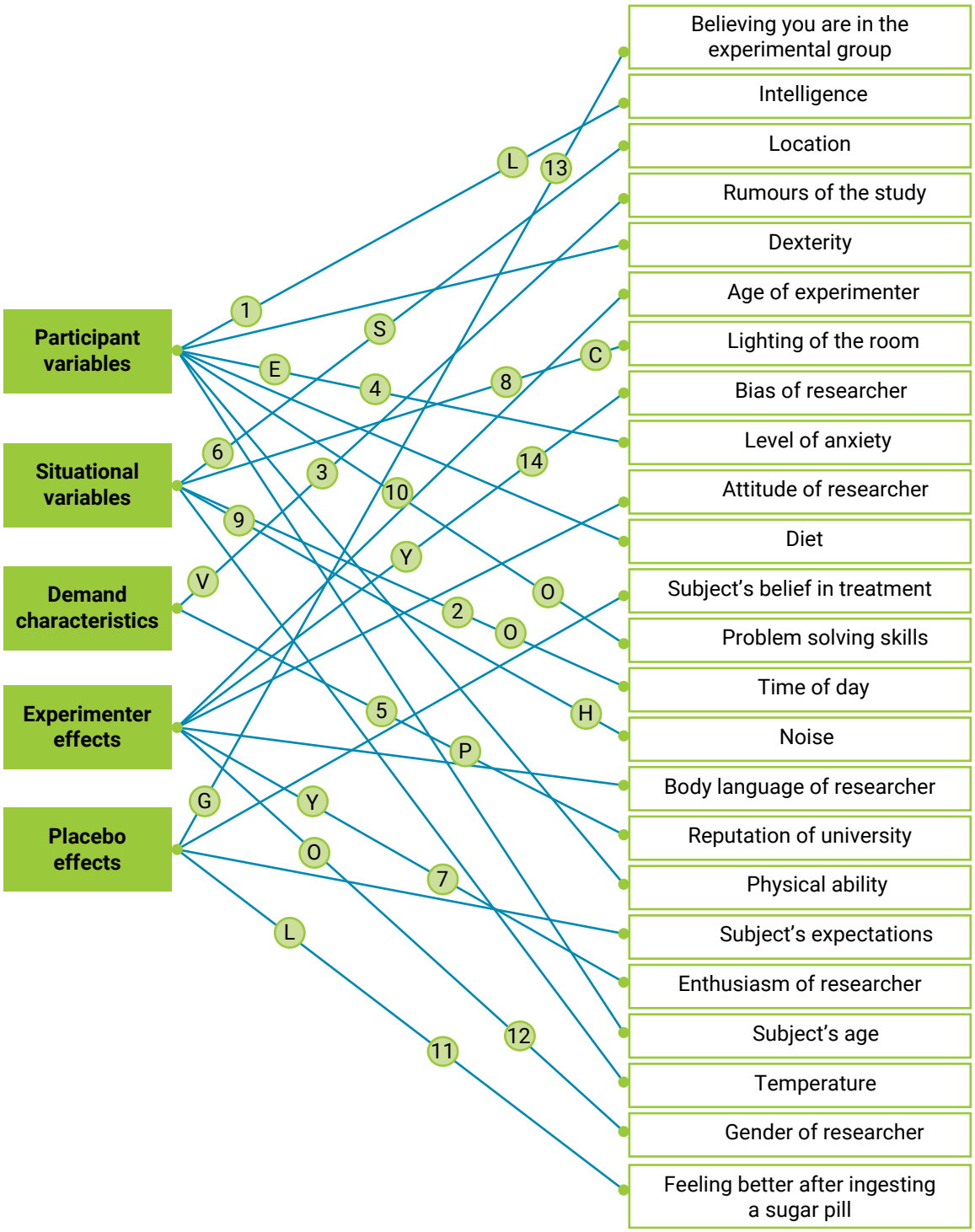


The personal characteristics that the individual participants bring to an experiment	Try to predict and eliminate as many environmental factors as possible that could influence the results. Holding as many environmental factors as constant as possible. Use randomisation procedures to change the order participant's progress through an experiment. Use counterbalancing in repeated measures (within subject) designs.	When there is a change in a participant's behaviour due to their belief that they are receiving some kind of experimental treatment and they respond in accordance with that belief, rather than to the effect of the IV
External factors associated with the experimental setting that can influence participant responses and therefore the results	Random sampling, random allocation, using a within subject experimental design so that each participant is exposed to all experimental conditions	Includes experimenter interaction with participants, unintentional errors made when making observations or measuring responses or when analysing data. Treating participants differently depending on which experimental group they belong or changes in the body language of the researcher.



Types of extraneous variables

Using a ruler, draw lines to match the type of extraneous variable to the correct examples on the right. Some lines will transect both a number and a letter. Write the correct letters beside the numbers in the grid at the bottom of the page to reveal a message.

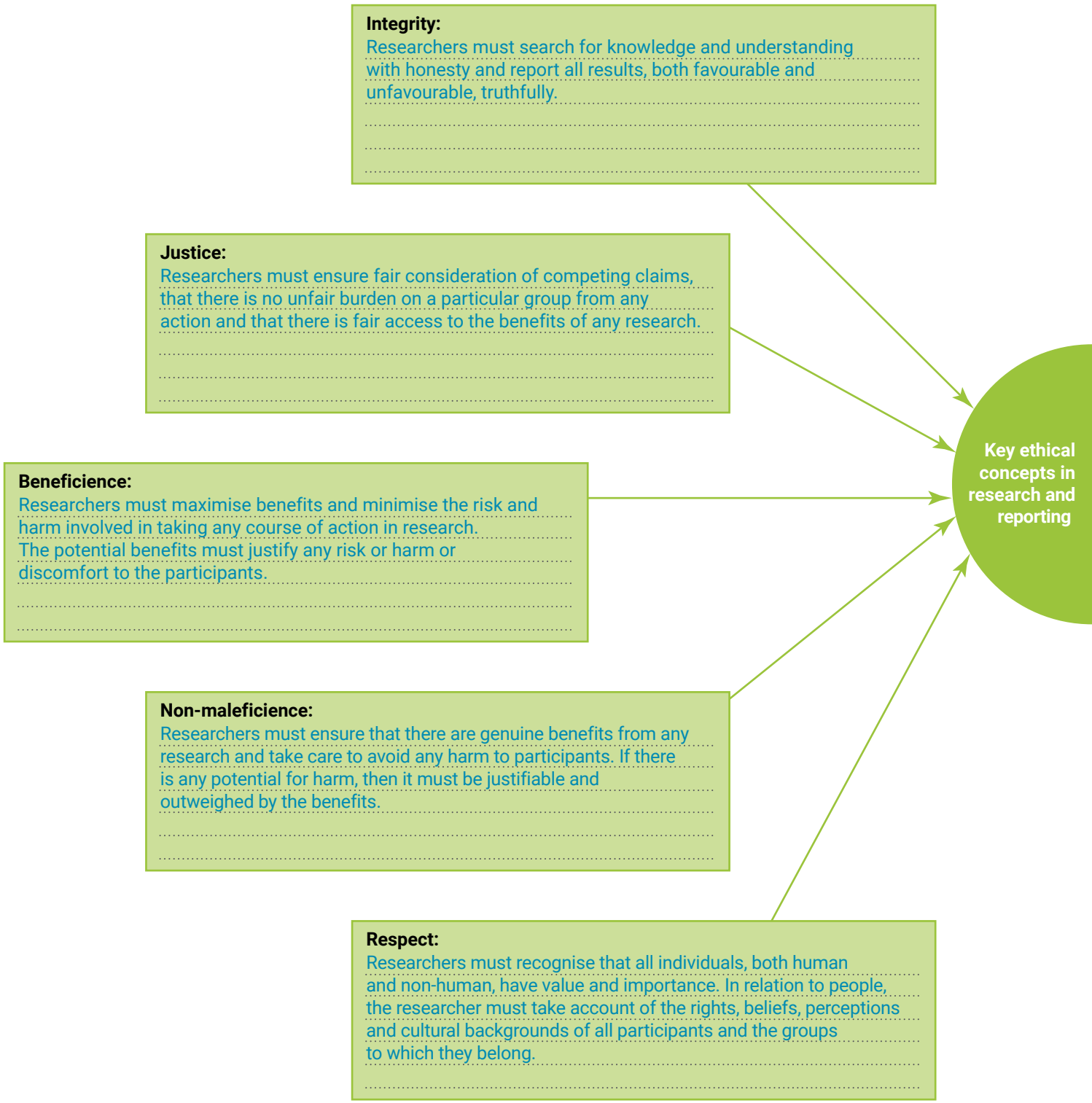


L	O	V	E	P	S	Y	C	H	O	L	O	G	Y
1	2	3	4	5	6	7	8	9	10	11	12	13	14

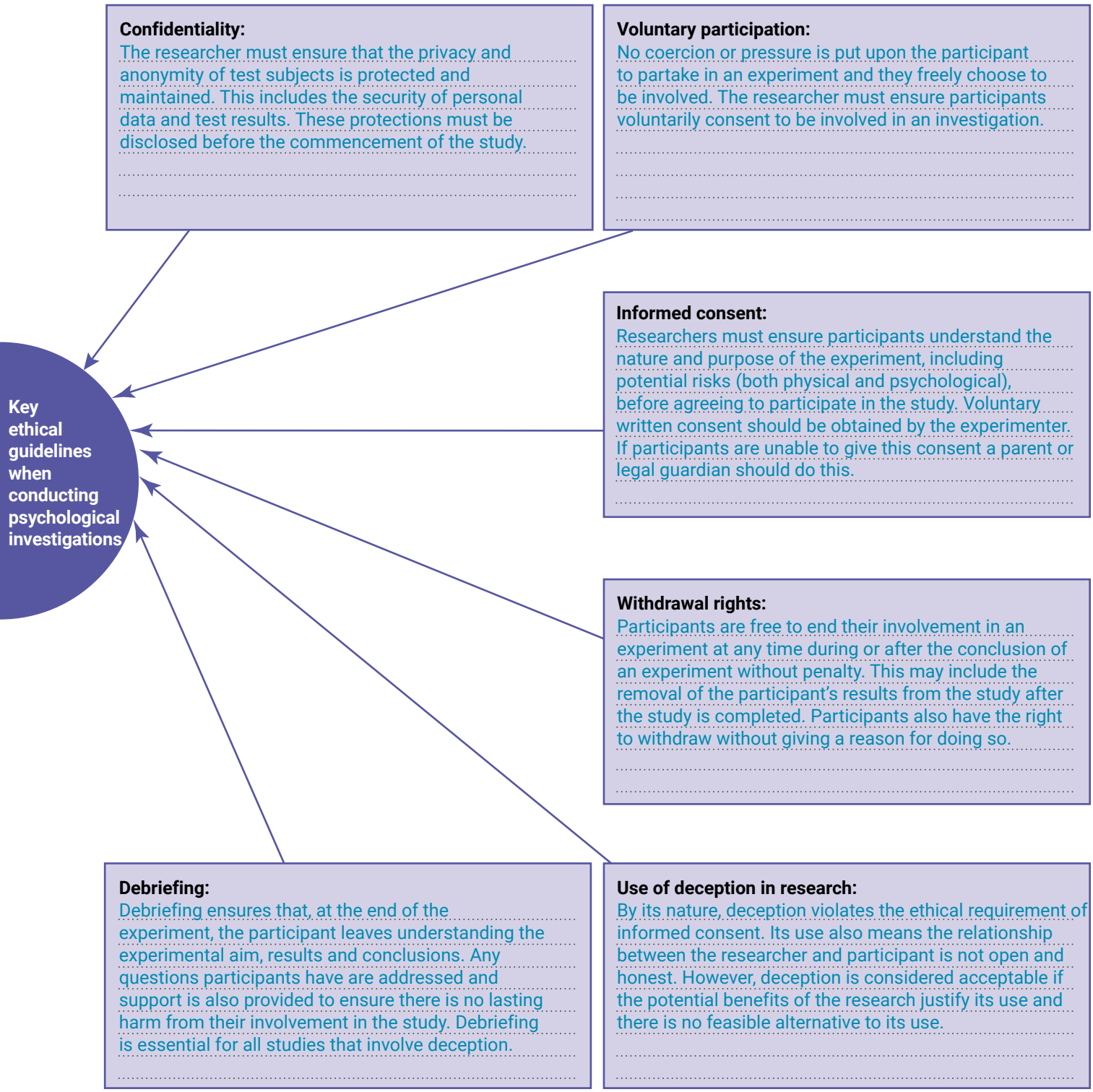
ACTIVITY 1.20

Summarising ethical concepts and guidelines

1 Fill in the panels to complete the chart summarising the five key ethical concepts that apply to research.



2 Fill in the panels to complete the chart summarising the six key ethical guidelines that must apply to psychological research.



ACTIVITY 1.21

Classifying ethically appropriate conduct for psychological research

The National Statement on Ethical Conduct in Human Research (2007) was devised to 'promote ethically good human research'. This comprehensive document is organised around five values that should guide the design, review and conduct of all research with people. Tick the value that best reflects each ethical concept.

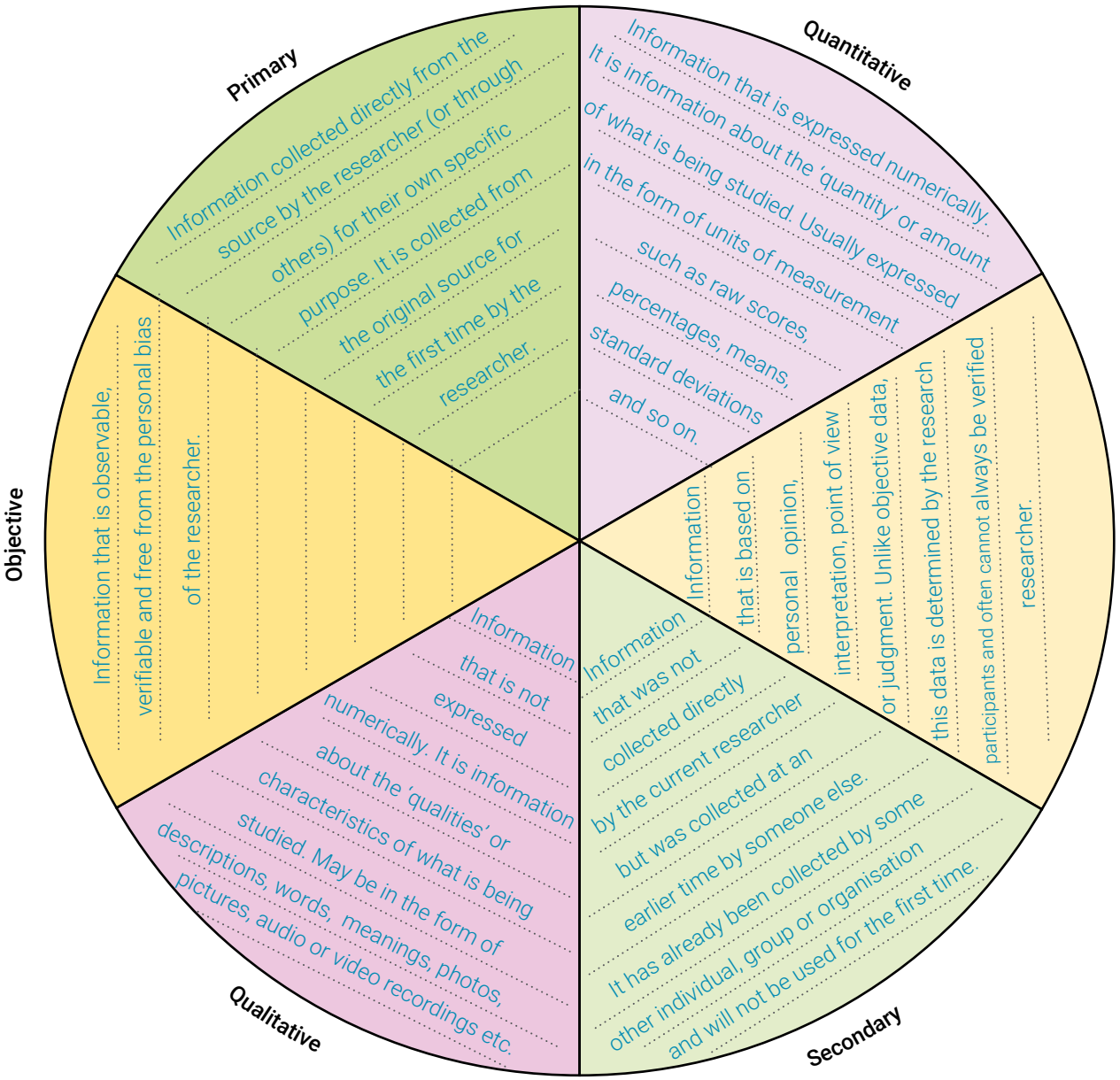
Ethical concept	Integrity	Justice	Beneficence	Non-maleficence	Respect
1 The research must be carried out with a commitment to following all ethical standards.	✔				
2 The research must have potential benefits to participants or the wider community.			✔		
3 The researcher should avoid continually imposing on the same people to participate in their investigation when other suitable participants are available.		✔			
4 The researcher must understand and accept that informed consent is required from all participants regardless of their age or any other personal characteristic.					✔
5 The research must be carried out honestly.	✔				
6 The potential benefits of the research must justify any risks of potential harm to participants.			✔		
7 The researcher must recognise and take account of the rights, beliefs, perceptions and cultural backgrounds of all participants.					✔
8 The research outcomes should be made accessible to participants in a way that is timely and clear.		✔			
9 The research must be carried out and supervised by someone with the expertise that is appropriate for the research.	✔				
10 The researcher must allow any participant to opt out of the research whenever they want to without giving any reason.				✔	
11 The researcher should be focused on achieving good outcomes from their research.			✔		
12 The researcher must not withhold any unfavourable results.	✔				

Ethical concept	Integrity	Justice	Beneficence	Non-maleficence	Respect
13 The researcher must understand and accept that all participants have a right to privacy.					✔
14 The researcher must ensure personal information about participants is protected from loss, misuse and unauthorised access.					✔
15 The researcher must ensure that the costs and benefits of the research are fairly distributed.		✔			
16 The researcher must accurately report all results.	✔				
17 The researcher must properly consider and not overlook the cultural backgrounds and sensitivities of the participants.					✔
18 All participants should be debriefed if the research has unavoidably required that they be deceived about its true purpose or some other aspect.				✔	
19 Whenever possible, the research should be based on a thorough study of the current literature, as well as previous studies.	✔				
20 Where the risks to participants are no longer justified by the potential benefits of the research, the research must be suspended to allow time to consider whether it should be discontinued or at least modified.				✔	

ACTIVITY 1.22

Identifying different types of data

1 Explain the difference between the different types of data by writing in the different segments.



ACTIVITY 1.22 *continued*

2 For each statement below, indicate the segments of the circle that best describe the type of data described and then add two of your own.

Statement	Type of data					
	Primary	Secondary	Qualitative	Quantitative	Objective	Subjective
A researcher collects water samples and tests them for purity	✔			✔	✔	
A volunteer is asked to taste-test water by drinking several different samples	✔		✔			✔
Students fill in a school satisfaction survey using Likert scales from 1–10	✔			✔		✔
A university student writes a report on economic growth based on government data she has researched		✔		✔	✔	
A doctor looks at EEG (brainwave) data to determine a patient's state of consciousness	✔			✔	✔	
A scientist collects rain gauge data from local farmers dating back 20 years and correlates it with verbal recounts of the weather based on the farmer's memory		✔		✔		✔
The federal government collects survey data from every household in Australia every four years	✔			✔		✔
A teacher reviews how well her class performed on the last unit test they completed	✔			✔	✔	
A school reviews all of the test data collected by teachers to evaluate the effectiveness of its teaching programs		✔		✔	✔	
Customers entering a shopping centre are asked why they are shopping there as part of marketing research	✔		✔			✔
.....						
.....						
.....						
.....						

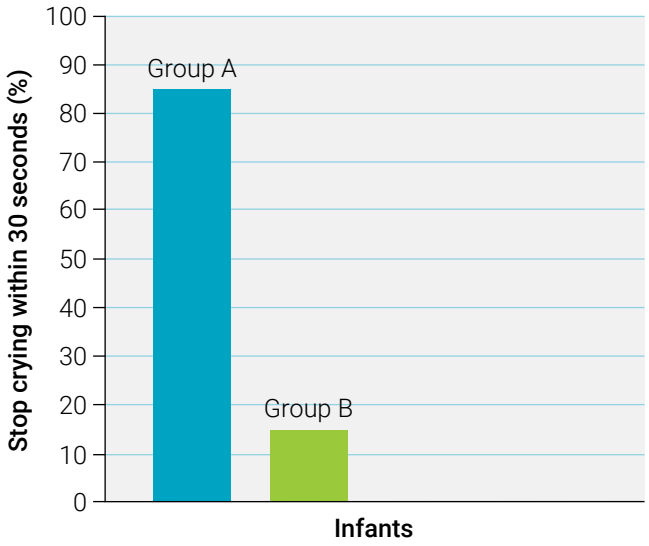
ACTIVITY 1.23

Evaluation of research scenarios

Read each scenario and 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 a 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 stopped 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.

1 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

2 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.

3 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).

4 Identify the type of research design

independent groups

5 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).

6 Explain whether the conclusion drawn by the researcher is justified.

Explanation should refer to:

- the researcher's conclusion
- specific results that 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 1.24

Repeatability, reproducibility and validity in research

Select terms from the shaded panel below to correctly complete the paragraph about repeatability, reproducibility and validity. Each term should be used only once.

accurately	repeatability	reproduceable	operationalise	validity
external validity	similar	characteristics	automated	changed
internal validity	sample	repetitions	measure	variable
evaluated	replicated	results	conditions	stable
different	target	objectively	quality	procedures
extraneous variables	human error			

The goal of research is to obtain results that are repeatable, reproduceable and valid. Repeatable refers to the degree to which a specific research investigation obtains similar results when it is conducted again under the same conditions and on all occasions. Reproducibility refers to how close the results are to each other when an investigation is replicated under changed conditions such as by a different researcher. Validity refers to the extent to which a measure accurately measures what it claims to measure. For example, an IQ test should measure human intelligence and nothing else. It should also accurately measure this construct as objectively as possible. The quality of research can be evaluated in terms of the levels of repeatability, reproducibility and validity achieved on a scale from low to high. Higher quality research produces data that is accurate, dependable and remains stable over numerous repetitions of the experiment. Avoiding human error, ensuring experimental procedures are clear and using automated forms of data collection are ways of increasing experimental repeatability and reproducibility. Highly valid research means that the study has produced results that accurately measure the variable they claim to measure. This means researchers must carefully

ACTIVITY 1.24 *continued*

operationalise variables so they can be measured as objectively as possible while also defining the behaviour or mental processes very accurately. Controlling extraneous variables as much as possible, designing experiments to reflect the real world and selecting samples that accurately reflect the characteristics of the target population are ways of increasing experimental validity. Internal validity refers to the extent to which an investigation actually investigates what it claims to be measuring. External validity refers to the extent to which the results obtained in a study can be applied beyond the sample from which they were generated. It is important to note that a scientific measure can be reproduceable even though it is not valid, but a measure cannot be valid unless it is also repeatable and reproduceable.

ACTIVITY 1.25

Thinking about repeatability, reproducibility, internal validity and external validity

For each of the following statements relating to research, tick the boxes that indicate what aspects of the research will be most improved. More than one box may be ticked.

	Statement	This will increase... Repeatability	Reproducibility	Internal validity	External validity
1	Replacing human taste testing with chemical analysis to determine the level of sweetness in a particular food product	✓	✓	✓	
2	Adjusting the operationalisation of a dependent variable so that it better reflects what the researcher is measuring			✓	
3	When a second researcher independently produces a similar set of results by conducting an experiment using the same procedures and a similar sample		✓		
4	Ensuring that ratings of the target behaviours recorded by different observers closely match		✓		
5	Using a stratified sample rather than a simple random sample when surveying public opinion on national immigration policy				✓
6	Significantly increasing the size of the experimental and control groups in research investigating the effects of social media use on high school performance	✓	✓		✓
7	Setting up an observational study of children at play in a setting that resembles a pre-school yard rather than a research facility				✓
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	✓	✓	✓	
9	Three different research groups get the same results in similar experiments		✓		
10	An IQ test is improved over time to measure human intelligence more accurately	✓	✓	✓	

ACTIVITY 1.26

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
29 Involving personal opinion or interpretation
30 The entire group of research interest from which a sample is drawn
32 The variable which the researcher tests and manipulates
33 A research sample that does not adequately represent key characteristics of the population from which it was drawn
34 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
31 Statistics used for interpreting and giving meaning to results
35 A general explanation of a set of observations about behaviour and/or mental processes which seem to be related
36 A research design that exposes the same group of participants to all of the experimental conditions
37 A research design that exposes each experimental group to a different experimental condition

1 CONFORMITY
2 CONFOUNDING
3 OPERATIONALISING
4 INDEPENDENTGROUPS
5 DEPENDENTVARIABLE
6 SINGLEBLIND
7 RESEARCHHYPOTHESIS
8 RANDOMALLOCATION
9 JUSTICE
10 SELFREPORT
11 RANDOMALLOCATION
12 CROSSSECTIONALSTUDY
13 EXTRANEOUSVARIABLE
14 STATISTICALSIGNIFICANCE
15 MEAN
16 SECONDARYDATA
17 NATURALEXPERIMENT
18 GENERALISATION
19 REPEATEDMEASURES
20 EXPERIMENTALDESIGN
21 PLACEBOEFFECT
22 VARIABLE
23 PEERREVIEW
24 QUANTITATIVEDATA
25 EXTRANEOUSVARIABLE
26 EXPERIMENTALDESIGN
27 EXPERIMENTER
28 OBJECTIVE
29 SUBJECTIVE
30 POPULATION
31 INFERENTIAL
32 INDEPENDENT
33 BIASED
34 CONTROL
35 THEORY
36 WITHHOLDING
37 BEWILDERMENT

ACTIVITY 1.27

True/False quiz on research methods

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

Statement	T/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 research design that exposes the same group of participants to all of the experimental conditions is called a within groups design.	T
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 A research design that exposes each experimental group to a different experimental condition is called a within groups design.	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 If research is repeatable it means similar results have been achieved under similar conditions.	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 If research is reproducible it means similar results have been achieved under different conditions.	T
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?

TOPIC 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	2.11	2.12	2.13	2.14
• the roles of different subdivisions of the central and peripheral nervous systems in responding to, and processing and coordinating with, sensory stimuli received by the body to enable conscious and unconscious responses, including spinal reflexes	✓	✓	✓			✓						✓	✓	✓
• the role of neurotransmitters in the transmission of neural information across a neural synapse to produce excitatory effects (as with glutamate) or inhibitory effects (as with gamma-amino butyric acid [GABA]) as compared to neuromodulators (such as dopamine and serotonin) that have a range of effects on brain activity				✓	✓		✓			✓	✓	✓	✓	✓
• synaptic plasticity – resulting from long-term potentiation and long-term depression, which together act to modify connections between neurons (sprouting, rerouting and pruning) – as the fundamental mechanism of memory formation that leads to learning								✓	✓	✓	✓	✓	✓	✓
Key science skills												✓		

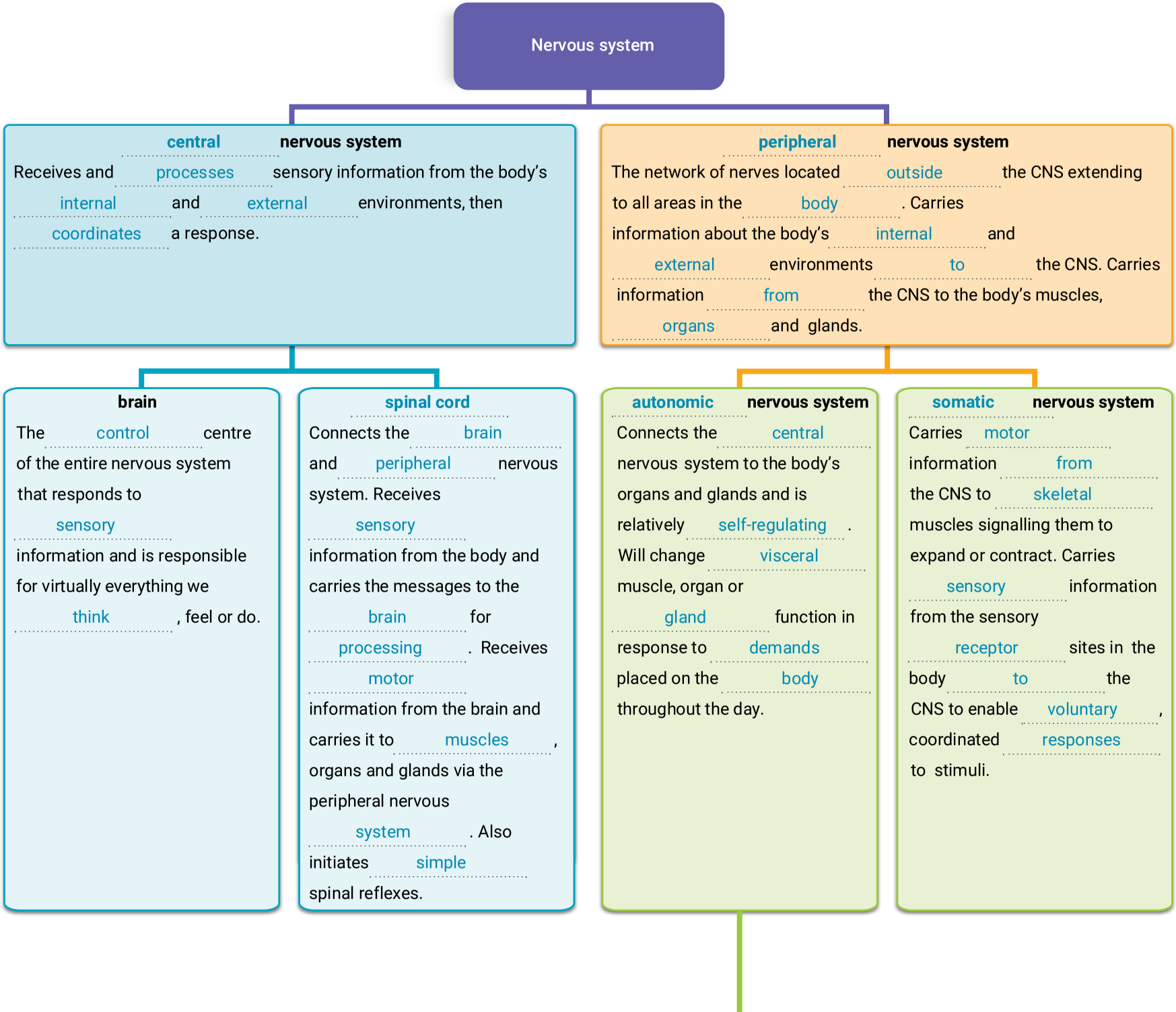
Source: © VCAA, *VCE Psychology Study Design: 2023–2027*. p. 34.

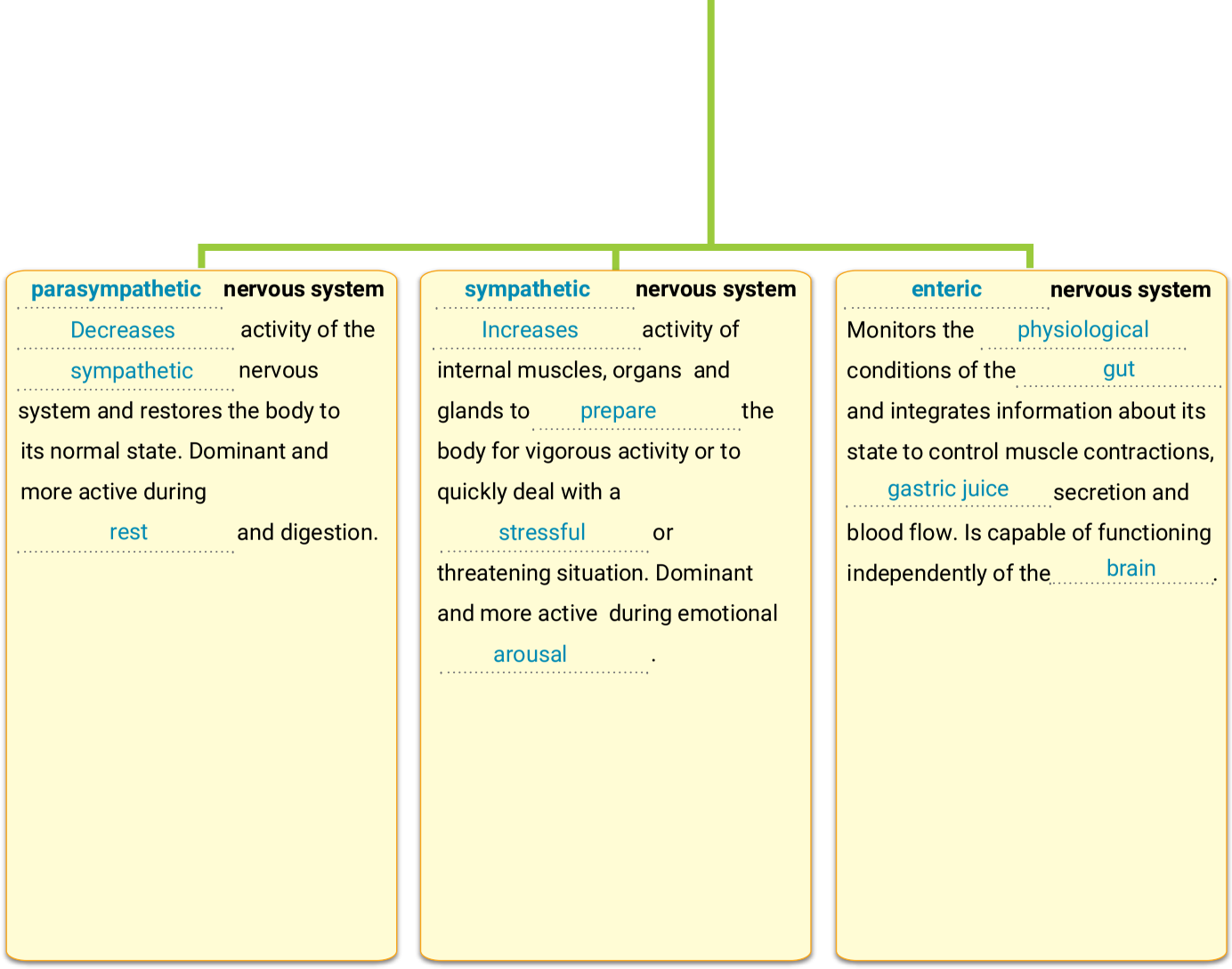
ACTIVITY 2.1

Summarising human nervous system organisation and functions

Complete the chart of the human nervous system 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	gastric juice	physiological
gut	system	enteric		


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 .
enteric nervous system
Monitors the physiological conditions of the gut and integrates information about its state to control muscle contractions, gastric juice secretion and blood flow. Is capable of functioning independently of the brain .

ACTIVITY 2.2

Conscious verses unconscious responses to stimuli

Select terms from the shaded panel below to correctly complete the passage about conscious verses unconscious responses to sensory stimuli. All terms are used and terms can be used more than once.

nervous system	goal	awareness	deciding	conscious
increased	regulated	spinal reflex	brain	immediate
faster	internally	spinal cord	voluntary	automatic
respiration	adaptive	sensory	harmful	autonomic
withdraw	within	unconscious	unintentional	receptors
neural				

Our brain and nervous system are constantly processing sensory stimuli detected by sensory receptors. Our responses to these stimuli may be conscious or unconscious. A conscious response to a sensory stimulus is a reaction that involves awareness. The response will usually be a voluntary reaction that is goal directed. For example, hearing your alarm in the morning and deciding to get out of bed and get dressed. A conscious response may also be triggered by internally generated stimuli. These originate from within our bodies. For example, feeling thirsty and pouring yourself a glass of water. An unconscious response to a sensory stimulus is a reaction that does not involve awareness. It is involuntary, unintentional and automatic. Such bodily responses are often regulated by the autonomic nervous system. For example, in response to increased demands for oxygen by our muscles when running, our heart rate and respiration (breathing) rate will increase. Another type of unconscious response is a spinal reflex. This is an unconscious, automatic response controlled by neural

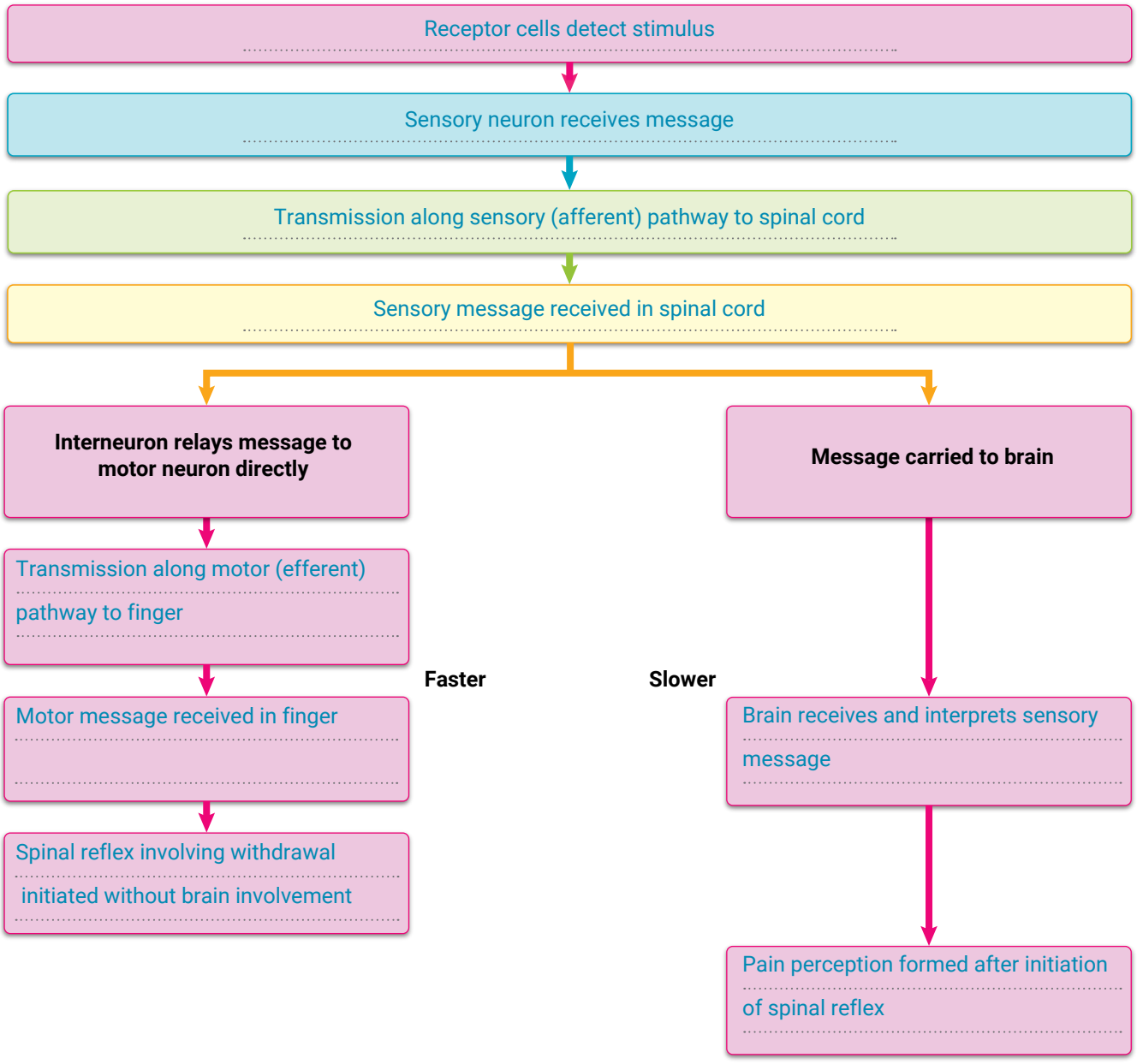
circuits in the spinal cord. For example, if you were to touch the hot metal handle of a frying pan, you would automatically withdraw your hand to release the handle before the sensory information travels to your brain and therefore before the pain is experienced. Such an immediate response enables a faster reaction time. Spinal reflexes are considered adaptive as they save time in situations that may be very harmful to the organism.

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 from the shaded panel below into the flow chart to show the correct order for your spinal reflex and pain experience.

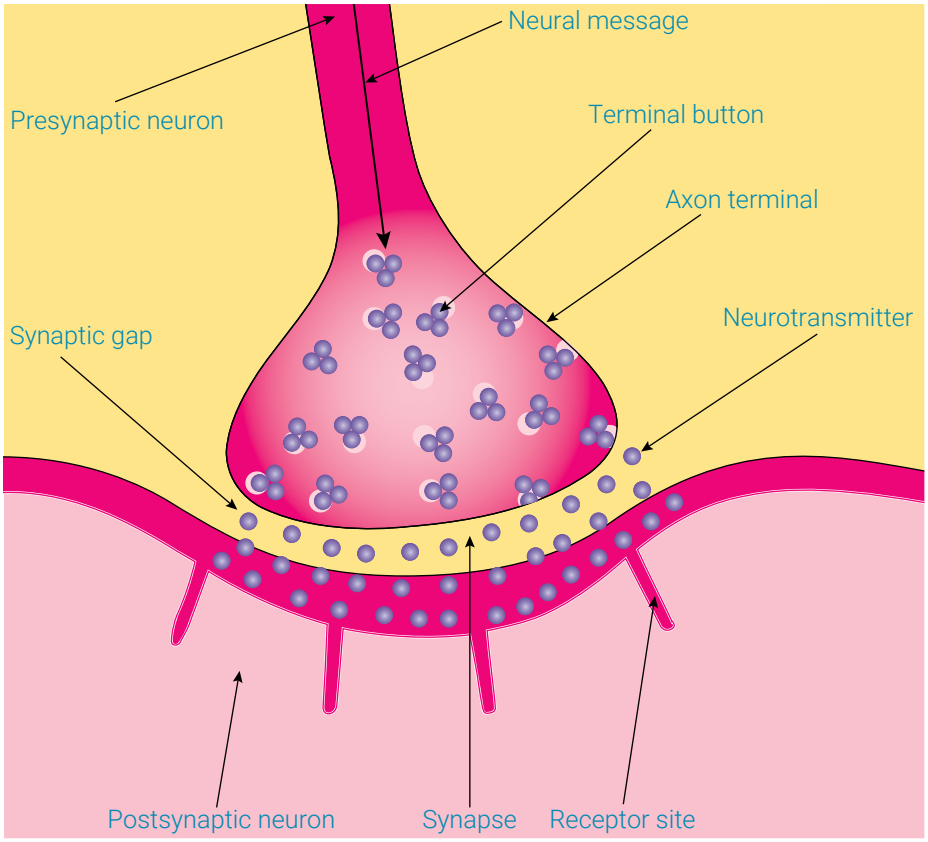
sensory message received in spinal cord	sensory neuron receives message	pain perception formed after initiation of spinal reflex	transmission along motor (efferent) pathway to finger	motor message received in finger
brain receives and interprets sensory message	spinal reflex involving withdrawal initiated without brain involvement	transmission along sensory (afferent) pathway to spinal cord	receptor cells detect stimulus	



ACTIVITY 2.4

Neurotransmission at a synapse

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



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

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

ACTIVITY 2.5

How do neurotransmitters and neurohormones enable communication in the nervous system?

Select terms from the shaded panel below to correctly complete the passage explaining how neurotransmitters and neurohormones enable communication in the nervous system. All terms are used and terms can only be used once.

receptor site	firing	synapse	neurohormones	synaptic gap
noradrenaline	hormone	adrenal glands	influence	learning
neuromodulators	glutamate	enhances	neuron	inhibitory
presynaptic	connections	postsynaptic	less	fine-tune
absorbed	location	anxiety	neurotransmitter	reuptake
growth	GABA	different	receive	seizures
uncontrolled	bind	cells	prevent	dendrite
excitatory	nervous system	inhibitory	terminal button	one
secrete	brain			

Adjacent neurons in the nervous system communicate by releasing neurotransmitters from the terminal button of the presynaptic neuron into the tiny space called the synaptic gap. This neurotransmitter can then bind with a receptor site found on the dendrite of the postsynaptic neuron. This junction of communication is known as a synapse. Neurotransmitter is a chemical substance produced by a neuron that carries a message to other neurons or cells. It exerts its effect by binding to the receptor site of the postsynaptic neuron that is specialised to receive that specific neurotransmitter. Neurotransmitter that does not bind is absorbed back into the terminal button by the presynaptic neuron in a process called reuptake. Some neurotransmitters have an excitatory effect, which means they stimulate postsynaptic neurons to perform their functions.

ACTIVITY 2.5 *continued*

Other neurotransmitters have an inhibitory effect, which means they prevent postsynaptic neurons from firing. The same neurotransmitter, however, may have either an excitatory or an inhibitory effect at a particular receptor site location. Some neurons produce only one type of neurotransmitter, whereas other neurons can make many. This means that a single neuron may secrete one neurotransmitter at one synapse and a different neurotransmitter at another. Some neurotransmitters also occur as hormones and are called neurohormones. For example, noradrenaline is a neurotransmitter and a hormone. It is secreted as a hormone by the adrenal glands into the blood, and as a neurotransmitter from neurons in the brain. Some neurotransmitters can also influence the action of another neurotransmitter. These are called neuromodulators. Glutamate and GABA are the most common neurotransmitters found in the CNS.

Glutamate is the main *excitatory* neurotransmitter. This means that glutamate enhances information transmission by making postsynaptic neurons more likely to fire. Glutamate is important for learning and memory. Its excitatory effects promote the growth and strengthening of synaptic connections between neurons. Gamma-amino butyric acid (GABA) is the primary inhibitory neurotransmitter in the CNS. It works by making postsynaptic neurons less likely to fire. One of its roles is to fine-tune neurotransmission in the brain. Without the inhibitory effect of GABA, activation of postsynaptic neurons can get out of control. Their uncontrolled activation can spread throughout the brain, causing seizures and other problems such as anxiety.

ACTIVITY 2.6

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 nervous system	neurotransmitter; neuromodulator

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 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.

16 A neurotransmitter carries a message from the presynaptic neuron to the postsynaptic neuron or cell to produce either an excitatory or inhibitory effect, whereas a neuromodulator will influence the effect of a neurotransmitter and can exert this influence over a large number of neurons at once.

ACTIVITY 2.7

Thinking about the functions of neurotransmitters and neuromodulators

Cut and paste and match the functions with the neurotransmitter or neuromodulator in the boxes

has been linked to mental illness including anxiety and sleep disorders as well as depression

considered the main excitatory neurotransmitter in the brain

only acts as an inhibitory neurotransmitter

acts as a mood stabaliser by modulating the excitatory effects of other neurotransmitters

is the primary inhibitory neurotransmitter in the brain

enhances neural transmission by making the postsynaptic neurons more likely to fire

is involved in most brain function including learning, memory, perception and thinking

plays a key role in regulation of the sleep-wake cycle

If neurons in the substantia nigra are damaged, loss of this neurotransmitter can cause Parkinson's disease.

reduced levels of this neurotransmitter is linked to obsessive compulsive disorder (OCD)

has multiple functions depending on where in the brain it acts

experience of reward and/or pleasure

reduced amounts of this neurotransmitter can be linked to mental disorders such as anxiety and phobias

reduced amounts of this neurotransmitter can result in seizures due to uncontrolled neural activation

makes postsynaptic neurons less likely to fire

many drugs that target depression work by increasing the levels of this neuromodulator in the brain

its excitatory effects promote the growth and strengthening of synaptic connections between neurons

initiation of smooth, coordinated voluntary muscle movements

mostly an excitatory neurotransmitter but can also be inhibitory in other brain locations

plays a key role in regulating mood and emotional processing

involved in reward-based learning

has crucial roles in the synaptic changes that occur during learning and memory

sufficient levels play a key role in making us feel positive, calm and happy

plays a key role in motivation and appetite

Non-neuromodulator neurotransmitters
Glutamate considered the main excitatory neurotransmitter in the brain enhances neural transmission by making the postsynaptic neurons more likely to fire is involved in most brain function including learning, memory, perception and thinking its excitatory effects promote the growth and strengthening of synaptic connections between neurons has crucial roles in the synaptic changes that occur during learning and memory
Gamma-amino butyric acid (GABA) only acts as an inhibitory neurotransmitter is the primary inhibitory neurotransmitter in the brain makes postsynaptic neurons less likely to fire reduced amounts of this neurotransmitter can be linked to mental disorders such as anxiety and phobias reduced amounts of this neurotransmitter can result in seizures due to uncontrolled neural activation

Neuromodulator neurotransmitters
Dopamine If neurons in the substantia nigra are damaged, loss of this neurotransmitter can cause Parkinson's disease. has multiple functions depending on where in the brain it acts experience of reward and/or pleasure initiation of smooth, coordinated voluntary muscle movements mostly an excitatory neurotransmitter but can also be inhibitory in other brain locations involved in reward-based learning plays a key role in motivation and appetite
Serotonin plays a key role in regulating mood and emotional processing has been linked to mental illness including anxiety and sleep disorders as well as depression acts as a mood stabiliser by modulating the excitatory effects of other neurotransmitters plays a key role in regulation of the sleep-wake cycle reduced levels of this neurotransmitter is linked to obsessive compulsive disorder (OCD) many drugs that target depression work by increasing the levels of this neuromodulator in the brain sufficient levels play a key role in making us feel positive, calm and happy

ACTIVITY 2.8

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	embryonic
experience	experiences	function	genetically	language
learn	learning	lifespan	memory	more
motor	networks	neural	physiological	plastic
plasticity	responsive	sensory	think	tissue
younger				

Neural plasticity is the ability of the brain's neural structure and 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.

ACTIVITY 2.8 *continued*

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, such as 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.

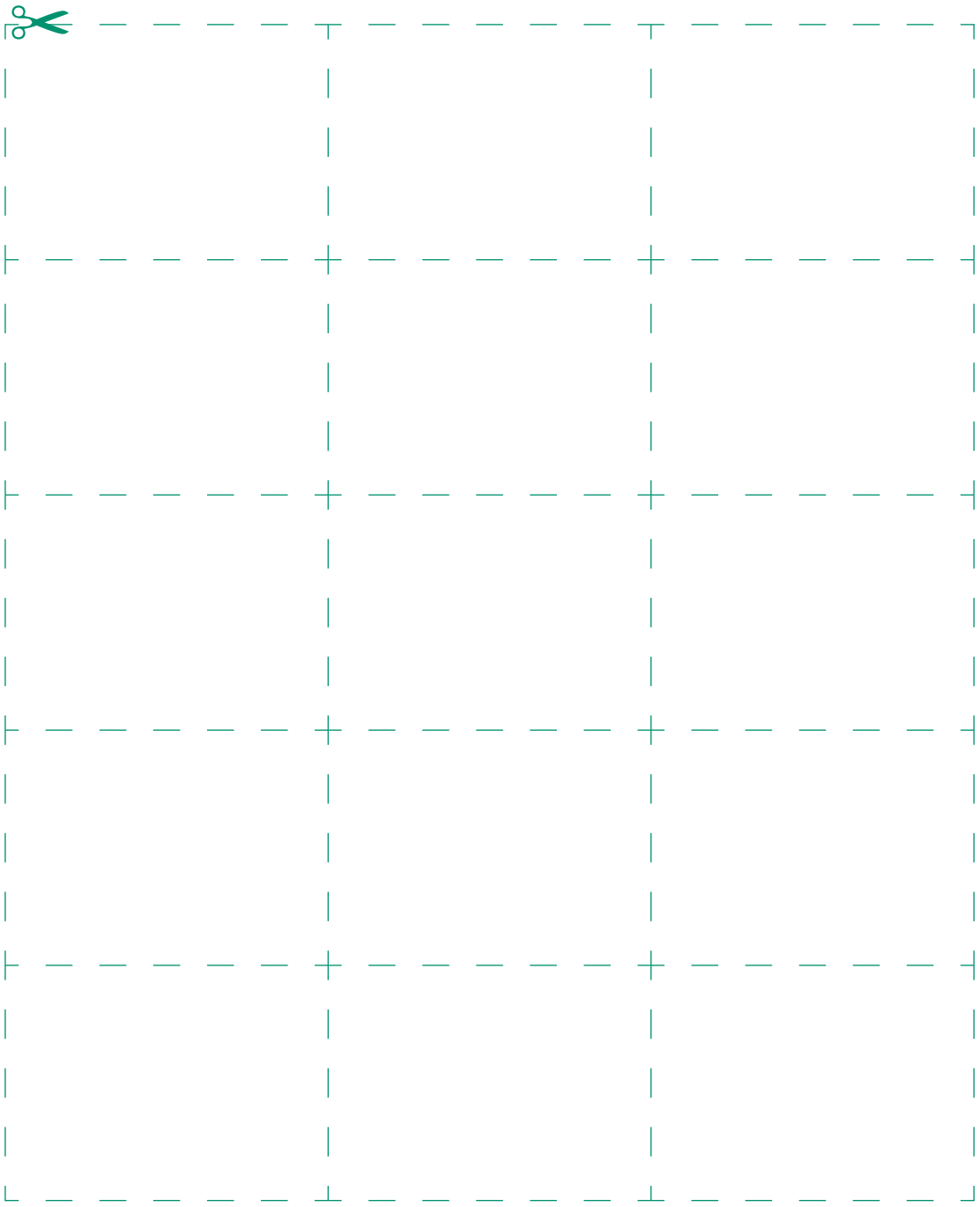
Generally, the more complex an experience is in terms of the variety of sensory inputs, the more distinctive the structural changes that will occur in brain tissue involved in that experience.

ACTIVITY 2.9

Thinking about how neural pathways can become reorganised

Cut out the following statements and then paste them to complete the table relating to three key processes involved brain plasticity.

Growth of new nerve endings forming new connections around terminated synapses	Maintains cognitive efficiency and ensures the brain can adapt to new and changing environments	Growth of new nerve endings called 'sprouts' on axons or dendrites
Increase in frequency of stimulation of a new neural circuit	Increase in frequency of an alternate neural circuit with simultaneous decrease in frequency of an existing (parallel) circuit	The creation of a new neural pathways or modification of existing neural pathways
A child recovers their language ability lost as a result of a brain injury by rerouting alternative areas of the brain to take the place of damaged regions	Learning to play the piano through practice will stimulate the creation of new neural networks that are activated through repeated practice	A person forgets the process of how to complete long division because they have never practiced it since primary school
To allow a presynaptic neuron to form new connections to other neurons	To create alternate neural pathways to bypass pre-existing pathways or damaged neural circuits	Removal of dendritic connections from synapses decreasing neural connections
Creation of new extensions on a neuron	The elimination of weak, ineffective or unused synapses	Decrease in frequency of stimulation of an existing neural circuit



ACTIVITY 2.9 *continued*

	Sprouting	Rerouting	Pruning
Description of process	Creation of new extensions on a neuron	The creation of a new neural pathways or modification of existing neural pathways	The elimination of weak, ineffective or unused synapses
Purpose	To allow a presynaptic neuron to form new connections to other neurons	To create alternate neural pathways to bypass pre-existing pathways or damaged neural circuits	Maintains cognitive efficiency and ensures the brain can adapt to new and changing environments
What changes occur?	Growth of new nerve endings called 'sprouts' on axons or dendrites	Growth of new nerve endings forming new connections around terminated synapses	Removal of dendritic connections from synapses decreasing neural connections
What causes the change?	Increase in frequency of stimulation of a new neural circuit	Increase in frequency of an alternate neural circuit with simultaneous decrease in frequency of an existing (parallel) circuit	Decrease in frequency of stimulation of an existing neural circuit
Example	Learning to play the piano through practice will stimulate the creation of new neural networks that are activated through repeated practice	A child recovers their language ability lost as a result of a brain injury by rerouting alternative areas of the brain to take the place of damaged regions	A person forgets the process of how to complete long division because they have never practiced it since primary school

ACTIVITY 2.10

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

1 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.

2 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
• 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)

3 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 2.11

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 109, 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.

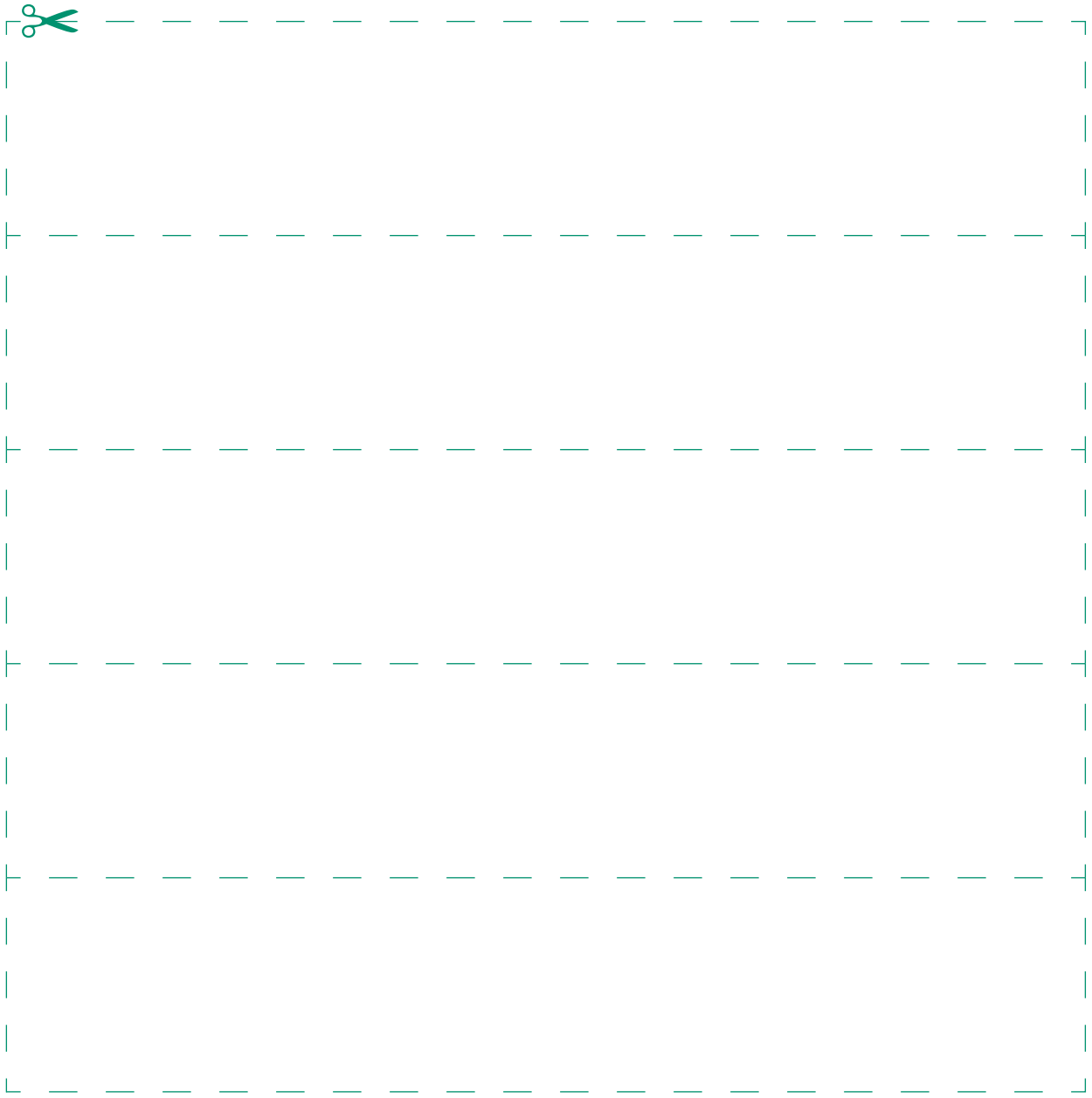
Repetition of the learning experience (e.g. through practice) is now more likely to reactivate neurons A and C by releasing excitatory neurotransmitter glutamate into the synaptic gap. Meanwhile, the synapse between B and C might only seldom activate or not activate at all.

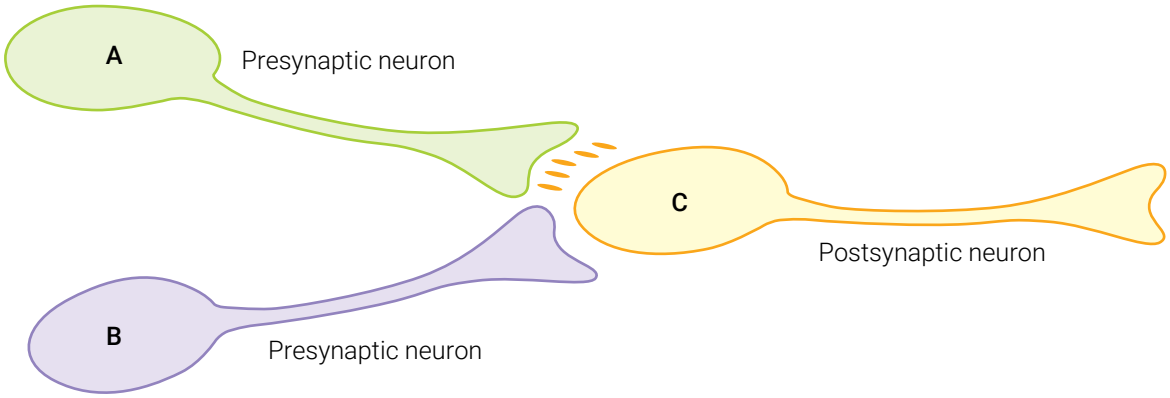
The increase in glutamate combined with repeated activation now makes the postsynaptic neuron C more responsive to any level of activation by presynaptic neuron A. The sensitivity of neuron C to neuron B, however, remains low due to lack of stimulation.

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 2.12

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 2.12 *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.

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).

Crossword on concepts and terms relating to nervous system functioning

Across

2 A neurotransmitter effect that increases postsynaptic activity
6 Entire network of nerves located outside the CNS
12 Long thin bundle of nerve fibres that extends from the base of the brain connecting it to the peripheral NS
15 A type of cell considered as the building block of the brain and nervous system
18 Subdivision of the autonomic NS that activates internal muscles, organs and glands to prepare the body for vigorous activity or to deal with stress
19 Subdivision of the autonomic NS that helps to maintain the internal body environment in a steady, balanced state of normal functioning
20 A modulating neurotransmitter that plays a role in mood regulation, emotional processing, sleep onset and pain perception
21 A neurotransmitter effect that decreases postsynaptic activity
23 Division of the NS comprising the brain and spinal cord
25 Sub-division of the peripheral nervous system that connects the CNS to the body's internal organs and glands
26 The site of communication between two neurons
27 Subdivision of the autonomic NS that detects the physiological condition of the gastrointestinal tract, integrates information about its state, provide outputs to control the gut
28 Subdivision of the peripheral NS that carries sensory information to the CNS and motor information from the CNS

Down

1 An unconscious, automatic response controlled solely by neural circuits in the spinal cord
3 A response to a sensory stimulus that involves awareness
4 Part of the CNS that plays a vital role in receiving and processing sensory information
5 A chemical messenger released and exerting its effects locally at a synapse
7 The ability of the brain's neural structure to be changed by experience
8 When new connections are made between neurons to create alternate neural pathways
9 The creation of new extensions on a neuron to allow it to make new connections with other neurons
10 Considered the primary excitatory neurotransmitter in the nervous system
11 The elimination of weak, ineffective or unused synapses
13 A response to a sensory stimulus that does not involves awareness
14 Considered the primary inhibitory neurotransmitter in the nervous system
16 A type of neurotransmitter that is able to regulate the effects of other neurotransmitters
17 An abbreviation for the term used to describe the process when increased stimulation results in strengthening of neural pathways
22 An abbreviation for the term used to describe the process when inadequate stimulation results in weakening of neural pathways
24 A neurotransmitter linked to Parkinson's disease that is involved in initiation of muscle movements as well as other functions

1 SPINALREFLEX
2 EXOCRINE
3 CONSCIOUS
4 BRAIN
5 NEUROTRANSMITTER
6 PERIPHERAL
7 PHYSIOLOGICAL
8 RETRONASAL
9 SPROUTING
10 GLUTAMATE
11 PRUNING
12 SYNAPTIC
13 UNCONSCIOUS
14 GABA
15 NEURON
16 NEURODOMAIN
17 LIMBIC
18 SYMPATHETIC
19 PARASYMPATHETIC
20 SEROTONIN
21 INHIBITORY
22 LIMBIC
23 CENTRAL
24 DOPAMINE
25 AUTONOMIC
26 SYNAPSE
27 INTERNEURON
28 SOMATIC

ACTIVITY 2.14

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 on the right.

Statement	T/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 A neuromodulator is a type of neurotransmitter.	T
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 Sprouting and rerouting both involve the formation of new dendritic connections.	T
12 Pruning results from complete deactivation of a neural circuit.	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 Pruning is believed to be adaptive to maintain cognitive efficiency.	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 Serotonin plays a role in maintaining the sleep-wake cycle.	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 Dopamine is involved in reward pathways associated with feelings of pleasure.	T
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 Dopamine has many functions and can act as both an excitatory as well as an inhibitory neurotransmitter.	T
25 Neuromodulators only release their chemical messengers into a single synapse.	T

TOPIC 3

Stress as an example of 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	3.14
• internal and external stressors causing psychological and physiological stress responses, including the fight-or-flight-or-freeze response in acute stress and the role of cortisol in chronic stress	✓	✓	✓		✓						✓	✓	✓	✓
• the gut-brain axis (GBA) as an area of emerging research, with reference to the interaction of gut microbiota with stress and the nervous system in the control of psychological processes and behaviour				✓	✓							✓	✓	✓
• the explanatory power of Hans Selye's General Adaptation Syndrome as a biological model of stress, including alarm reaction (shock/counter shock), resistance and exhaustion						✓					✓	✓	✓	✓
• the explanatory power of Richard Lazarus and Susan Folkman's Transactional Model of Stress and Coping to explain stress as a psychological process (primary and secondary appraisal only)							✓	✓				✓	✓	✓
• use of strategies (approach and avoidance) for coping with stress and improving mental wellbeing, including context-specific effectiveness and coping flexibility									✓		✓	✓	✓	✓
Key science skills										✓				

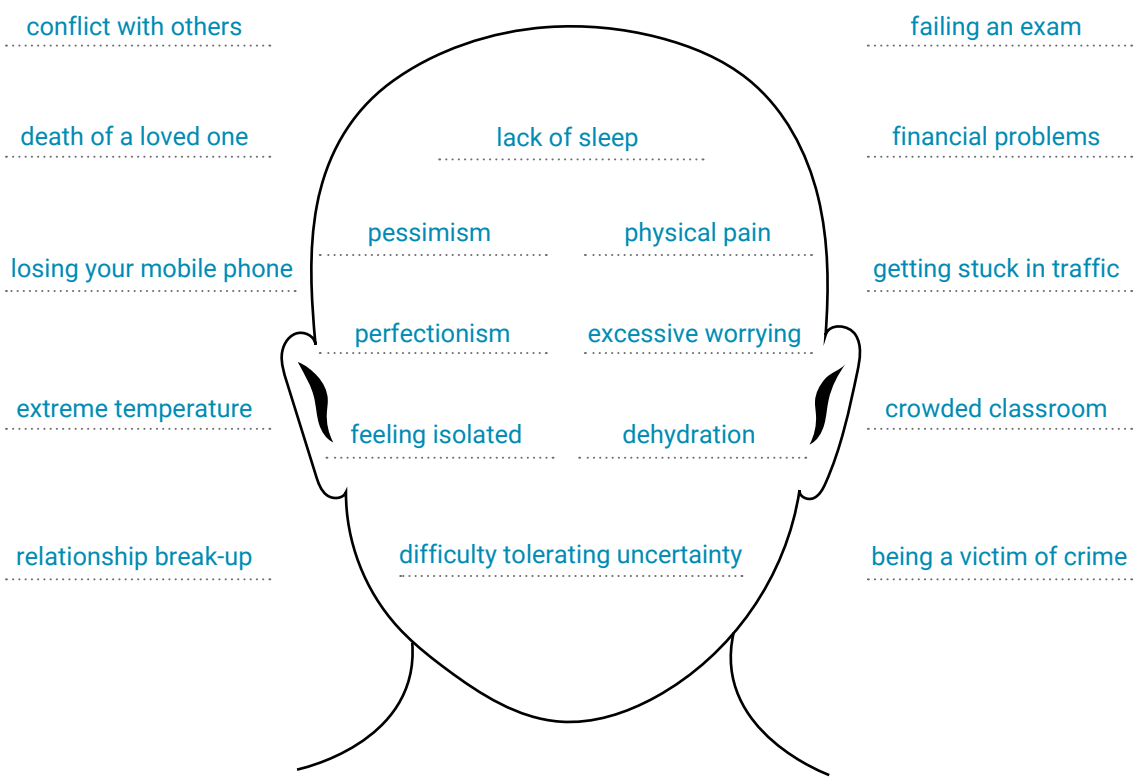
Source: © VCAA, *VCE Psychology Study Design: 2023–2027*. p. 34.

ACTIVITY 3.1

Internal and external stressors

Categorise the following stressors as either 'internal' or 'external' by writing the internal stressors inside the person's head and the external stressors in the surrounding space.

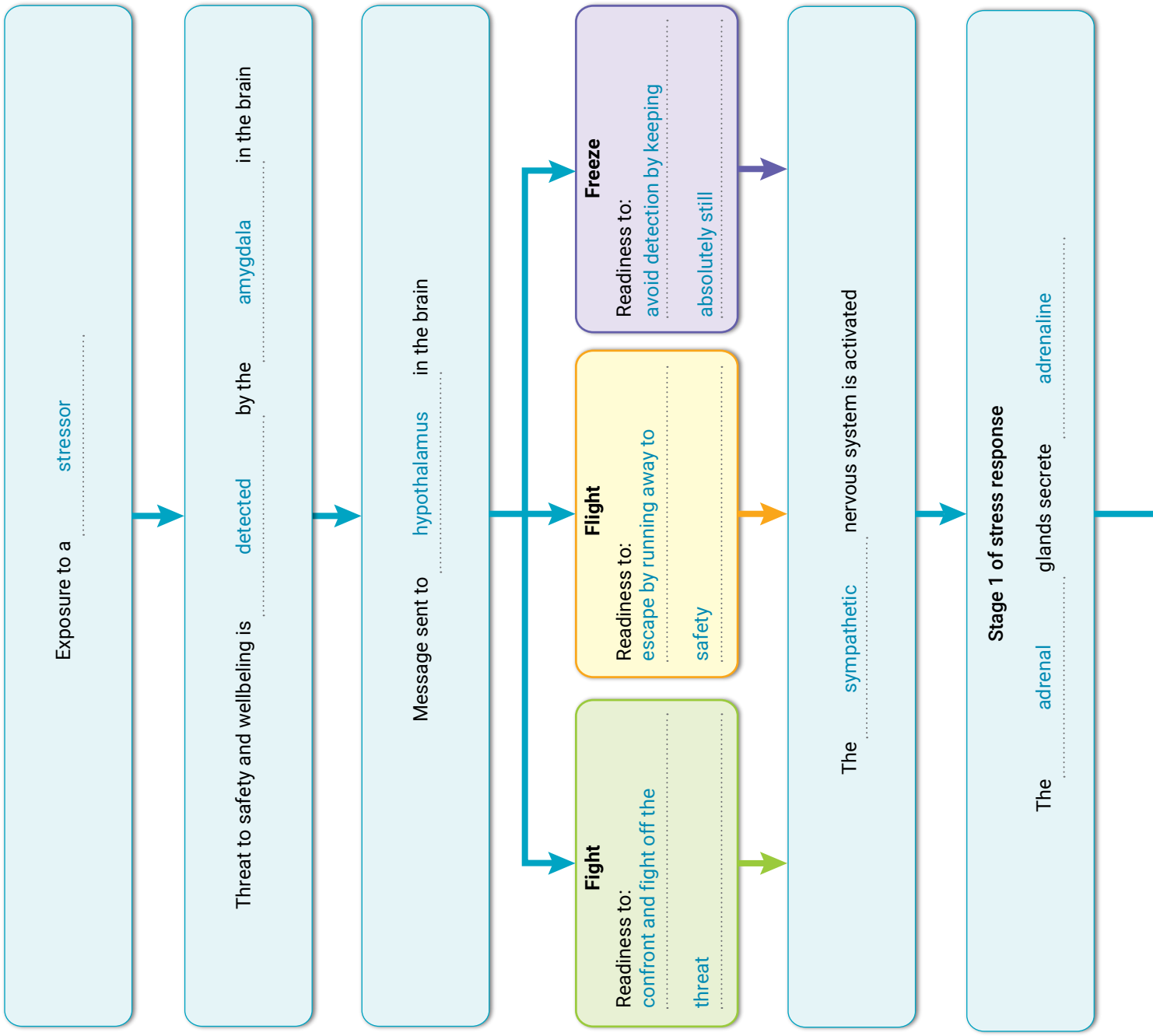
lack of sleep	perfectionism	feeling isolated
pessimism	financial problems	extreme temperature
physical pain	excessive worrying	dehydration
conflict with others	crowded classroom	relationship break-up
death of a loved one	losing your mobile phone	being a victim of crime
failing an exam	getting stuck in traffic	difficulty tolerating uncertainty

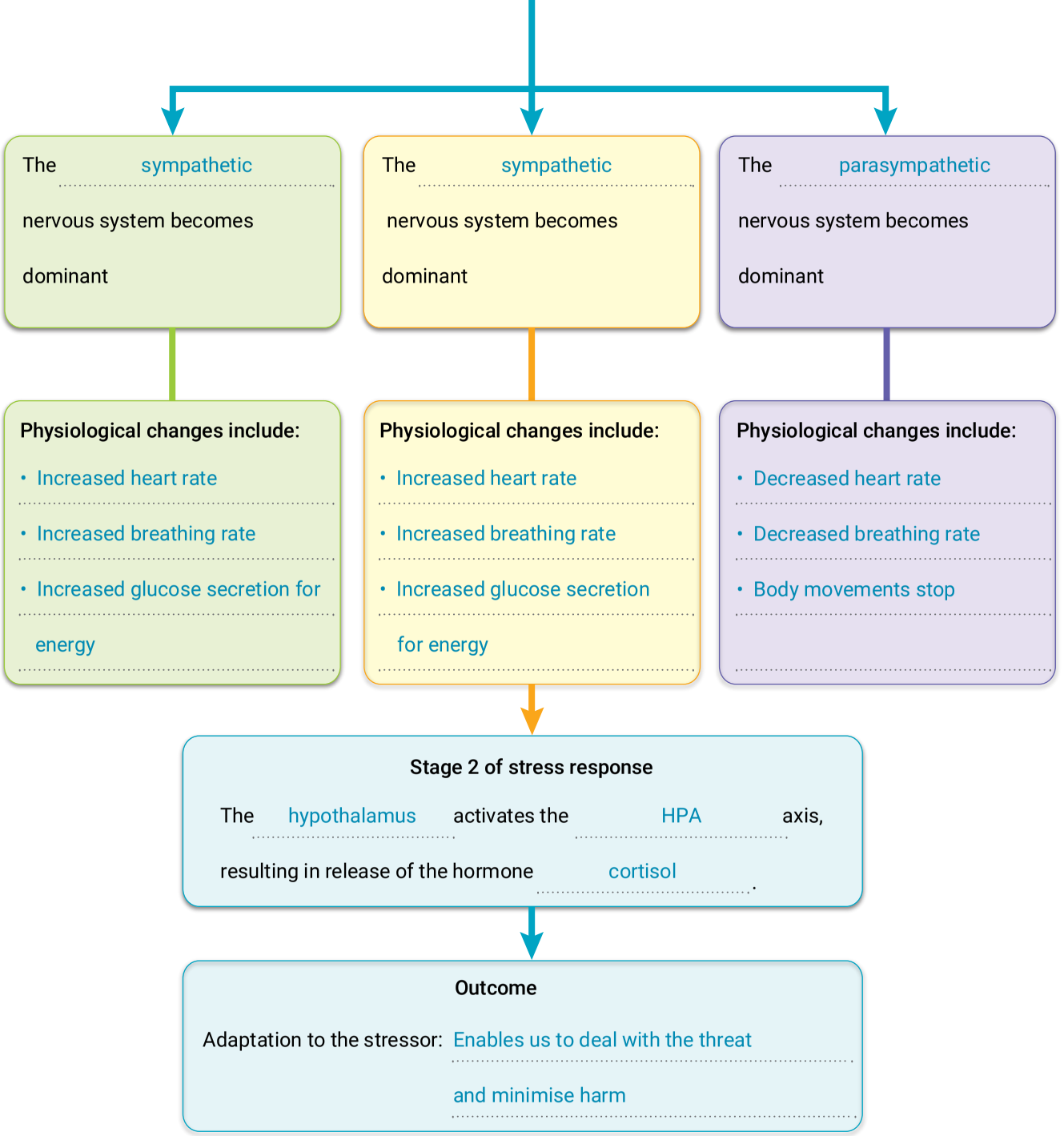


ACTIVITY 3.2

Summarising fight-or-flight-or-freeze

Complete the flow chart to summarise the fight-or-flight-or-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:
• Increased heart rate
• Increased breathing rate
• Increased glucose secretion for energy
Physiological changes include:
• Increased heart rate
• Increased breathing rate
• Increased glucose secretion for energy
Physiological changes include:
• 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 3.3

Role of cortisol in chronic stress

Part A

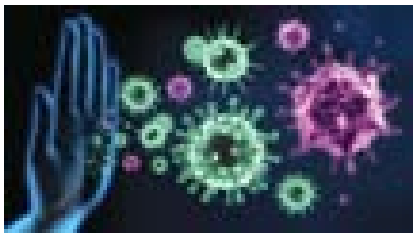
Describe five roles cortisol plays in chronic stress in the empty boxes below. The images provide clues.

1. Suppress immune system functioning and keep body in a high alert state

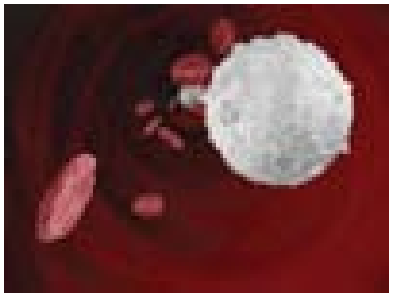
2. Secrete glucose into bloodstream

5. Turn off all bodily systems not immediately required to deal with a stressor (e.g. digestion)

Role of cortisol in chronic stress



3. Enhance metabolism



4. Reduce inflammation (by blocking activity of white blood cells)

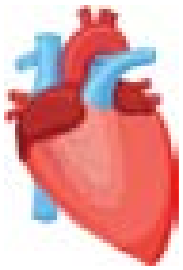
Part B

Describe five harmful, long-term effects of cortisol in the empty boxes below. The images provide clues.

1. Impaired immune system functioning and increased vulnerability to disease

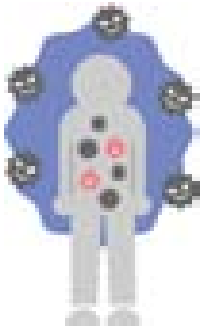
2. Increased risk of physical health problems (e.g. hypertension, heart disease, diabetes)

Harmful, long-term effects of cortisol



5. Increased risk of mental health problems (e.g. depression, anxiety, PTSD)

3. Build-up of fat tissue and weight gain

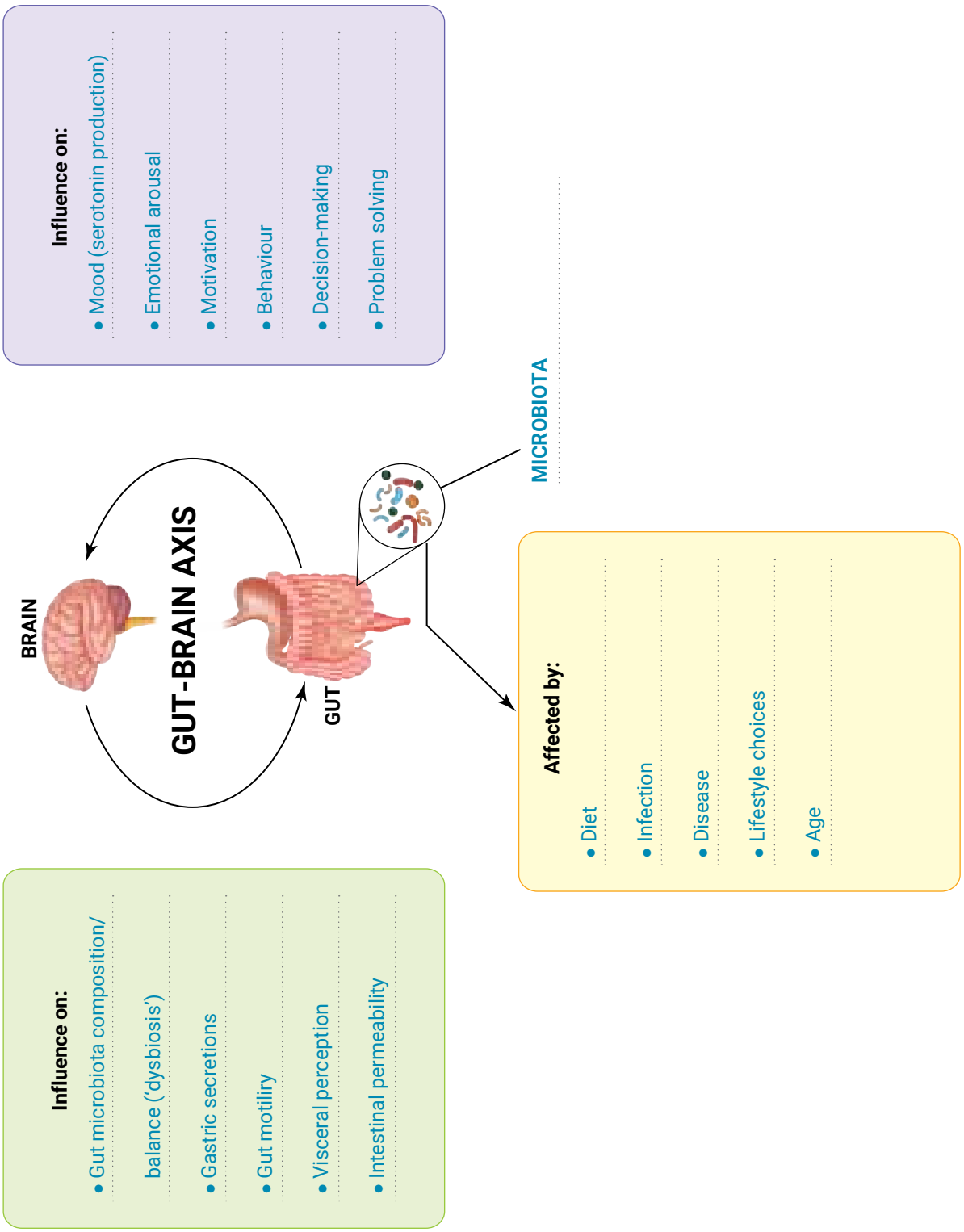


4. Impaired cognitive performance, learning and memory problems

ACTIVITY 3.4

Gut-brain axis (GBA)

Complete the following diagram summarising the bi-directional influences between the brain and gut and factors affecting the gut environment.



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.

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 per cent

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 slow 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 that 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' (gets 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, with reference to the fight-flight response and gut-brain axis.

Fight–flight response

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).

Gut-brain axis

The article describes that if you are stressed or nervous, this can affect your stomach/gut and can cause you to experience 'dyspepsia'. It explains that a number of processes occur in the brain that are passed onto the stomach and affect the digestive process. This is accurate in terms of what is known about the gut-brain axis (GBA).

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.

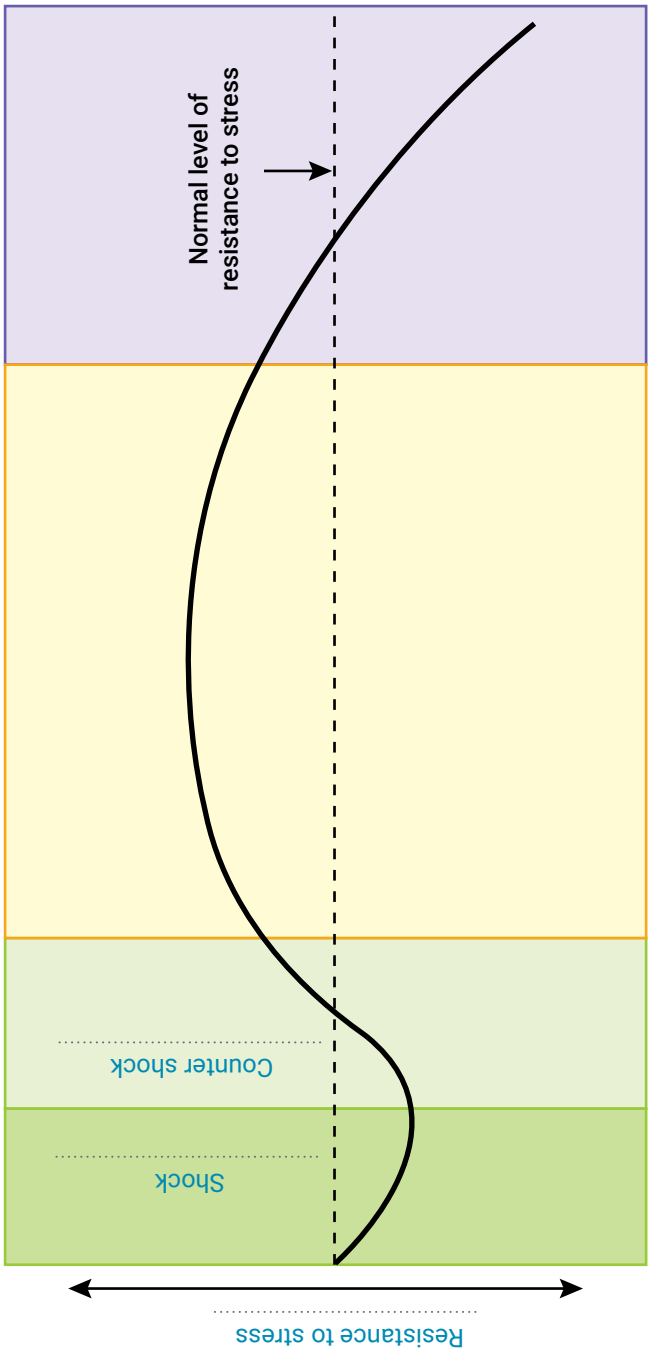
6 According to the article, why might you 'get the runs when you are stressed'?

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

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 three stages. Include the names of any chemicals or hormones that may be present and relevant nervous system involvement in your answers.



Stage 1

Alarm reaction .....

(immediate response) .....

Stage 2

Resistance .....

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

Stage 3

Exhaustion .....

(vulnerable and weak) .....


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 3.7

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 friendly students, 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 3.8

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 3.8 *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 3.9

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 on the right.

Statement	T/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 There is no single 'right way' to cope.	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 It is never helpful to use both approach and avoidance strategies to cope with a situation.	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 It is always best to delay dealing with an overwhelming task.	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 Coping strategies are innate and cannot be learnt.	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 3.10

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 × 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 3.10 *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 three points in time)

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

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)

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, for example:

- *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 3.11

Media analysis/response

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

Source: CartoonStock

1 Identify two possible internal stressors and two possible external stressors Clarckson could be experiencing.

Possible **internal stressors** could include: perfectionism, physical pain, lack of sleep, feelings of incompetence, lack of motivation, negative self-talk, loneliness, low self-esteem.

Possible **external stressors** could include: tight/short work deadlines, amount of work, continual interruption during work (e.g. phone calls, emails, people talking to him, etc), conflict with colleagues, job insecurity, factors in the work environment such as excessive heat/cold/noise/inadequate lightning/uncomfortable seating, financial problems, demanding customers.

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

Answer should refer to observable signs of stress and include such things as: shortness of breath; sweating; fidgeting; accelerated speech; anger; irritability/short-temper; difficulties concentrating, making decisions, problem-solving and/or thinking clearly; and an increase in sick days/absenteeism.

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 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 3.12

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)** chronic
(j)	**2** The three-stage physiological response to stress that occurs regardless of the type of stressor that is encountered.	**(b)** context-specific effectiveness
(a)	**3** Stress that continues for a prolonged period of time.	**(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** Stressor that originates outside the individual from situations and events in the environment.	**(e)** secondary appraisal
(n)	**6** The bi-directional, multi-faceted, communication existing between central and enteric nervous systems.	**(f)** primary appraisal
(b)	**7** When there is a match or 'good fit' between the coping strategy used and the stressful situation.	**(g)** gut microbiota
(p)	**8** Making an effort to escape from having to deal with a stressor.	**(h)** internal
(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)** external
(d)	**12** An involuntary physical reaction that prepares the body to deal with a sudden and immediate threat.	**(l)** stressor
(h)	**13** Stressor that originates with the individual.	**(m)** cortisol
(s)	**14** The third stage of the General Adaptation Syndrome.	**(n)** gut-brain axis

ACTIVITY 3.12 *continued*

(q)	**15** Stress that lasts for a relatively short period of time.	**(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 microorganisms present in the digestive tract.	**(q)** acute
(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 3.13

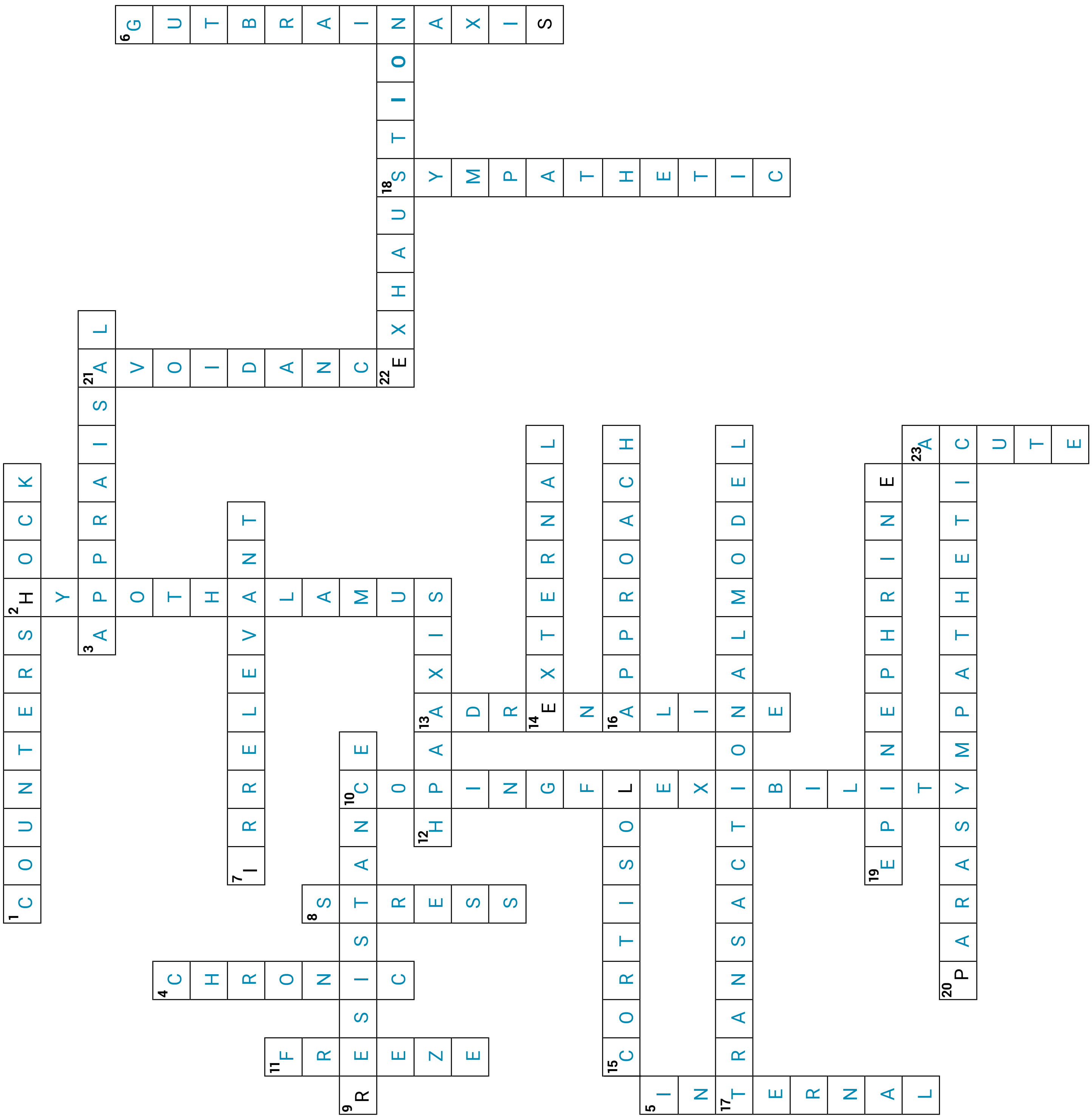
Crossword on concepts and terms in stress as a psychological process

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
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 Stressor that originates outside an individual
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 Another name for 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
5 Stressor that originates within an individual
6 The bi-directional communication link between the central and enteric nervous system
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
23 Stress that lasts for a relatively short time


1 COUNTERSHOCK
2 HYPOTHALAMUS
3 APPRAISAL
4 CHRONIC
5 INTERNAL
6 GUTBRAINAXIS
7 IRRELEVANT
8 STRESS
9 RESISTANCE
10 COPINGFLEXIBILITY
11 FREEZE
12 HPAAXIS
13 ADRENALINE
14 EXTERNAL
15 CORTISOL
16 APPROACH
17 TRANSACTIONALMODEL
18 SYMPATHETIC
19 EPINEPHRINE
20 PARASYMPATHETIC
21 AVOIDANCE
22 EXHAUSTION
23 ACUTE

ACTIVITY 3.14

True/False quiz on stress as a psychobiological process

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

Statement	T/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 The stages of the Transactional Model of Stress and Coping are: stressor, primary appraisal, secondary appraisal, coping response.	T
11 Gut microbiota can be affected by both internal and external factors.	T
12 External stressors can include major life events such as divorce or death.	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 Internal stressors can be physical or psychological.	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 3.14 *continued*

Statement	T/F
20 The gut-brain axis is bi-directional and suggests that the brain influences gut functioning and the gut influences brain functioning.	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 Chronic stress lasts longer than acute stress.	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

TOPIC 4

Approaches to understand learning

	Activities																
Key knowledge	4.1	4.2	4.3	4.4	4.5	4.6	4.7	4.8	4.9	4.10	4.11	4.12	4.13	4.14	4.15	4.16	4.17
• behaviourist approaches to learning, as illustrated by 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, and operant conditioning as a three-phase process (antecedent, behaviour and consequence) involving reinforcement (positive and negative) and punishment (positive and negative)	✓	✓	✓	✓	✓		✓	✓	✓	✓	✓					✓	✓
• social-cognitive approaches to learning, as illustrated by observational learning as a process involving attention, retention, reproduction, motivation and reinforcement												✓	✓	✓		✓	✓
• approaches to learning that situate the learner within a system, as illustrated by Aboriginal and Torres Strait Islander ways of knowing where learning is viewed as being embedded in relationships where the learner is part of a multimodal system of knowledge patterned on Country															✓	✓	✓
Key science skills						✓											

Source: © VCAA, *VCE Psychology Study Design: 2023–2027.* p. 35.

ACTIVITY 4.1

Thinking about learned and unlearned behaviours

1 Explain the difference between the two concepts relating to learned and unlearned behaviours in the boxes below. Include an example of each.

Active learning	versus	Passive learning
Intentional, conscious effort to acquire new knowledge or skills. e.g. Memorising a list of names		Unintentional, unconscious attainment of new knowledge or skills. e.g. Being able to sing along to a song from the radio that you did not deliberately try to learn

Learned behaviour	versus	Unlearned behaviour
A relatively permanent change in behaviour resulting from experience. e.g. Being able to solve a mathematics equation through practice		Behavioural change that is dependent on genetic programming or behaviour that occurs due to innate reflexive response to stimuli. e.g. Toddlers beginning to walk after a period of crawling

Maturation	versus	Reflex
Naturally occurring behaviour that involves an orderly sequence of developmental change that occurs in the nervous system and other bodily structures controlled by genetic inheritance e.g. The rapid acquisition of increased verbal abilities in toddlers from age two onwards		An automatic, relatively fixed and predictable response to a stimulus that does not necessarily require conscious effort e.g. Coughing if we accidently inhale some dust into our lungs

Unconditioned reflex	versus	Conditioned reflexive response
A naturally occurring and predictable behavior that is genetically programmed to occur in response to a stimulus e.g. Closing our eyes when a puff of air hits them		A reflexive behavior that has been reprogrammed to occur in response to a different stimulus than was genetically programmed e.g. Feeling scared when we hear certain music playing when watching a horror movie

Classical conditioning	versus	Operant conditioning
Behavioural change that results from learning that two events go together after we experience them occurring together on a number of occasions e.g. Feeling hungry when we smell the cafeteria food nearby		Behavioural change that results from forming a three-way association between a specific stimulus, a behavioural response and the consequence of that response e.g. Taking paracetamol to reduce the severity of a headache because in the past that has helped relieve the symptoms

2 Think of three examples from your own life that illustrate unlearned and learned behaviours. For each example, try to classify it using terms from **question 1**.

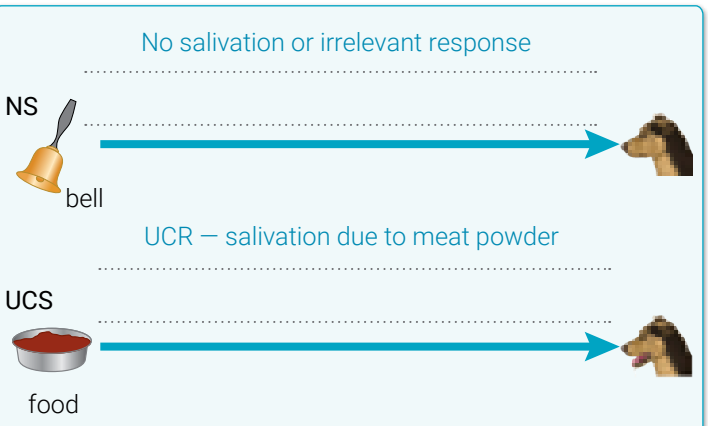
Unlearned behaviours	Learned behaviours
Many answers are possible but should be identifiable as either reflexes or behaviours requiring a maturational progression. e.g. Learning to run AFTER learning to walk, etc	Many answers are possible but should be identifiable as resulting from either direct or indirect experiences (such as observation or vicarious learning). e.g. Becoming fluent in two languages, learning how to balance a bike, etc

Classical conditioning as a three-phase process

1 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.

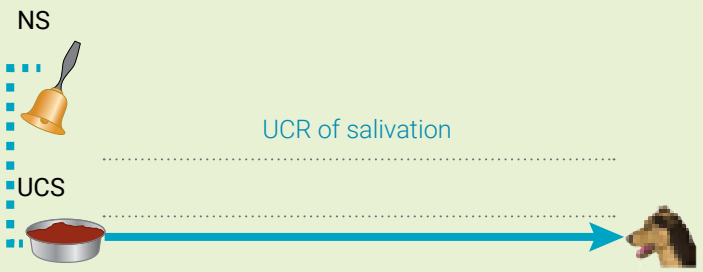
Before conditioning

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



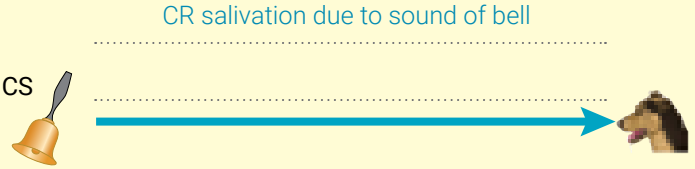
During conditioning

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 triggered by the unconditioned stimulus to produce the unconditioned response.



After conditioning

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



2 Decide if each of the following terms involved in classical conditioning are learned or not learned and justify your decision.

Term	Learned or not learned?	Justification
unconditioned stimulus	Not learned	Innately causes reflexive response
neutral stimulus	Not learned	Has no previous behaviour associated with it
conditioned stimulus	learned	The association of the CS to the UCS must be learned from repeated pairings
unconditioned response	Not learned	Innate reflexive response triggered by a stimulus
conditioned response	learned	Acquired behavioural response that is similar to the UCR now triggered by the CS

3 Explain the role of contiguity in learning through classical conditioning.

Contiguity refers to the formation of a connection or an association between two events when the events occur close together in time and/or space. The two events become linked so that it is difficult to think of one event without thinking of the other. This explains how the neutral stimulus becomes the conditioned stimulus.

ACTIVITY 4.3

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 at 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)

Summarising learning and classical conditioning

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

permanent	changes	classical	reflexive	passive
behavioural	before	predictably	stimuli	acquisition
salivate	unconditioned	spontaneous	conditioned	sound
involuntary	learning	pairing	tone	anticipatory
active	digestive	neutral	accidental	single
strength	association	Pavlov	behaviour	extinction

A relatively permanent change in an organism's behaviour due to experience is called learning. Learning can be active, such as paying attention in a classroom, or it can be passive, such as remembering a bike route without ever consciously trying to memorise it. It is relatively permanent because the change in behaviour must last beyond a single moment in time. Temporary changes in behaviour are not considered learning. Learning the association of two different stimuli is called classical conditioning. The scientific study of classical conditioning began with an accidental discovery made by Russian physiologist, Ivan Pavlov in the 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 salivation response as the food itself. In Pavlov's classic experiments, a tone is sounded just before food is presented. At this time, the tone is called a/an neutral stimulus because it does not produce a relevant behavioural response. In contrast, the food is called a/an unconditioned stimulus because it produces the unconditioned behavioural response of salivation when food is placed in the dog's mouth. This type of response is a reflexive, involuntary behaviour that is reliably and predictably caused by the unconditioned stimulus. Through repeated pairing of the tone and food, trial by trial, the two

stimuli become associated together. Eventually, the dogs in Pavlov's experiment would salivate on hearing the tone. This is a type of anticipatory behaviour because the dogs now associate the tone as heralding the arrival of food. At this point, salivation is now called the conditioned response and the tone is now called a conditioned stimulus. It is labelled 'conditioned' because the association has been learned. The classical conditioning process of learning the conditioned response is called acquisition. It is important to note that a conditioned stimulus–response association is not necessarily permanent. When the strength of an association fades over time and disappears, extinction is said to have occurred. Extinction may also not be permanent. If a conditioned response reappears when the conditioned stimulus is presented following a rest period, spontaneous recovery is said to have occurred.

ACTIVITY 4.5

Using classical conditioning terms to analyse scenarios

Part A

Becoming more familiar with using 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 (screaming at Arun)

UCR crying due to mother's screaming

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 from nearly being hit by the taxi

CS techno song

CR upset and tearful when she hears the techno song

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 due to the virus

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.

ACTIVITY 4.5 *continued*

Analysis:

NS .....

UCS .....

UCR .....

CS .....

CR .....

ACTIVITY 4.6

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 **Female**	81 19	12 2	18 4	19 8	22 3	7 2	2 –	1 –
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 that 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.

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 type of research design used by Wickes.

within groups design

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 adolescents aged over 13 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 the toilet)

conditioned response: wake up (and go to the 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 fewer than 3 nights, 14 between 4–6 nights, and 17 wet the bed on 7+ nights.

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 fewer 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.)

Operant conditioning as a three-phase model

1 Complete the following diagram illustrating the three-phase model of operant conditioning. Name each phase at the top and then add a description of each phase with an example.

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

2 Explain why an antecedent stimulus is also called a discriminative stimulus.

The antecedent stimulus is also called the discriminative stimulus because it helps the learner to distinguish between the consequences that follow specific behaviours in different situations. For example, a driver soon learns that the brake pedal will slow a car while the accelerator pedal will accelerate it. In this case the driver is discriminating between the two pedals based on the consequences that follow.

3 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 4.8

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)** discriminative stimulus
(k)	**12** Another term for the antecedent stimulus, which highlights how a learner distinguishes different types of consequences associated with certain behaviours.	**(l)** positive punishment

ACTIVITY 4.9

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.

three-phase	consequences	stimulus	strength	operant
voluntary	weakened	present	associating	response
repeated	behaviour	signals	strengthened	signal
antecedent	increasing	desirable	sequence	undesirable

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 and 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 order of occurrence in the model is the antecedent (which is a stimulus in the environment), a behaviour (which is a voluntary 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 you 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). However, had you not seen the bench or if there was no bench, then you could not sit down to rest and get physical relief. This highlights that the antecedent must 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,

ACTIVITY 4.9 *continued*

thereby increasing the likelihood that it will be repeated in the future. If sitting down on the bench causes it to immediately collapse, 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.

ACTIVITY 4.10

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	staying out later than agreed	weakened

Event	Type of consequence	Behaviour affected	Behaviour likely to be weakened or strengthened?
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.	negative punishment	poor work performance	weakened
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.	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

Event	Type of consequence	Behaviour affected	Behaviour likely to be weakened or strengthened?
10 Arun uploads a YouTube video of himself dancing that 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
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 (shock is turned off when rat turns right).	negative reinforcement	turning right in maze	strengthened

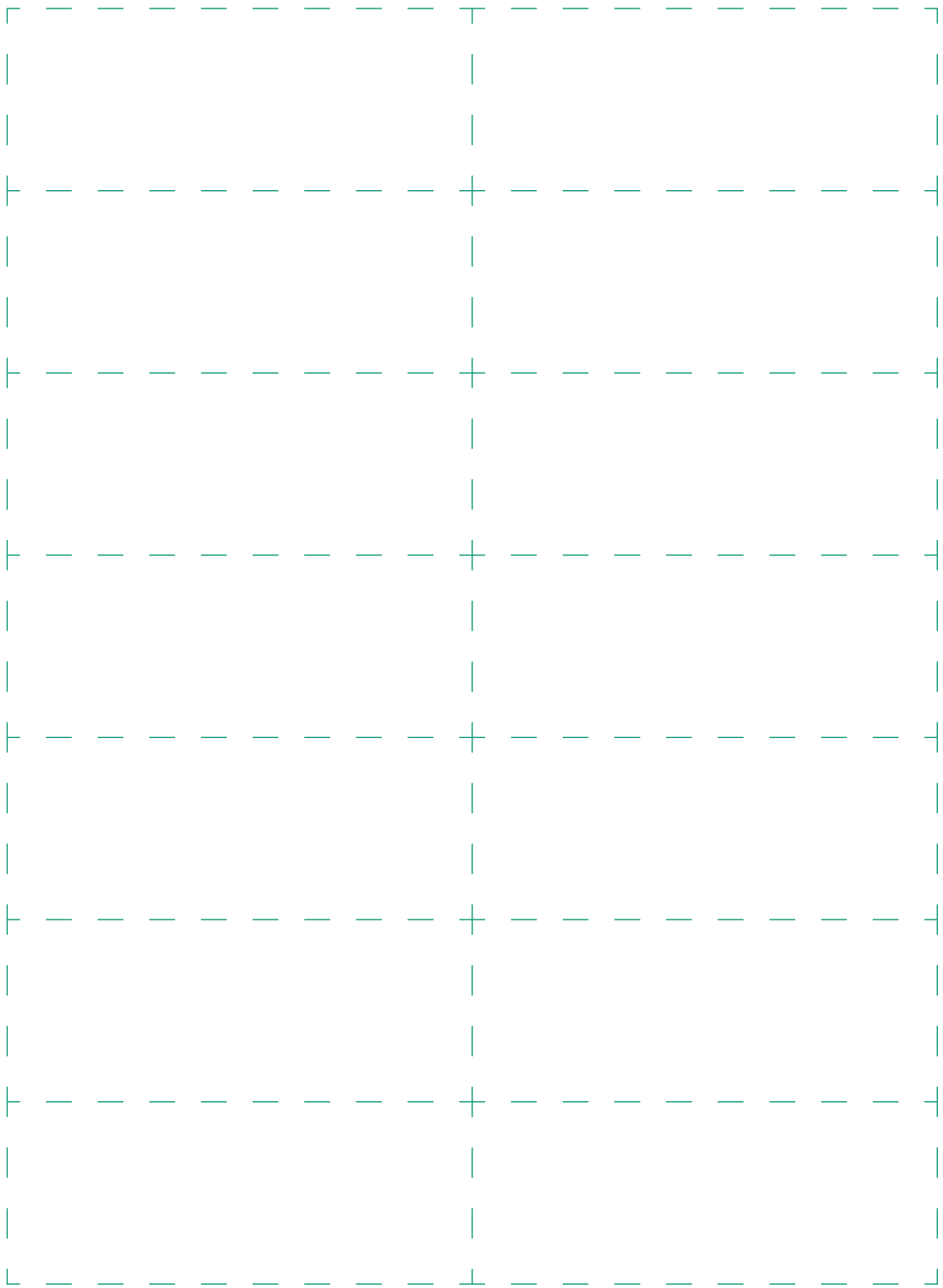
ACTIVITY 4.11

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
Order of presentation of the stimulus and the response	The response (whether conditioned or unconditioned) always occurs after the stimulus is presented (whether conditioned or unconditioned).	The response usually occurs before the consequence is applied (if the consequence is acting as the stimulus) or after the antecedent stimulus (environmental cue suggesting behaviour to perform).
Increase in learned behaviour associated with stimulus	Conditioned response (association) will increase when the UCS is repeatedly presented with the NS.	Association of behaviour to the antecedent followed by desirable consequences will become strengthened.
Decrease in learned behaviour associated with stimulus	Conditioned response (association) will decrease when the NS is repeatedly presented without the UCS.	Association of behaviour to the antecedent followed by undesirable consequences will become weakened.

Association of behaviour to the antecedent followed by undesirable consequences will become weakened.	Conditioned response (association) will decrease when the NS is repeatedly presented without the UCS.
The response is usually voluntary, (e.g. intentional, conscious) involving the central nervous system.	The response is usually involuntary (e.g. reflexive, unconscious), involving the autonomic nervous system.
The response usually occurs before the consequence is applied (if the consequence is acting as the stimulus) or after the antecedent stimulus (environmental cue suggesting behaviour to perform).	Association of behaviour to the antecedent followed by desirable consequences will become strengthened.
Conditioned response (association) will increase when the UCS is repeatedly presented with the NS.	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.	Ivan Pavlov (1849–1936)
B.F. Skinner (1904–1990)	The learner has an active role because responses are primarily voluntary and the learner must operate on its environment in some way.
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 response (whether conditioned or unconditioned) always occurs after the stimulus is presented (whether conditioned or unconditioned).



ACTIVITY 4.12

Summarising observational learning as social learning

Select terms from the shaded panel below to correctly complete the paragraph about observational learning. Each term should be used and some terms are used more than once.

behaviour	reproduce	vicarious	influenced	more
model	cognitive	responses	latent	less
values	conditioning	observe	copy	retention
beliefs	motivation	mental	attention	consequences
learn	social learning	undesirable	information	punished
fictional				

Observational learning occurs when we observe the behaviour and consequences of the actions of a model. A model may be a real person or they can be a fictional person, such as a superhero or character in a movie. Albert Bandura described observational learning as social learning because as we grow from infancy to adulthood we observe and are influenced by the people around us. This interaction provides us with a rich source of information about our environment. By watching behaviour and its consequences being experienced by others, we can learn the behaviours we wish to copy and those we do not. We are more likely to reproduce responses from models whose behaviour and consequences we perceive as desirable. We are less likely to reproduce responses from models whose behaviour and consequences we perceive as undesirable. This highlights how social learning also involves learning through conditioning. Bandura called this vicarious conditioning because the observer's behaviour is conditioned by watching someone else being reinforced or punished without them personally experiencing the consequence directly. For example, a child who sees another child scolded by their parent for bad behaviour might vicariously learn to avoid that behaviour because they too do not wish to get scolded by their parent. Bandura concluded that it is not only behavioural responses that can be socially learned. Many of our attitudes,

ACTIVITY 4.12 *continued*

values and beliefs are also the product of observing others. As well as observation, social learning also involves cognitive processes such as paying close attention to the model and forming mental representations (memories) of the behaviours that are observed. Bandura's model of this process involves a sequence of processes that summarise the observational learning process. This includes attention, retention, reproduction, motivation and reinforcement. This model allows for learned behaviours that are not immediately shown, possibly because the learner has no motivation. When learned behaviour is demonstrated some time later it is known as latent learning.

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 it 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).

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).

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.

ACTIVITY 4.14

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 • 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 4.15

Aboriginal and Torres Strait Islander ways of knowing

Complete the following paragraph on Aboriginal and Torres Strait Islander ways of knowing using the terms in the shaded panel below. Each word is used only once.

cultural	ancestral	community	self-identity	waterways
songlines	locations	multimodal	stories	dance
relational	landscape	learning	knowing	land
walking	embedded	Country	learners	physical

Aboriginal and Torres Strait Islander peoples' ways of knowing and learning are holistic and relational to Country. Country is the land, waterways and seas to which Aboriginal and Torres Strait Islander people are connected through ancestral ties and family origins. The connection to Country is spiritual and physical, and includes responsibility for physical safeguarding of the land.

Because they demonstrate where one is from, both Country and cultural group are critical to any Aboriginal and Torres Strait Islander person in their self-identity and when introducing oneself to other First Nations people. Connection to Country has ongoing life responsibilities to the land where a person is born or where their ancestors were born.

The knowledge accumulated by Aboriginal and Torres Strait Islander people over many thousands of years is embedded in Country, and their ways of knowing and learning are embedded within the different relationships they have as learners, including with their family, community, the land, the waters and the skies.

This knowledge is attached to numerous locations throughout Australia along navigational tracks called songlines. The knowledge is often in multimodal form and is shared and learnt in multimodal ways, such as through stories, song, dance and ceremony.

ACTIVITY 4.15 *continued*

Over thousands of years, learning has existed due to the story of the landscape by telling stories on Country, walking Country and learning the story that is written within the land.

ACTIVITY 4.16

Crossword on concepts and terms in models to explain learning

Across

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

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

9 In social learning, the type of conditioning that occurs through observation alone, without direct and personal experience of the consequences

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

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

13 A type of learning that involves observation of a model's actions and the consequences

14 Strengthening or increasing the likelihood of a response by using a pleasant stimulus

15 The stimulus that is initially neutral but will later elicit the conditioned response through classical conditioning

Down

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

2 The response to the conditioned stimulus acquired through classical conditioning

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

5 An emotional reaction acquired through classical conditioning

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

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

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

1 ANTECEDENT
2 CONDITIONED STIMULUS
3 CLASSICAL
4 BEHAVIOUR
5 CONDITIONED RESPONSE
6 UNCONDITIONED RESPONSE
7 NEGATIVE REINFORCEMENT
8 UNCONDITIONED STIMULUS
9 VICARIOUS
10 UNCONDITIONED RESPONSE
11 OPERANT
12 NEUTRAL
13 OBSERVATIONAL
14 POSITIVE REINFORCEMENT
15 CONDITIONED STIMULUS

ACTIVITY 4.17

True/False quiz on models to explain learning

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

Statement	T/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 If someone observes a model's behaviour and does not reproduce the behaviour, it does not mean that the behaviour was not learned.	T
6 Negative reinforcement decreases the likelihood that a response will occur.	F
7 A fly landing on your nose could be considered to be an antecedent.	T
8 Classical and operant conditioning demonstrate that learning is best defined as a temporary change in behaviour due to experience.	F
9 We are more likely to want to imitate the behaviour of someone we perceive as similar to ourselves.	T
10 Modelling involves learning based on observing the behaviour of others.	T
11 In observational learning, vicarious reinforcement refers to when the learner is rewarded by watching the model perform a behaviour that is interesting.	F
12 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
13 Observational learning is a method of social learning involving attention, retention, reproduction, motivation and reinforcement.	T
14 A reinforcer is a stimulus that precedes a response and subsequently increases the probability of that response.	F
15 Observational learning does not involve conditioning.	F
16 In classical conditioning, the neutral stimulus must be presented before the unconditioned stimulus, ideally within about half a second.	T
17 Taking a paracetamol tablet to reduce the pain associated with a headache would be considered positive reinforcement.	F
18 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
19 Observational learning is used by children but not adults.	F
20 Observational learning is considered an active form of learning because it involves cognitive processes.	T

Statement	T/F
21 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
22 Both operant and classical conditioning can occur vicariously through observational learning.	T
23 A conditioned stimulus is a stimulus that is learned, whereas a neutral stimulus is a stimulus that is not learned.	T
24 A child doing his homework because he receives the teacher's approval is demonstrating behaviour learnt through classical conditioning.	F
25 Response cost removes a reinforcer and is a form of negative punishment aiming to weaken a response.	T

TOPIC 5

The psychobiological process of memory

	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
• the explanatory power of Atkinson–Shiffrin multi-store model of memory in the encoding, storage and retrieval of stored information in sensory, short-term and long-term memory stores	✓	✓	✓	✓	✓	✓	✓								✓
• the roles of the hippocampus, amygdala, neocortex, basal ganglia and cerebellum in long-term implicit and explicit memories								✓	✓	✓					✓
• the role of episodic and semantic memory in retrieving autobiographical events and in constructing possible imagined futures, including evidence from brain imaging and post-mortem studies of brain lesions in people with Alzheimer's disease and aphantasia as an example of individual differences in the experience of mental imagery													✓	✓	✓
• the use of mnemonics (acronyms, acrostics and the method of loci) by written cultures to increase the encoding, storage and retrieval of information as compared with the use of mnemonics such as sung narrative used by oral cultures, including Aboriginal peoples' use of Songlines											✓	✓			✓
Key science skills													✓		

Source: © VCAA, *VCE Psychology Study Design: 2023–2027.* p. 35.

ACTIVITY 5.1

Thinking about the process model of memory

1 In each box below, explain the three key terms relating to the process model of memory.

Encoding	Storage	Retrieval
Definition: Conversion of information into a usable form so that it can be neurologically represented and stored in memory	Definition: Retention of encoded information over time within the brain	Definition: Recovery of stored information into conscious awareness for use when needed
How failure might occur: Not paying attention or misinterpretation of incoming sensory information/stimuli	How failure might occur: Insufficient rehearsal of incoming information or insufficient linking with other stored memories	How failure might occur: Inability to activate correct retrieval cues or decay of neural pathways associated with the memory

2 Apply the process model of memory to the following scenario.
Imagine you are sitting in a mathematics class listening to your teacher, who is explaining a new procedure for solving equations. Later that evening, you successfully apply that learning to complete your mathematics homework.

By paying close attention to the teacher, visual and verbal information inputted through sensory receptors is able to become **encoded** into a neurological form inside the brain. By practicing in class or by asking questions, incoming

sensory information is sufficiently rehearsed to enable longer-term **storage**. Later that evening, when sitting down to complete the homework, correct recall cues are able to be activated, allowing the **retrieval** of the correct procedures required to complete the task.

ACTIVITY 5.2

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

ACTIVITY 5.2 *continued*

Store	Function	Capacity	Duration
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')
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 5.3

Memory store function, capacity and duration

Tick which memory store is most involved in relation to each statement. More than one memory store may be involved with some statements.

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 can be catagorised as implicit or explicit depending on awareness.			✔
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 This store is also known as working memory because it allows manipulation and processing of information.		✔	
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 Memories of personal events are stored here.			✔
20 Information transferred to this store can be held there indefinitely using a rehearsal technique.		✔	

ACTIVITY 5.4

An overview of the Atkinson–Shiffrin model

Select terms from the shaded panel below to correctly complete the passage about memory. Each term should be used and terms are used only once.

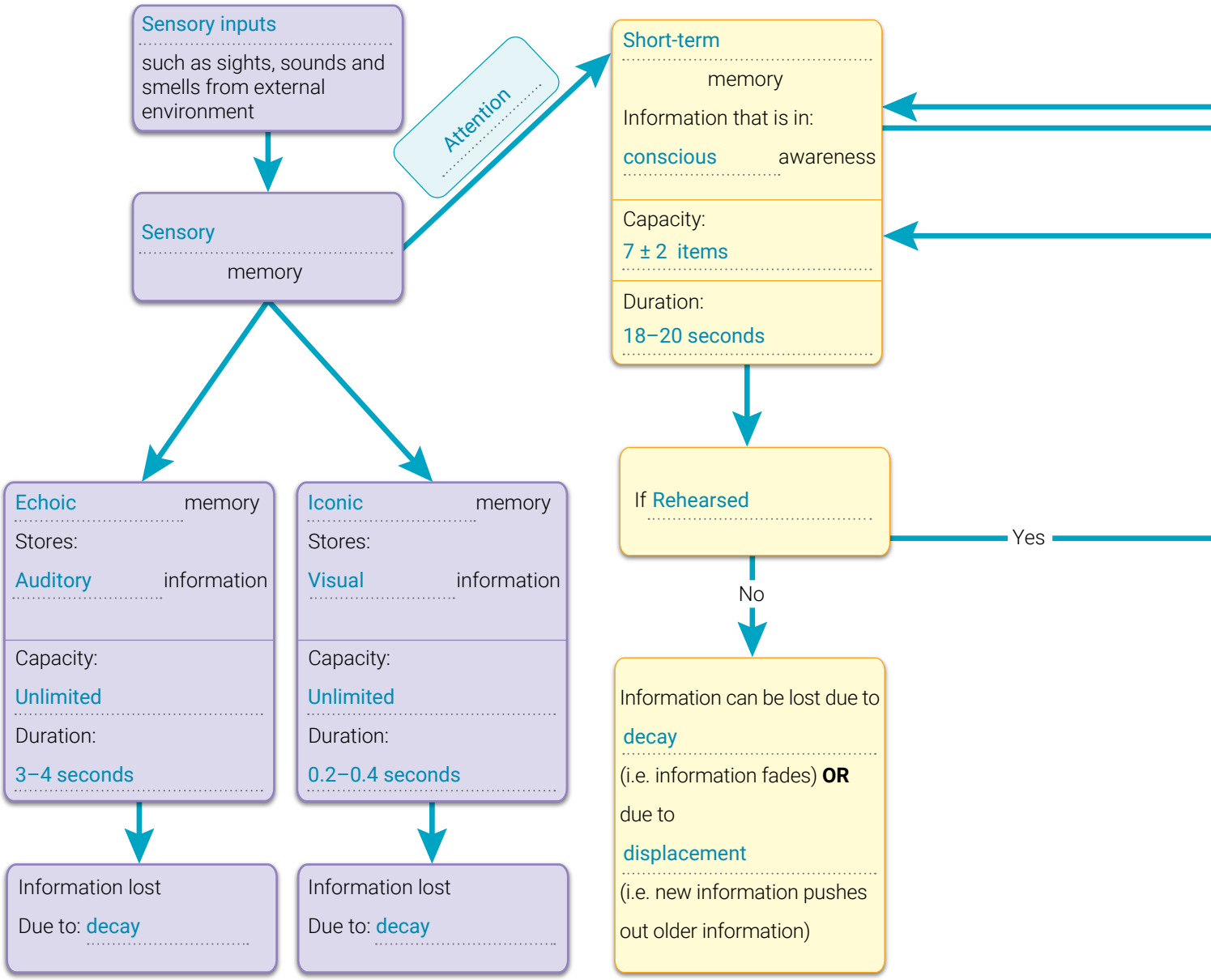
changed	multi-store	short-term	new	stores
sensory	three	encoding	neurologically	transferred
flow	conversion	decay	long-term	retrieval
18–20	processing	recovery	models	seconds
raw	storage	unlimited	conscious	unencoded

Psychologists have developed several models of memory that typically show a flow of information through different memory stores. Most models involve three core processes of encoding, storage and retrieval. Encoding refers to the conversion of sensory information into a usable form that can be neurologically represented and retained. Storage refers to the retention of the changed information over time and retrieval refers to the recovery of stored information for use when needed. According to the Atkinson–Shiffrin multi-store model, sensory memory is the gateway for new information and can store vast quantities of this raw sensory input for up to several seconds depending on the type of information. At this stage the information remains unencoded. If we attend to this information, it can then 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 applied. If further information processing occurs here, then information from short-term memory can become encoded into long-term memory. This can store an unlimited amount of information for up to a lifetime.

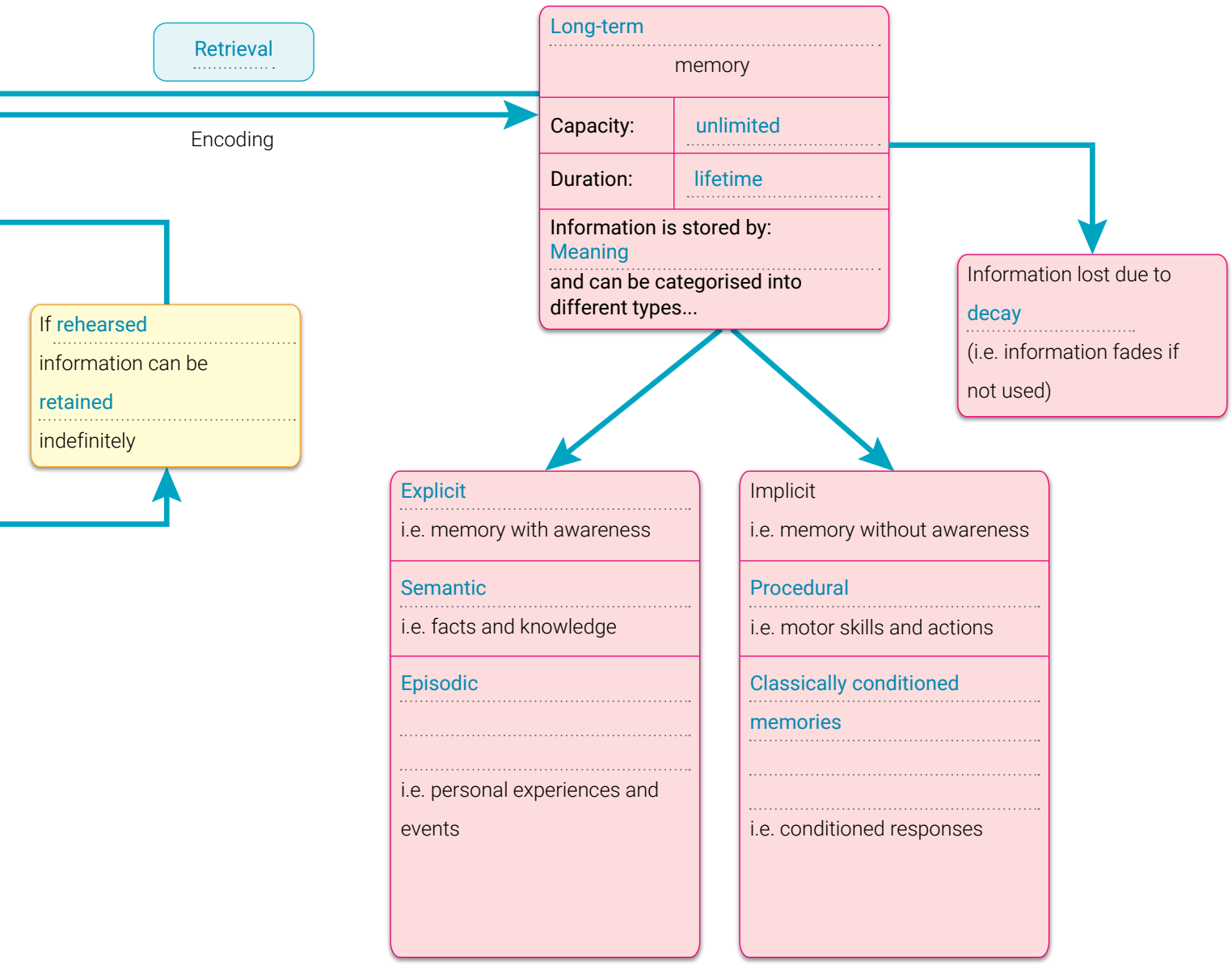
ACTIVITY 5.5

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

Using the words provided in the shaded panel on the opposite page, complete this flow chart to summarise the different memory stores and transfer of information through the Atkinson–Shiffrin multi-store model of memory. All words are used and some words can be used more than once.



Echoic	Lifetime	Classically conditioned memories	Visual	Sensory inputs	Episodic	Conscious
Decay	Implicit	Retained	Sensory	Procedural	Iconic	Attention
Unlimited	Semantic	Short-term	Explicit	3–4 seconds	Rehearsed	Meaning
Displacement	7 ± 2 items	18–20 seconds	Long-term	Retrieval	0.2–0.4 seconds	Auditory



ACTIVITY 5.6

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

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

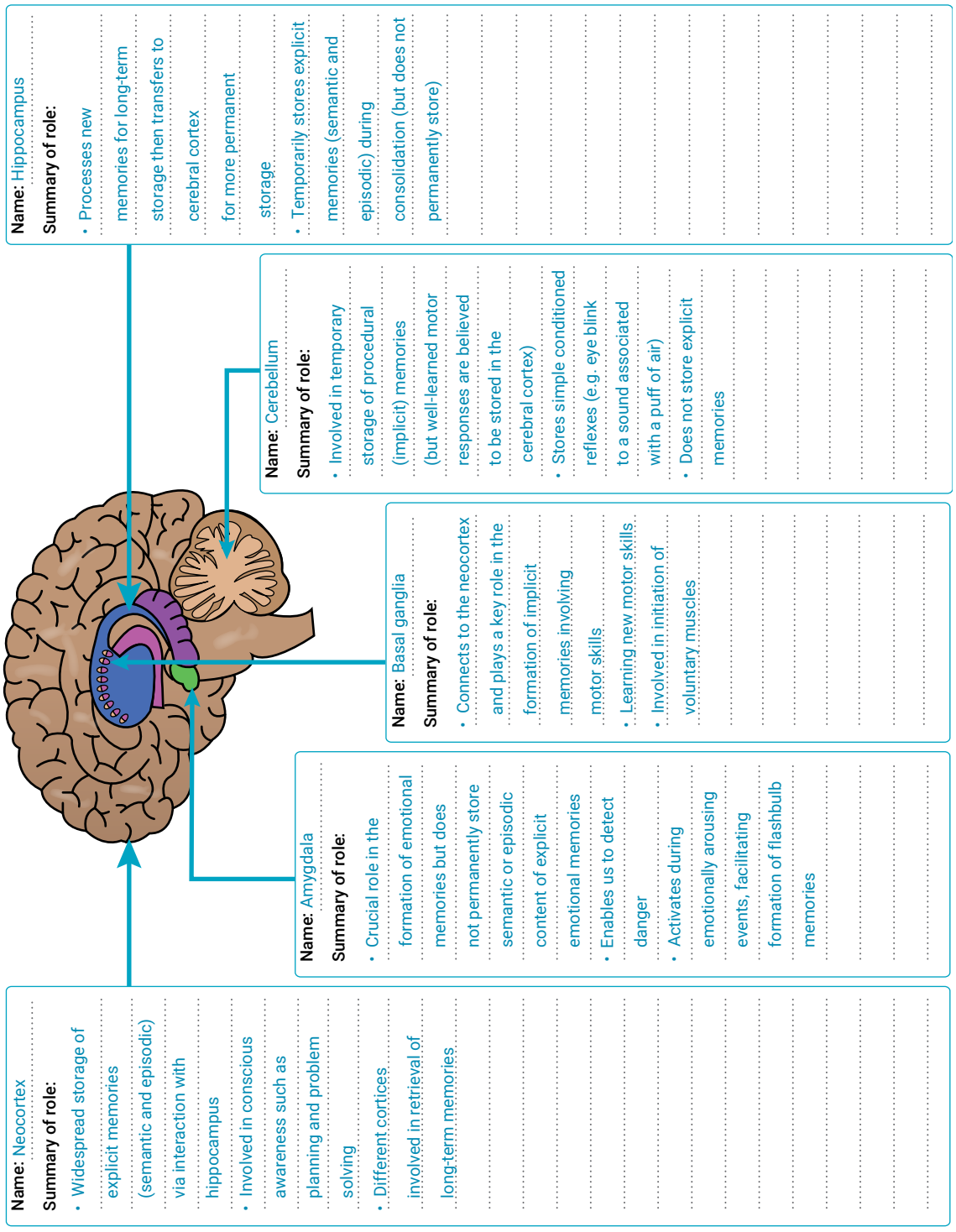
Name: Classically conditioned memory

Description: Conditioned responses to conditioned stimuli

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

Brain regions involved in long-term memory formation and storage

Name each of the brain regions indicated in this diagram. For each region, summarise the role it plays in the formation or storage of long-term memories.



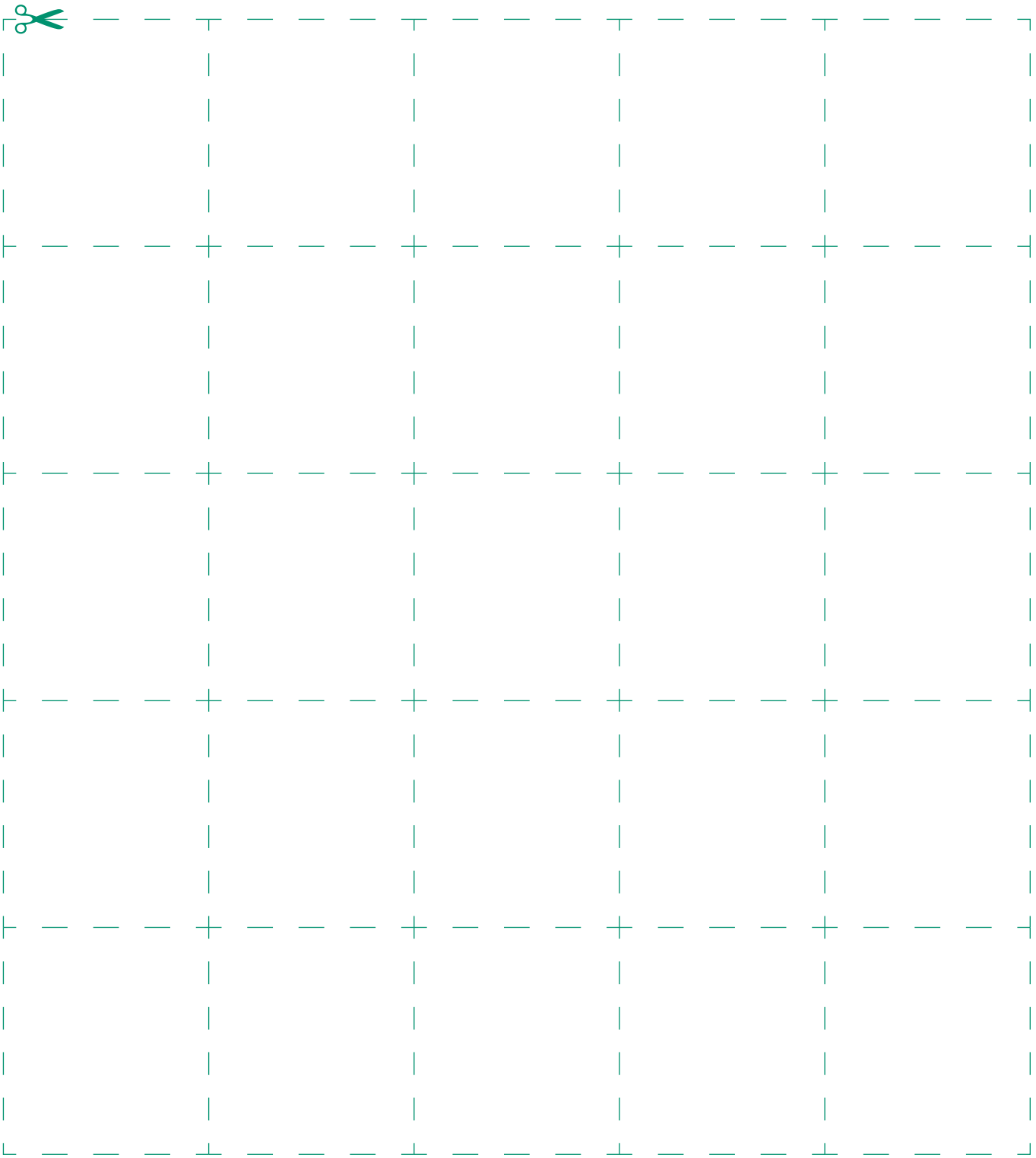
ACTIVITY 5.9

Identifying roles of brain structures involved in formation and storage of long-term memories

Cut out each role on the following page and arrange them under the correct heading in this table. Not every cell in the table will be filled by the end.

Neocortex	Hippocampus	Amygdala	Basal Ganglia	Cerebellum
The most recently evolved layer of the brain found only in mammals	Ensures memories become neurologically stable	Plays a key role in processing emotional memories	Connects to the neocortex and is crucial in formation of implicit memories involving motor-skills	Large structure located at the back of the brain that is densely packed with neurons
Plays the most crucial role in allowing conscious thought such as thinking, planning and problem solving	Involved in consolidation of explicit long-term memories	Key brain structure that enables us to detect danger	Damage to this brain structure is common in people who suffer from Parkinson's disease showing motor function impairments	Coordinates fine muscle movements and helps regulate posture and balance
Believed to be the final storage location for most long-term memories	Transfers memories to the neocortex for permanent storage	Involved in the formation of classically conditioned emotional responses	Helps us to become less sensitive to repetitive environmental stimuli (habituated)	Plays a critical role increasing ease and fluency of well-rehearsed motor skills such as playing the piano
Contains different areas that specialise in receiving and processing different sensory information	Integrates new information with previously stored information when forming memories	Can be influenced by adrenaline during emotionally arousing events sometimes forming flashbulb memories	Damage to this structure reduces our ability to remember and therefore improve motor skills	Involved when learning new motor skills but is not the site of implicit memory storage
				Facilitates acquisition of classically conditioned reflexes such as eye blinking when a balloon is about to be burst

Ensures memories become neurologically stable	Connects to the neocortex and is crucial in the formation of implicit memories involving motor-skills	Large structure located at the back of the brain that is densely packed with neurons	The most recently evolved layer of the brain found only in mammals	Plays a key role in processing emotional memories
Involved in consolidation of explicit long-term memories	Damage to this brain structure is common in people who suffer from Parkinson's disease, showing motor function impairments	Coordinates fine muscle movements and helps regulate posture and balance	Plays the most crucial role in allowing conscious thought, such as thinking, planning and problem solving	Key brain structure that enables us to detect danger
Transfers memories to the neocortex for permanent storage	Helps us to become less sensitive to repetitive environmental stimuli (habituated)	Plays a critical role increasing ease and fluency of well-rehearsed motor skills such as playing the piano	Facilitates acquisition of classically conditioned reflexes, such as eye blinking when a balloon is about to be burst	Involved in the formation of classically conditioned emotional responses
Integrates new information with previously stored information when forming memories	Damage to this structure reduces our ability to remember and therefore improve motor skills	Involved when learning new motor skills but is not the site of implicit memory storage	Contains different areas that specialise in receiving and processing different sensory information	Can be influenced by adrenaline during emotionally arousing events, sometimes forming flashbulb memories
				Believed to be the final storage location for most long-term memories



ACTIVITY 5.10

Analysis of a scenario involving LTM formation and storage

Identify the long-term memory types (semantic, episodic, procedural, classically conditioned) and brain regions involved (neocortex, hippocampus, basal ganglia, amygdala, cerebellum) in different parts of the scenario, focusing on the storage role/s of the brain regions. Tick the boxes that apply and then name and explain the different brain regions involved. 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:** explicit ✔ / implicit ☐ semantic ✔ / episodic ✔ / procedural ☐ / classically conditioned ☐ **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	explicit ✔ / implicit ☐ semantic ✔ / episodic ✔ / procedural ☐ / classically conditioned ☐ **brain region(s) involved in storage and explanation of choice:** neocortex — 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	explicit ☐ implicit ☑ semantic ☐ episodic ☐ procedural ☐ classically conditioned ☑ **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	explicit ☐ | implicit ☑ semantic ☐ | episodic ☐ | procedural ☑ | classically conditioned ☐ **brain region(s) involved in storage and explanation of choice:** neocortex — 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.) basal ganglia — initiation and control of voluntary muscles involved in balance and walking
Xanthe knows how to cross busy roads safely	explicit ☑ | implicit ☐ semantic ☑ | episodic ☑ | procedural ☐ | classically conditioned ☐ **brain region(s) involved in storage and explanation of choice:** neocortex — 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

An overview of Alzheimer's disease

Use the terms provided in the shaded panel below to correctly complete the passage about Alzheimer's disease. Each term is used once.

cognitive	procedural	death	neurodegenerative	anterograde
hippocampus	long-term memory	irritability	symptoms	semantic
memory loss	*tau*	forgetting	neurofibrillary tangles	outside
transport	neurons	acetylcholine	dementias	within
recognise	beta amyloid	deeper	explicit	personality
naturally	slowly	memories	accumulate	communication

Alzheimer's disease is a neurodegenerative disorder characterised by the degeneration of brain neurons, causing increasing memory decline, deterioration of cognitive and social skills, and personality changes. As more neurons die, affected brain areas shrink. Like other dementias, Alzheimer's disease eventually causes death. Short-term memory loss is usually the first symptom. As the disease moves into deeper parts of the brain, long-term memory is increasingly impaired. Damage to neurons in the hippocampus prevents formation of new memories and leads to anterograde amnesia. The disease also damages neurons in networks that encode existing memories. This leads to retrograde amnesia.

Generally, explicit memories are the most affected. Implicit memories tend to remain mostly intact or are less severely affected. Procedural memories for motor skills are often the last to deteriorate. Because Alzheimer's disease affects brain function, many other aspects of behaviour are also disturbed. This can include forgetting significant events; inability to recognise friends and family; inability to recall common words or names; diminished ability to follow directions or perform everyday skills

such as getting dressed, cooking or cleaning; being unable to follow a story in a movie or book; and the loss of previously known semantic knowledge.

The rate of progression of Alzheimer's disease and its symptoms varies between people. It typically starts slowly, and early symptoms can be subtle. These can include memory loss for recent events; confusion; unusual levels of irritability; impaired decision-making; reduced interest in hobbies and social activities; and needing to be prompted about personal care.

Neural tissue in a brain with Alzheimer's disease typically shows high levels of abnormal structures that interfere with neural communication within and between neurons that impair normal brain function.

Plaques are fragments of protein called beta amyloid that the body produces normally. In Alzheimer's disease, the fragments accumulate over time to form clumps outside and around neurons impairing synapses and inhibiting communication between neurons. Inside neurons, another protein called *tau* accumulates. Gradually these tau deposits form neurofibrillary tangles. These look like twisted fibres and inhibit transport of essential nutrients within the neuron, eventually leading to cell death. People with Alzheimer's disease also have greatly reduced levels of the neurotransmitter acetylcholine (ACh). The amount of ACh in the brain decreases naturally as we age. With Alzheimer's disease, however, it decreases much faster than normal.

ACTIVITY 5.12

True/False quiz on Alzheimer's disease

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

Statement	T/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 5.13

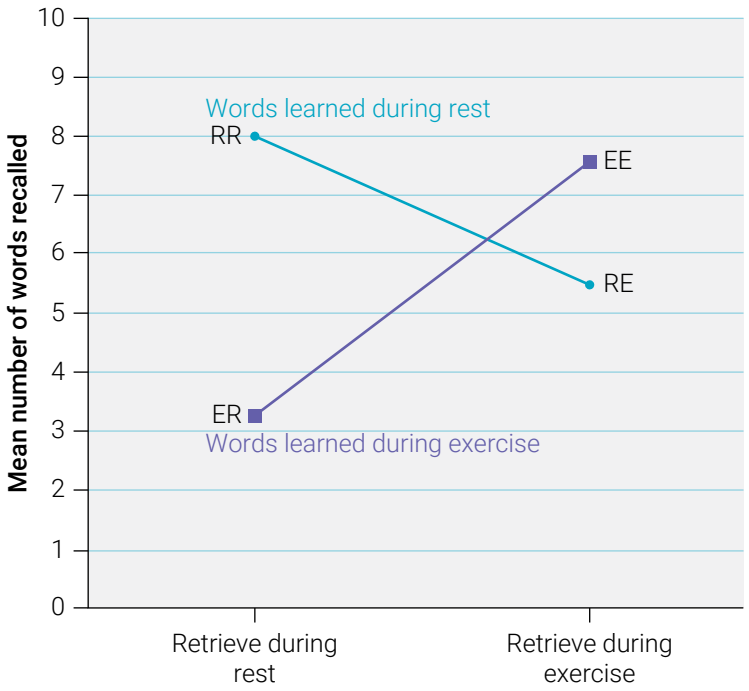
Evaluation of research on retrieval cues

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.

within groups design (repeated measures)

3 Identify the sampling procedure.

non-random (convenience sampling)

4 Identify the operationalised independent and dependent variables.

independent variable: change in heart rate

dependent variable: number of correct words recalled

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 (e.g. 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 5.14

Techniques that increase encoding, storage and retrieval

1 Distinguish between an acronym and an acrostic.

An acronym is a pronounceable word formed from the first letters of a group of words whereas an acrostic is a sentence (or phrase) that uses the first letters of the information to be remembered as the first letters of words used.

2 Find out what each of the following acronyms stand for.

Acronym	Stands for:
NASA	National Aeronautics and Space Administration
QANTAS	Queensland and Northern Territory Aerial Services
WHO	World Health Organization
NHMRC	National Health and Medical Research Council

3 Write down four of your favorite texting acronyms and what they stand for.

My favorite texting acronyms	Stands for:
	Responses are personal and will vary

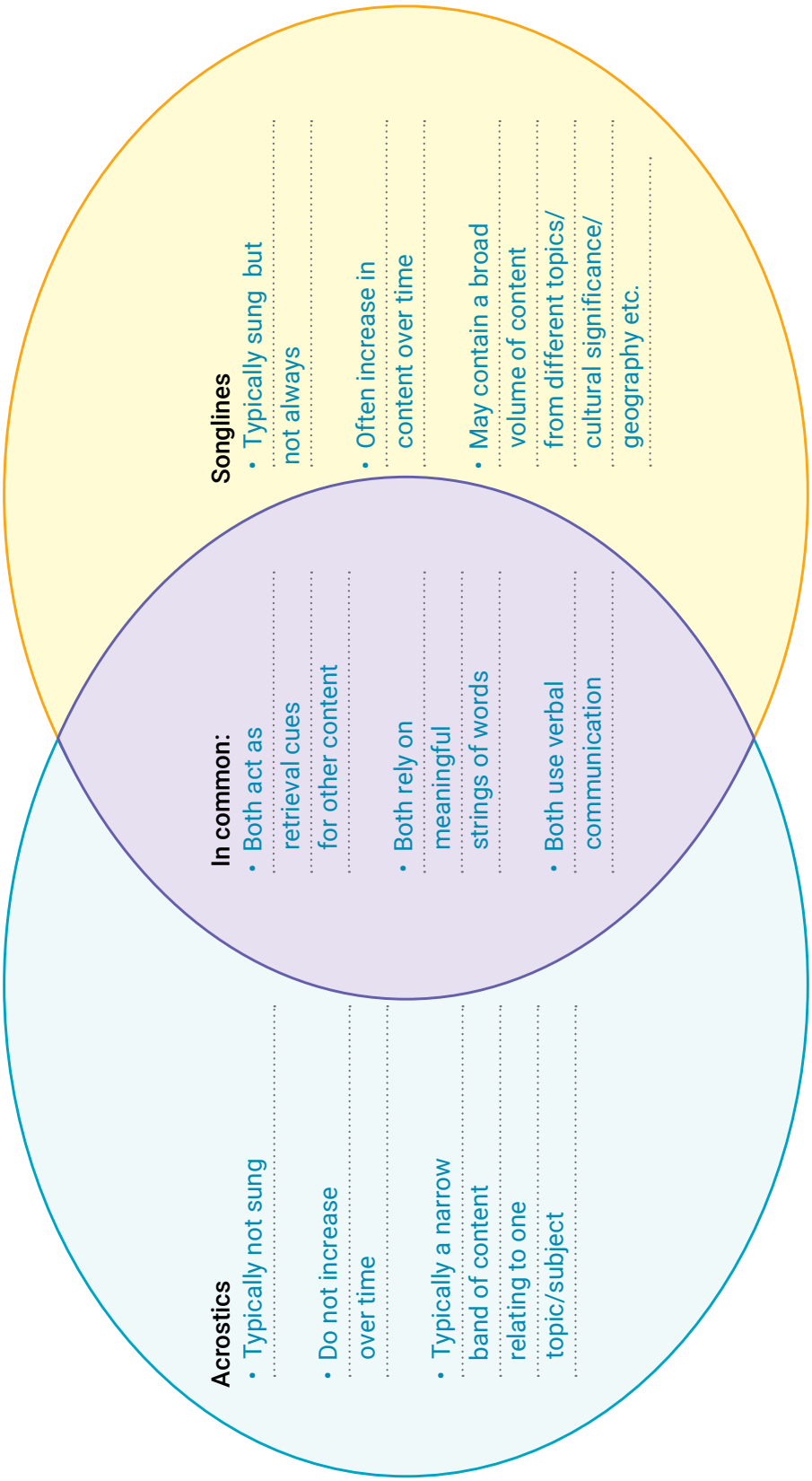
4 Find out what these famous acrostics stand for. A hint is given for each!

Acrostic	Hint!	Stands for:
Roy G Biv	Physics	The order of the colours of the rainbow. (red, orange, yellow, green, blue, indigo and violet)
Every Good Boy Deserves Fruit	Music	The notes of the lines in music
My Very Educated Mother Just Served Us Nachos	Astronomy	The correct order of the planets (Mercury, Venus, Earth, Mars, Jupiter, Saturn, Uranus, Neptune)
Real Monkeys Insist on Very Useful Xmas Gifts	Physics	The correct order of the electromagnetic spectrum (radio waves, microwaves, infrared, visible light, ultraviolet, x-rays, gamma rays)

5 Write out two of your own acrostics to help you learn part of the Year 12 Psychology course.

My acrostics for psychology	Stands for:

6 Complete the following Venn diagram to show the difference and similarity between a Songline (such as those used by First Nations Australians) and an acrostic (as its commonly defined in psychology).



ACTIVITY 5.15

Crossword on concepts and terms in memory

Across

2 LTM of facts and knowledge; knowing *that*

7 A brain structure located at the back of the brain associated with coordination of fine motor skills, regulation of posture and balance

8 Entry point for incoming information that may later become stored

12 A carefully chosen sentence made from words that act as memory retrieval cues, usually linked to the first letter of each word

14 LTM of personally experienced events

16 The repetition of information, vocally or sub-vocally, to extend duration of STM

17 LTM that can be consciously retrieved and stated

18 A deep brain structure associated with Parkinson's disease and implicit memory associated with motor skills

19 Information from sensory can be encoded into this store if attention is paid; capacity is limited

20 Part of temporal lobe crucial for the formation of new semantic and episodic memory

21 The loss of information from a memory store due to being pushed out by new information

Down

1 The neurobiological process of making a new memory stable and enduring in LTM

3 Visual sensory memory

4 LTM of skills or procedures; knowing *how*

5 Outer sheet of wrinkly neural tissue that forms the outer layer of the brain and plays a crucial role in LTM storage and retrieval

6 Brain structure involved in regulating and encoding emotions

9 LTM that does not require conscious or intentional retrieval

10 A brain condition that prevents people from being able to use visual imagery when thinking

11 The loss of information from a memory store due to lack of rehearsal

13 The recovery of information from LTM back into conscious awareness

15 Also known as a dreaming track, used by First Nations Australians to remember navigational routes as well as other information associated with Country

22 Memory system capable of storing information indefinitely without rehearsal

23 Auditory sensory memory

24 The conversion of sensory information into a usable form that can be stored in the brain as a neurological representation

CONSOLIDATION
SEMANTIC
CONICE
PREOCCUPIED
SENSORY
DECAY
ACROSTIC
ALARM
NEBULA
EXCHANGE
RELEASE
ALIEN
DECAY
APHASIA
TEMPORAL
SHORT
ACTION
ENCODING
MEMORY
CHOICE
LONG
TERM
DISPLACEMENT
IMPLICIT
RETRIEVAL
PROACTIVE
INTERFERENCE
HIPPOCAMPUS

UNIT 4

HOW IS MENTAL WELLBEING SUPPORTED AND MAINTAINED?

TOPIC 6

The demand for sleep

	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	6.13	6.14	6.15
• sleep as a psychological construct that is broadly categorised as a naturally occurring altered state of consciousness and is further categorised into REM and NREM sleep, and the measurement of physiological responses associated with sleep, through electroencephalography (EEG), electromyography (EMG), electro-oculography (EOG), sleep diaries and video monitoring	✓	✓	✓	✓										✓	✓
• regulation of sleep-wake patterns by internal biological mechanisms, with reference to circadian rhythm, ultradian rhythms of REM and NREM Stages 1–3, the suprachiasmatic nucleus and melatonin					✓	✓	✓	✓	✓			✓	✓	✓	✓
• differences in, and explanations for, the demands for sleep across the life span, with reference to total amount of sleep and changes in a typical pattern of sleep (proportion of REM and NREM)										✓	✓	✓	✓	✓	✓
Key science skills										✓	✓		✓		

Source: © VCAA, *VCE Psychology Study Design: 2023–2027*. p. 39.

ACTIVITY 6.1

Explaining some characteristics of human consciousness

1 Define 'consciousness'.

Our awareness of something either internal or external to our self, including our awareness of all objects and events in the external world, and our sensations, mental experiences and our own existence at any given moment

2 Complete the following table describing the differences between normal waking consciousness and altered state of consciousness.

Normal waking consciousness (NWC)	Altered state of consciousness (ASC)
Description: Associated with being awake Aware of objects and events in the external world Aware of sensations and mental experiences Aware of feelings Aware of normal passage of time Constantly changes throughout time awake Not a single state – varies throughout the day in relation to how alert we are Can include levels of heightened or lowered alertness Approximately two-thirds of each 24-hour day/night cycle Examples: Awake at school, driving a car, reading a book, feeling relaxed, being alert, etc	Description: Associated with being in states that are different to NWC Involves changes in awareness of objects and events in the external world Mental processing of internal and external stimuli shows distinguishable, measurable changes Possible less inhibition or self control Exaggeration of emotional response Distortion in perception of passage of time Altered awareness of sensation and/or perception Approximately one-third of each 24-hour day/night cycle Examples: Sleep, drug-induced states, meditation, daydreaming, anaesthesia, etc

3 Complete the following table about the nature of consciousness. In the second column, explain the concept in your own words. In the third column, describe an example that illustrates the concept.

Characteristic	Explanation	Example
Consciousness is an 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, thoughts and feelings 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
Consciousness is 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

Characteristic	Explanation	Example
Consciousness constantly changes as we shift our attention.	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.
Our level of consciousness can vary throughout the day.	Our level of conscious awareness can change throughout the day depending on the time of day and what we are doing.	During the day we may feel more alert in the morning but later in the day we may become fatigued and feel less able to focus our concentration. At night we sleep, moving from an NWC to an ASC.
Consciousness enables us to make sense of the world.	Our consciousness allows us to make judgements and perceptions about the stimuli we are experiencing so we can establish meaning in relation to our world and experiences.	By carefully observing a series of events unfolding, I can form a rational perception about why a situation is occurring. An example could be watching leaves fall from a tree and understanding why they fall down and not up.
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.

ACTIVITY 6.2

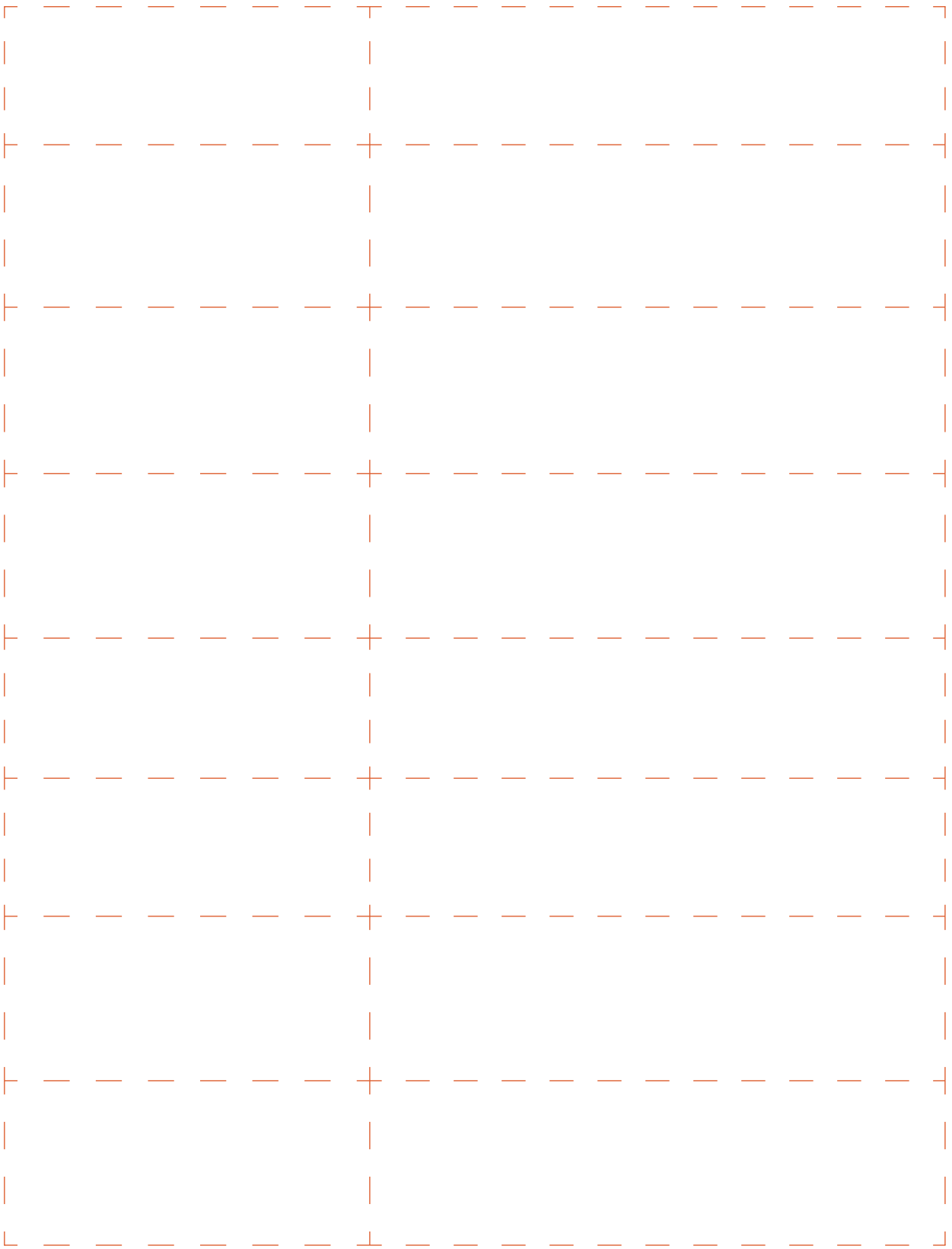
Mapping states of consciousness on a continuum

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 234 in the most appropriate place on the following consciousness continuum.

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

Meditative state	A naturally occurring altered state of consciousness in which attention shifts from external stimuli to internal thoughts, feelings and imagined scenarios
Coma	A naturally occurring altered state of consciousness characterised by perceptual disengagement from and unresponsiveness to the environment
Asleep	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
Anaesthetised	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
Daydreaming	An intentionally induced altered state of consciousness characterised by a deep state of relaxation achieved through the use of a meditation technique
Hypnotised	Highly focused and acutely aware of some aspect of one's internal or external environment e.g. when selectively attending to a difficult task
Focused attention	An intentionally induced altered state of consciousness characterised by responsiveness to suggestions made by the hypnotist and the subjective experience of consciousness
Normal wakefulness	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 6.3

Understanding why sleep is a psychological construct

Sleep as an altered state of consciousness is difficult to define precisely and can only be measured indirectly. For this reason, sleep is best considered a **psychological construct**. To help understand this further, explain each statement below relating to sleep.

Statement relating to sleep as a psychological construct	Explanation
Sleep is hard to define precisely.	There is no universally agreed definition of sleep that is accepted by all researchers. Competing definitions reflect the different research foci being explored.
Sleep is considered an altered state of consciousness.	Sleep is sufficiently different from normal waking consciousness to be considered an altered state. This is because the changes in psychological and physiological responses when we sleep are significant and measurable.
Sleep involves different levels of alertness.	During different stages of sleep our level of awareness of changes. In light sleep we can still be aware of external stimuli but as we enter deeper stages of sleep this awareness decreases substantially.
Sleep involves a variety of behaviours, such as dreaming.	Dreaming appears to be a common sleep phenomenon mostly associated with REM sleep. Dreaming cannot be directly measured, only self-reported. Researchers are still unsure of its purpose or whether it's a co-correlate to sleep.
Sleep as an ASC cannot be directly measured.	Deciding if a person is asleep can only be determined by measuring physiological and behavioural activities associated with sleep. These include monitoring breathing rate, EEG patterns, eye movements and muscle tone.

Statement relating to sleep as a psychological construct	Explanation
Quality of sleep is usually self-reported (subjective).	Research suggests that sleep can have different levels of quality based on how refreshed a person feels when they awake from sleep. However, quality of sleep is mostly determined through self-reports
Sleep stages are defined based on changes in brainwave patterns.	Researchers have identified different types of sleep called REM and NREM sleep. These labels are applied based on eye movements and associated brainwave activity. They are not direct measures of sleep itself.
Sleep involves multiple psychological and physiological changes.	Although sleep involves multiple changes in psychological and physiological function, many of these changes can also happen in other states of consciousness and therefore can only be used as a part measure of sleep as a conscious state.
Our understanding of sleep becomes more accurate as techniques for measuring it improve.	As technology continues to improve our ability to measure and observe changes in brain activity when we sleep, our understanding of what sleep is and what underlying function it serves improves. This means our definition of sleep can change over time.
Sleep is a fundamental human need that is as important as exercise.	Although researchers have determined that sleep is essential for good physiological and psychological health, they have yet to precisely determine how sleep fulfils that function beyond some understanding relating to the replenishment of neurotransmitters and removal of metabolic waste.

Comparing different methods for studying sleep

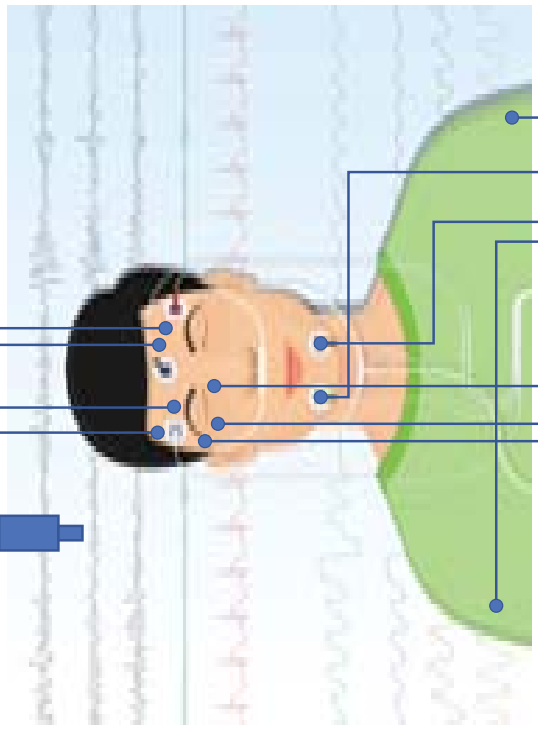
1 Fill in the boxes to describe the different physiological measures used during a sleep study.

Name of device: Electroencephalograph

Abbreviation: EEG

What is measured: Electrodes detect, amplify and record electrical activity in the cortex (neurons) near the surface and represent this activity as visual patterns referred to as brainwaves.

How the information is interpreted in relation to sleep: The amplitude and frequency of the waves can be an indicator of different stages of sleep. High frequency low amplitude waves can indicate being awake or in REM sleep. Low frequency high amplitude waves can indicate being in NREM sleep.



Name of device: Video recorder

Abbreviation: Video recording

What is measured:
- changes in posture or body position
- amount of 'tossing and turning'
- sleep-related breathing problems
- what happens when awakening from a nightmare or night terror
- behaviours associated with sleepwalking.

How the information is interpreted in relation to sleep: Sleep behaviours can be linked to abnormal sleeping patterns or sleep disturbances. The recordings can also be used to validate data from other devices. They also enable the researcher to maintain close supervision of the sleeper during the study.

Name of device:
Electro-oculargraph

Abbreviation:
EOG

What is measured:
Electrodes detect, amplify and record electrical activity in the muscles that control eye movements. When the eyes move these electrical signals are represented as wave patterns. Higher frequency waves indicate more rapid eye movements.

How the information is interpreted in relation to sleep:
Several varieties of eye movement are recorded during routine sleep studies–waking eye movements (WEMs), slow eye movements (SEMs) and rapid eye movements (REMs). These can be associated with REM or NREM sleep stages.

Name of device:
Electromyograph

Abbreviation:
EMG

What is measured:
Electrodes detect, amplify and record the electrical activity of muscles in the face, arms, legs or torso. This information is presented as wave patterns. Higher amplitude indicates a stronger muscle movement.

How the information is interpreted in relation to sleep:
As we fall into deeper sleep stages our muscles tend to relax more and show less activity. Higher levels of activity can indicate NREM sleep or being awake.

2 Complete the table to describe the use of sleep diaries as a way of researching sleep.

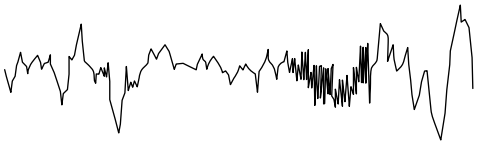
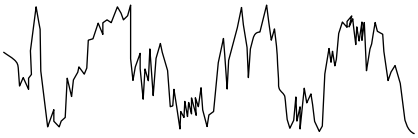
What is a sleep diary?	A sleep diary is a 'log' used to self-record and self-report sleep and waking time activities over a period of time, usually one week or more.
Type of data collected	Subjective (self-reported data)
Examples of types of data recorded	• the time when trying to fall asleep • the time when it is believed sleep onset occurred • the number, the time and length of awakenings during sleep • the time of waking up in the morning • the time of getting up after waking up in the morning • how well-rested the individual feels upon awakening • how sleepy the individual feels at different times during the day
How the information is interpreted in relation to sleep	Can be used to determine if behaviours may be affecting sleep patterns. These behaviours may include diet, habits, routines, use of devices, ingestion of drugs or medications, etc.

ACTIVITY 6.5

Brainwave patterns associated with EEG recordings of human sleep

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 6.6

Distinguishing between circadian and ultradian rhythms

Cut and paste each of the following statements into one or both columns comparing circadian and ultradian rhythms. Some statements are deliberately listed twice.

Involves physiological, psychological or behavioral changes

Changes occur as part of a cycle that is shorter than 24 hours

These cycles can be tied to circadian rhythms (linked to them).

Hunger and hormone level fluctuations throughout the day occur as this type of rhythm.

Sleepiness peaks at night and is lowest during daylight hours.

Minor fluctuations in body temperature occur

Sleep is an example because when we sleep for a period of time we go through multiple sleep cycles, each lasting around 90 minutes.

Can be influenced by external cues such as clocks or artificial light

Production of human growth hormone is an example

Minor fluctuations in body temperature occur.

Synthetic versions of melatonin can assist with sleep-wake cycle regulation.

Bright light exposure late at night can delay the onset of sleepiness.

Can be shifted forwards in the absence of external regulating cues such as clocks

Human sleep-wake cycle is an example

The suprachiasmatic nucleus (SCN) regulates the sleep-wake cycle within this rhythm.

Heart rate and respiration rate are examples of this type of rhythm.

Changes occur as part of a 24-hour cycle

Transitioning from REM to NREM sleep happens within this cycle.

The SCN controls the amount of melatonin production that regulates our feelings of drowsiness based on levels of light entering the eyes.

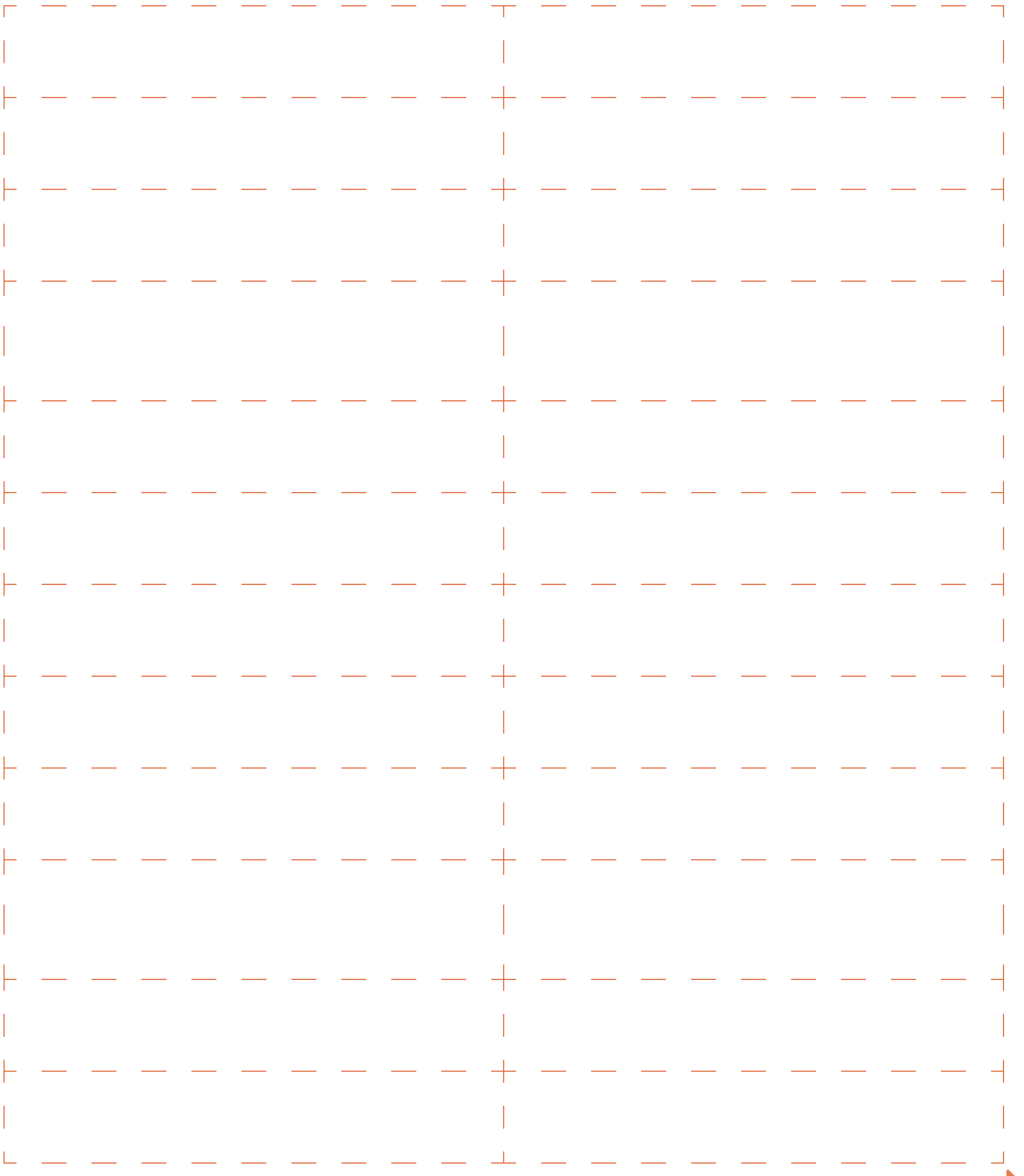
Originates within the individual (endogenous)

Originates within the individual (endogenous)

Involves physiological, psychological or behavioral changes

Eating three meals a day roughly equally spaced in time

Release of dopamine and noradrenalin in the brain



Circadian rhythm	Ultradian rhythm
Involves physiological, psychological or behavioral changes	Involves physiological, psychological or behavioral changes
Changes occur as part of a 24-hour cycle	Changes occur as part of a cycle that is shorter than 24 hours
Can be shifted forwards in the absence of external regulating cues such as clocks	These cycles can be tied to circadian rhythms (linked to them).
Minor fluctuations in body temperature occur.	Hunger and hormone level fluctuations throughout the day occur as this type of rhythm.
Originates within the individual (endogenous)	Minor fluctuations in body temperature occur.
Human sleep-wake cycle is an example	Originates within the individual (endogenous)
The suprachiasmatic nucleus (SCN) regulates the sleep-wake cycle within this rhythm.	Heart rate and respiration rate are examples of this type of rhythm.
Sleepiness peaks at night and is lowest during daylight hours.	Sleep is an example because when we sleep for a period of time we go through multiple sleep cycles each lasting around 90 minutes.
Can be influenced by external cues such as clocks or artificial light	Eating three meals a day roughly equally spaced in time
Bright light exposure late at night can delay the onset of sleepiness.	Transitioning from REM to NREM sleep happens within this cycle.
Production of human growth hormone is an example	Release of dopamine and noradrenalin in the brain
Synthetic versions of melatonin can assist with sleep-wake cycle regulation.	
The SCN controls the amount of melatonin production that regulates our feelings of drowsiness based on levels of light entering the eyes.	

ACTIVITY 6.7

Regulation of the sleep-wake cycle by the SCN

Part A

Complete the diagram below.

Level of light

Background levels of light depend on the source and intensity. These can be natural, like sunlight, or artificial like LED light from device screens.

Light enters the eyes and is detected by photoreceptors in the retina. This light can be detected both when eyes are open or closed. The receptors send neural signals to the SCN.

Neural signals

SCN

The SCN receives information about the amount of light from the eyes and adjusts our sleep–wake cycle accordingly. It signals the nearby pineal gland to produce and secrete more or less melatonin in relation to light intensity.

Neural signals

Pineal gland

Responds to neural signals from the SCN by secreting more or less melatonin into the blood stream. The amount depends on the amount of light received by the eye.

Secretion of melotonin into the blood stream

Feedback loop

The melatonin feedback loop enables the SCN to detect the level of melatonin in the blood and modify the output from the pineal gland to maintain an optimum level.

Affect on arousal?

Hormone increase	Hormone decrease
When there is less light the SCN signals the pineal gland to produce more melatonin, which increases drowsiness, making us less aroused.	When there is more light the SCN signals the pineal gland to produce less melatonin, which decreases drowsiness, making us more aroused.

Part B

Explain why the use of electronic devices later into the evening can cause sleep-onset insomnia and offer some advice you might give to promote better sleep hygiene.

Suggest they do not use their devices late into the night and instead adjust ambient light to be less intense and/or use the night mode, which changes the light frequency towards the red end of the light spectrum, on their devices. This will help signal the SCN to increase the body's production of melatonin to increase levels of sleepiness earlier in the evening.

ACTIVITY 6.8

Describing NREM and REM sleep

Fill in the table comparing NREM and REM sleep.

NREM Stage 1 (N1 sleep)	**NREM Stage 2 (N2 sleep)**
Light or deep sleep: Light	Light or deep sleep: Light but deeper that stage 1 (aka moderate sleep)
Physiological changes: Decrease in heart rate and breathing rate and slight decrease in body temperature. Decrease in muscle tension. Slow rolling eye movements Hypnic jerks may occur	Physiological changes: Continued decrease in heart rate, breathing rate and body temperature. Further decrease in muscle tension. Rolling eye movements cease
EEG pattern: Slight decrease in frequency of brainwave pattern from NWC but still has low amplitude.	EEG pattern: Slight decrease in frequency of brainwave pattern from NWC but amplitude remains low.
Timing of sleep stage: Begins with first descent into sleep (first cycle) and then occurs at the start and end of most sleep cycles	Timing of sleep stage: Follows N1 stage and then occurs at the start and end of most sleep cycles. N2 stages lengthen with each cycle as sleep continues.
Arousal threshold and response: Low arousal threshold (easily awoken). If awoken. most people will self-report that they have not been asleep.	Arousal threshold and response: Remains low but is higher than stage 1. More difficult to awaken. If awoken, most people will report that they were just thinking or dozing.
Percentage of total night's sleep Approximately 5%	Percentage of total night's sleep Up to 50%

NREM Stage 3 (N3 sleep)	**REM (REM sleep)**
Light or deep sleep:	Light or deep sleep:
Deep (slow wave sleep)	Deep
Physiological changes:	Physiological changes:
Heart rate and breathing rate at slowest levels	Muscles remain totally relaxed (in a state of sleep paralysis)
Muscles completely relaxed with very little movement	Slight twitching of small muscles in face, fingers and toes
No eye movements	Heart rate, body temperature and breathing rate can fluctuate.
	Eyeballs dart back and forth and up and down in jerky but coordinated
	movements
EEG pattern:	EEG pattern:
Increasing levels of high amplitude, low frequency delta waves	High frequency low amplitude wave patterns similar NWC (brain is active)
occurring more than 50% of the time	
Timing of sleep stage:	Timing of sleep stage:
Follows stage 2 sleep and initially lasts around 20–40 minutes	Follows at the end of each sleep cycle and the length of this stage
Stage length shortens as sleep progresses and may disappear	becomes longer and closer together in time as sleep progresses.
completely in latter half of sleep	Stage may last up to 25 minutes in later sleep.

Arousal threshold and response: Highest arousal threshold (very difficult to awake) If awoken, people will feel drowsy, disorientated and may take time to become fully alert (called sleep inertia) Percentage of total night's sleep Approximately 10–15%	Arousal threshold and response: Can be variable throughout the night but generally high arousal threshold If awoken, most people will report that they are dreaming. Percentage of total night's sleep Approximately 20–25%

ACTIVITY 6.9

NREM vs REM sleep characteristics

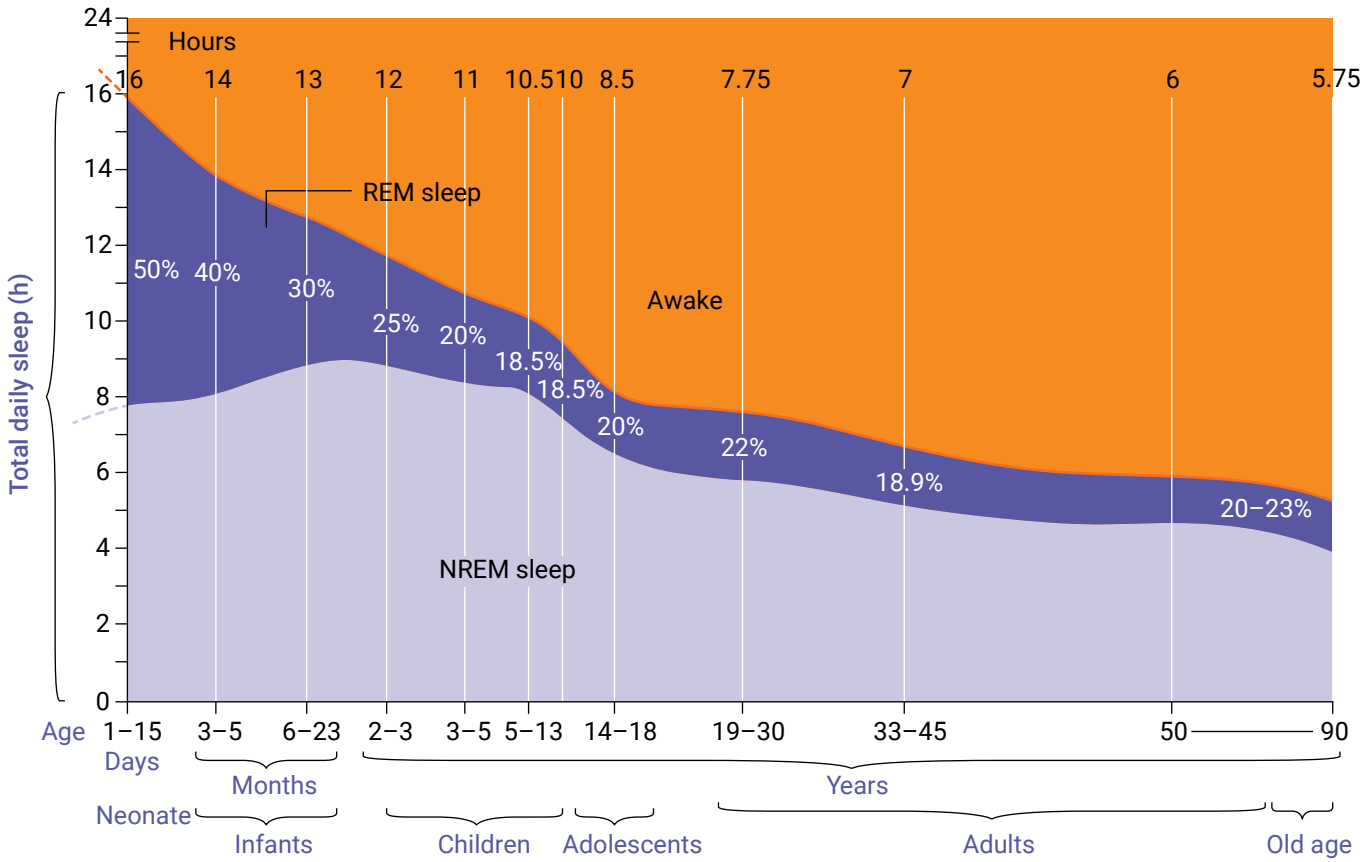
Tick which type of sleep is relevant to each statement. Either or both sleep types may be selected.

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 brainwave pattern	✔	✔
6 Brainwaves are consistently like those of alert wakefulness		✔
7 Brainwaves 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 brainwaves.	✔	
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 brainwaves 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 brainwave 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 6.10

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 years).

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 years)	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 per cent 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 as a newborn 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 per cent.

7 What are two other differences between the typical sleep of adolescents and elderly people that are not apparent in the graph?

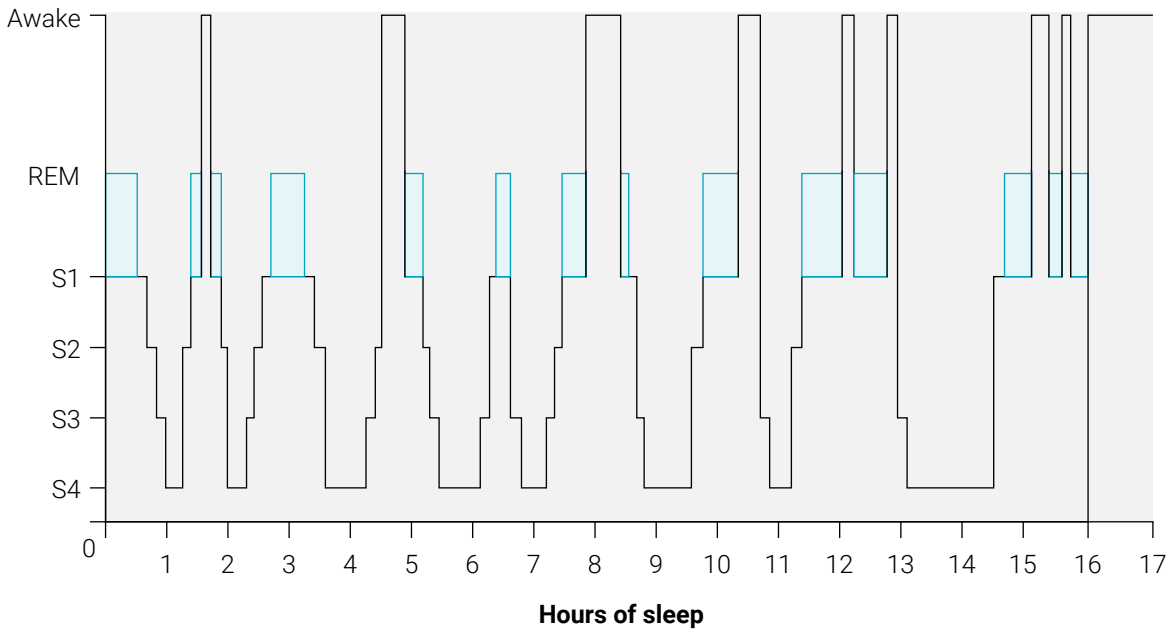
Differences include: adolescents tend to get less sleep than they need to function at their best; adolescents tend to experience a change in their sleep–wake cycle involving delayed sleep onset and more difficulty waking early; adolescents tend to experience more slow wave deep sleep; elderly people 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 6.11

Comparing sleep patterns across the life span

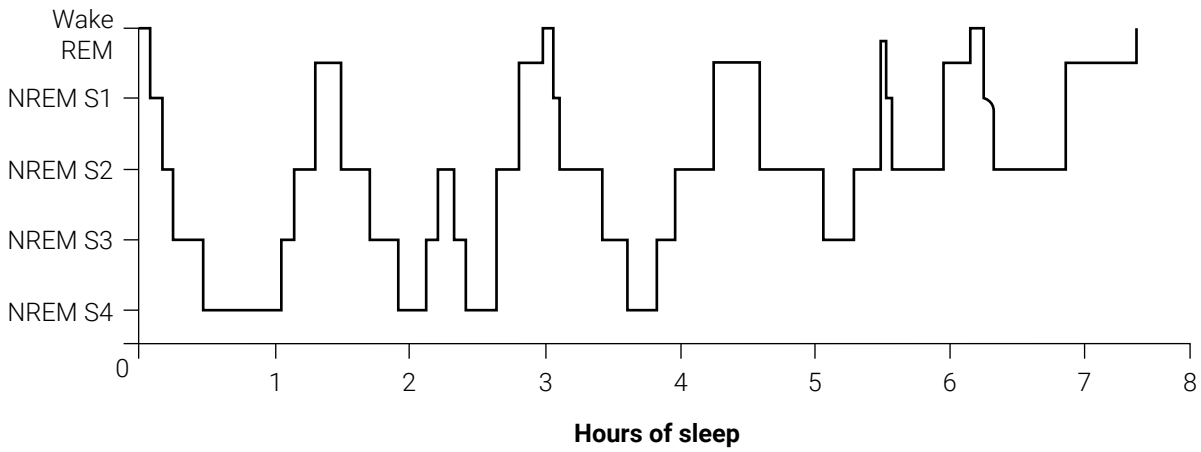
Compare the following three hypnograms labelled A, B and C. For each graph, determine the age of the person it most likely represents — a 2-week-old infant, a 32-year-old adult or a 69-year-old adult — and then analyse the sleep pattern to complete the table.

Hypnogram A



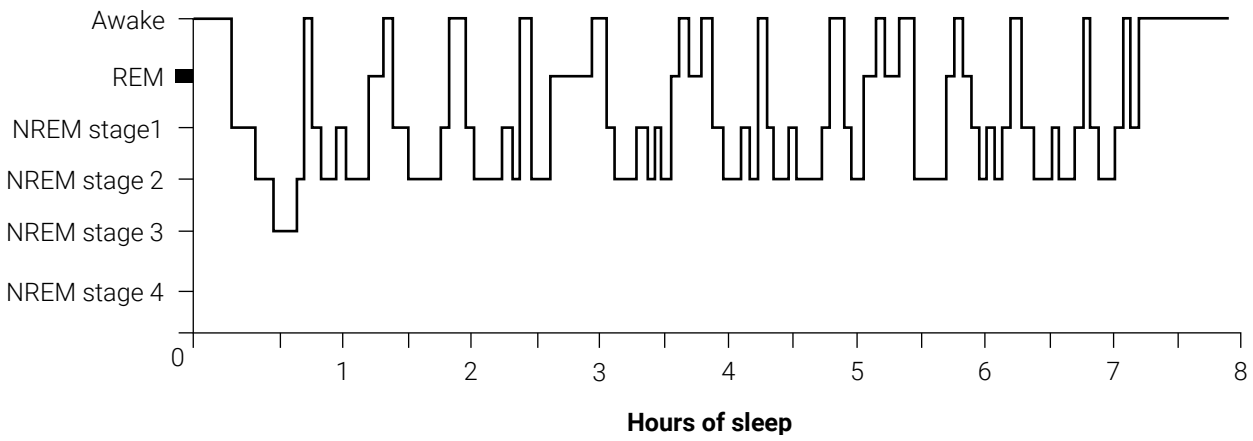
Age	2-week-old infant
Approximate total sleep time	about 16 hours
Proportion of REM(%) to NREM(%)	about 50% REM, 50% NREM
Fragmentation (number of awakenings during sleep episode)	8
Description of initial sleep onset	sleep onset directly into REM sleep
Regularity and duration of sleep cycles	irregular 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
Description of initial sleep onset	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, 75–80% NREM
Fragmentation (number of awakenings during sleep episode)	15
Description of initial sleep onset	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

Summarising sleep as a naturally occurring state of consciousness

Select terms from the shaded panel below to correctly complete the passage about sleep. Not all terms must be used.

24 hours	8 hours	90 minutes	age-related	alertness
amount	amplitude	beta	biological	breathing
circadian	cortisol	cyclical	two	environmental cues
evolutionary	eye movements	four	greater	high
tone	increases	lifespan	light	low
melatonin	NREM	pineal gland	reduction	REM
time	sleep	stable	stage 2	suprachiasmatic nucleus
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.

The main sleep episode comprises two types of sleep called REM and NREM sleep. REM sleep is characterised by rapid eye movements and beta brainwave 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 brainwave pattern characterised by high frequency and low amplitude brainwaves, whereas deep sleep is characterised by low frequency and high amplitude brainwaves. NREM sleep also involves progressive reduction in other physiological responses such as heart rate, breathing and muscle tone and movement.

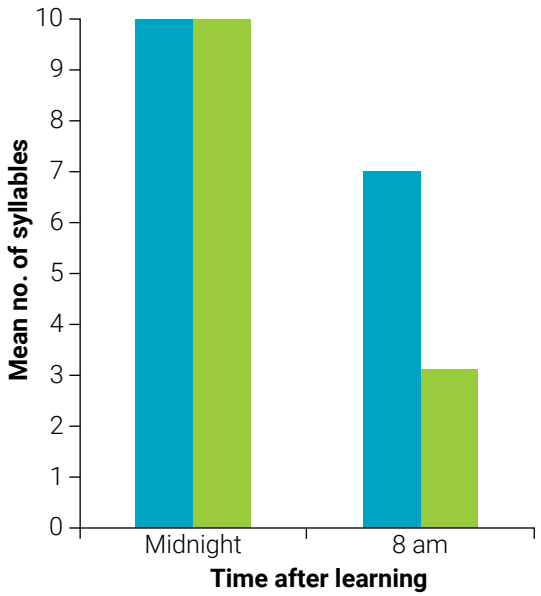
Human sleep patterns change throughout the entire lifespan. There is a general trend of less total sleep time as we get older and an age-related decrease in the proportion of NREM sleep. The proportion of time spent in REM sleep decreases markedly during the first two years and then remains relatively stable through to a very old age. In later adulthood, at around 60 or so, sleep is mostly NREM stage 2 sleep.

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. 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.

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

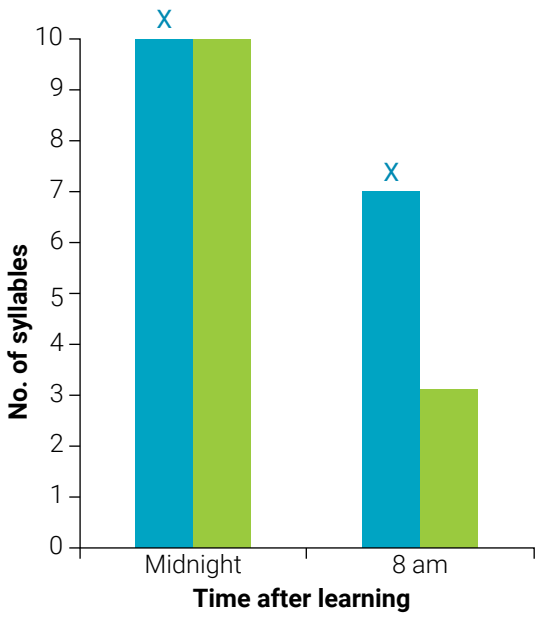
4 Which type of recall was used for retrieval?

free recall

5 Why were nonsense syllables used instead of ordinary, everyday words?

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

6 Identify each of the Group 1 results by placing an X at the top of each relevant column in the following copy of the graph.



7 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.

8 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.

9 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

10 Outline experimental procedures that could avoid these limitations.

Procedures should relate to the specific limitations given for question 9. 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.)

Crossword on concepts and terms for sleep

Across

1 A regularly occurring natural ASC that results in a partial or total suspension of conscious awareness
4 Type of sleep strongly associated with dreaming and involving fast eye movements
9 The hormone that is involved in the initiation of sleep and in the regulation of the sleep–wake cycle
11 A device that detects, amplifies and records electrical activity in voluntary muscles such as in the jaw, arms and legs
12 A type of biological rhythm that changes as part of a 24-hour cycle
14 A concept, description or model that describes a specific activity or process that is scientifically verifiable but difficult or impossible to observe or measure directly
15 Abbreviation used to describe a state of awareness different to normal waking consciousness
17 A device that detects, amplifies and records electrical activity produced by muscles that control eye movements
20 A stage of sleep associated with increasing levels of drowsiness and increased muscle relaxation
21 Anything that has its origins from outside an organism
22 Brainwave pattern associated with feeling awake but relaxed and becoming internally focused
23 The master biological clock that regulates the timing and activity of the sleep–wake cycle, as well as all other peripheral clocks involved with circadian rhythms

Down

2 A device that detects, amplifies and records electrical activity produced by brain neurons near the scalp
3 An innate timing mechanism that regulates the cycle of biological rhythms within the body
5 Anything that has its origins from within an organism
6 Brainwave activity associated with deeper sleep or degrees of unconsciousness
7 Abbreviation for the three stages of sleep not associated with fast eye movements
8 Also known as slow-wave sleep or deep sleep
10 Abbreviation used to describe a state of awareness usually associated with being awake
13 A biological rhythm that involves changes that occur as part of a cycle shorter than 24 hours
16 Our awareness of all objects and events in the external world, as well as our sensations, mental experiences and our sense of our own existence
18 Brainwave pattern often associated with being very drowsy, such as falling asleep, but is also associated with being creative and meditating
19 Brainwave pattern associated with high alertness and intensive mental activity
24 The lightest of all stages of sleep that is usually entered first

1 SLEEP
2 ELECTRONCEPHALOGRAPH
3 BIOLOGICALPSYCHOLOGY
4 REMATION
5 REMATION
6 DELTA
7 NREMYGRAPH
8 STAGE3
9 MELATONIN
10 NEWTON
11 ELECTRONSTRUCTION
12 CIRCADIAN
13 ULTRADIAN
14 CONSTRUCTION
15 ASCONSCIOUS
16 CONSCIOUS
17 ELECTROCHEMICAL
18 TROCHEE
19 BETA
20 STAGE2
21 EXOGENOUS
22 ALPHA
23 SUPRACHIASMATICNUCLEUS
24 STAGE1

ACTIVITY 6.15

True/False quiz on sleep

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

Statement	T/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 Endogenous influences or factors originate from within the body.	T
16 REM sleep periods tend to lengthen and get closer together during a normal night's sleep by a healthy young adult.	T
17 Muscles are more relaxed in N2 sleep compared to REM sleep.	F
18 NREM Stage 1 sleep tends to last less than five minutes.	T
19 Sleep diaries are considered objective data.	F
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

TOPIC 7

Importance of sleep to mental wellbeing

	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
• the effects of partial sleep deprivation (inadequate sleep either in quantity or quality) on a person's affective, behavioural and cognitive functioning, and the affective and cognitive effects of one night of full sleep deprivation as a comparison to blood alcohol concentration readings of 0.05 and 0.10	✓	✓	✓			✓			✓	✓	
• changes to a person's sleep-wake cycle that cause circadian rhythm sleep disorders (Delayed Sleep Phase Syndrome [DSPS], Advanced Sleep Phase Disorder [ASPD] and shift work) and the treatments of circadian rhythm sleep disorders through bright light therapy				✓	✓	✓			✓	✓	
• improving sleep hygiene and adaptation to zeitgebers to improve sleep-wake patterns and mental wellbeing, with reference to daylight and blue light, temperature, and eating and drinking patterns							✓	✓	✓	✓	
Key science skills			✓			✓					

Source: © VCAA, *VCE Psychology Study Design: 2023–2027.* p. 39.

ACTIVITY 7.1

Introduction to sleep disturbances

Select terms from the shaded panel below to correctly complete the paragraph about sleep. Each term should be used only once.

sleep-onset	abnormal	disrupt	sleep disorder	disturbances
isolated	primary	secondary	quality	treated
medical	sleep—wake	cognitive	quantity	behavioural
underlying	awakenings	improve	emotional	substance

Sleep is essential for good health and optimal cognitive function. Most people can quickly recover from isolated poor-quality sleep experiences provided they can get a good night's sleep shortly afterwards. Some people, however, can suffer from recurrent sleep disturbances. These are sleep-related problems that disrupt an individual's normal sleep—wake cycle. These disturbances can affect both the quality of sleep (how refreshing the sleep is) or the quantity of sleep (adequate length of sleep) or both. Sleep disturbances can include problems with sleep-onset (falling asleep), waking due to abnormal behaviours during sleep or disruptions to the normal sleep-cycles during sleep. If sleep disturbance is persistent and regularly disrupts sleep, causing distress or impairment, then it is referred to as a sleep disorder. There are two classifications of sleep disorders. A primary sleep disorder is a persistent sleep disturbance that cannot be attributed to another condition such as a mental health problem, medical condition or use of legal or illegal drugs. It therefore occurs in its own right. A secondary sleep disorder involves a sleep disturbance that results from another underlying condition or substance use. These may include regular awakenings because the person is suffering from back pain, a bladder infection or a mental health issue such as an anxiety disorder or depression. Secondary sleep disorders often improve when the underlying problem is successfully treated. Regardless of the type of disruption to sleep, all can result in impairment of emotional, behavioural and cognitive function.

ACTIVITY 7.2

Applying the 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 that requires him to work much longer than his usual hours. In addition, he has a 5-month-old baby at home.

1 Define 'partial sleep deprivation'.

Partial sleep deprivation involves having less sleep (either quantity or quality) than what is normally required. This may occur periodically or persistently over the short- or long-term.

2 Outline the effects partial sleep deprivation is having on Ken's affective, behavioural and cognitive functioning by cutting and pasting the statements from page 271 into the correct columns.

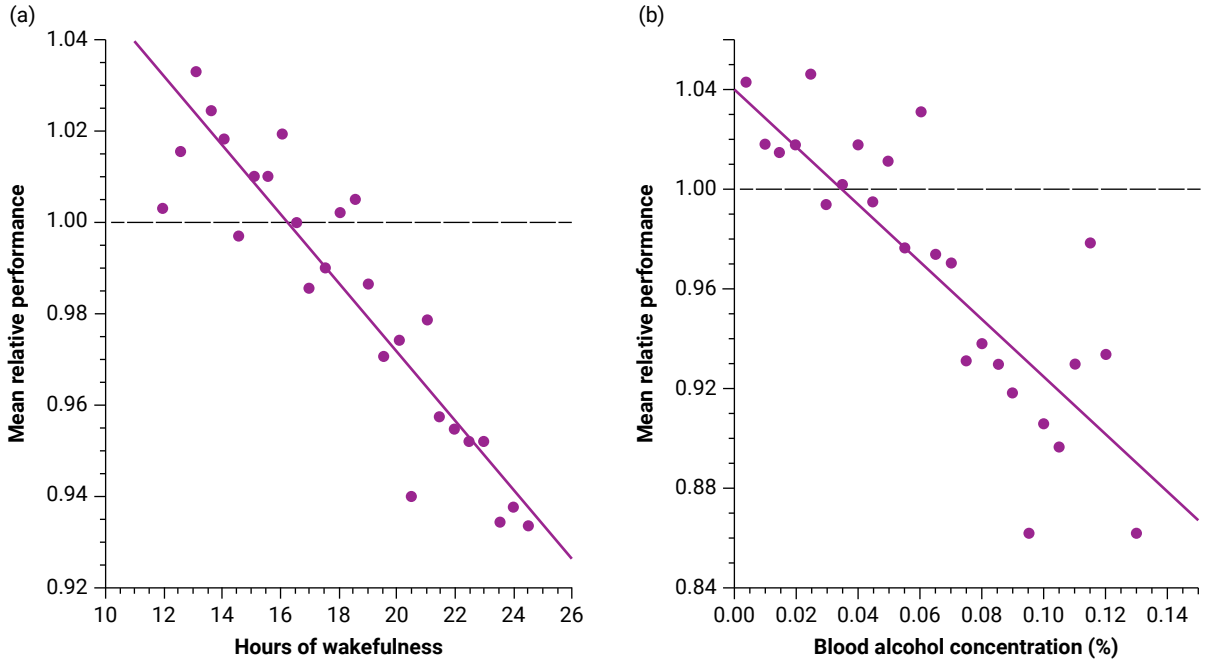
Affective	Behavioural	Cognitive
reduced ability to process emotional information	sleep inertia (slowness to respond after awakening)	increased likelihood of making mistakes on simple tasks
amplified emotional response	difficulty paying attention	reduced ability to divide attention effectively
reduced ability to control impulses	excessive sleepiness when awake	increased difficulty in making decisions
lower threshold for reacting aggressively	increased reaction time	reduced ability to form emotional perceptions
	decreased motor control	reduction in creativity
	increased chance of micro-sleeps	loss of situational awareness
	less alert when awake	decreased memory ability
	shaky hands/droopy eyelids	slowed thinking
	difficulty maintaining an awake state	reduced problem-solving ability
	increase in risk-taking behaviour	clouded thinking
		decrease in information processing speed

increased likelihood of making mistakes on simple tasks	shaky hands/droopy eyelids	lower threshold for reacting aggressively
excessive sleepiness when awake	reduced ability to control impulses	increase in risk-taking behaviour
increased reaction time	difficulty paying attention	slowed thinking
clouded thinking	loss of situational awareness	reduced ability to form emotional perceptions
reduced ability to divide attention effectively	amplified emotional response	reduction in creativity
less alert when awake	increased chance of micro-sleeps	decreased motor control
reduced problem-solving ability	decrease in information processing speed	difficulty maintaining an awake state
decreased memory ability	sleep inertia (slowness to respond after awakening)	increased difficulty in making decisions
reduced ability to process emotional information		

ACTIVITY 7.3

Analysing the Dawson and Reid (1997) study comparing the effect of sleep deprivation and BAC on performance

Read the information relating to how sleep deprivation can change awareness and adversely affect human performance based on the Dawson and Reid (1997) study and then respond to the following questions. The scatterplots of Dawson's and Reid's results are shown below:



Scatterplots showing performance in the (a) wakefulness and (b) alcohol conditions in the Dawson and Reld (1997) experiment

1 Identify and explain the type of experimental design used by Dawson and Reid in their 1997 study.

Within groups design. This means the test subjects were exposed to both experimental conditions but at different times.

2 Describe how the researchers could counter-balance this study.

Split the sample group into two sub-groups and change the order that the sub-groups are exposed to each experimental condition. So, half the test subjects complete the sleep deprivation condition first followed by the intoxication condition and then reverse the order of the procedure for the other half.

3 Explain how counter-balancing their study improved the validity of their results.

By counter-balancing, the researchers can identify if the procedural order of the experiment causes any unwanted or unexpected changes in the independent variable. If there are any changes identified, they can be taken into consideration and accounted for in the results. These could include order effects such as carry-over effects, etc.

4 Identify how many independent variables were used and describe how they were operationalised.

There are two identifiable IVs: hours of sustained wakefulness and blood alcohol concentration as a percentage.

5 Identify and operationalise the dependent variable in this study.

Mean relative performance on cognitive psychomotor tasks testing eye-hand coordination and speed of response

6 Write a suitable aim for the study.

To determine the equivalent level of sleep deprivation that can equate to a similar BAC in terms of the effects on cognitive psychomotor performance

7 Write a fully operationalised hypothesis for this study.

That sustained wakefulness will reduce cognitive psychomotor performance to the same level as equivalent blood alcohol concentrations

8 Explain the reason for measuring the mean relative performance.

The mean gives a measure of central tendency within a data set and is a more reliable measure than using individual data. It also helps to summarise the data set into a single value. The mean is also a more stable value than individual data.

9 Write a suitable conclusion for this experiment based on the results shown.

Sustained wakefulness of around 17 hours decreases performance in cognitive psychomotor tasks equivalent to a BAC of around 0.05% (the current legal maximum for drivers). Furthermore, a sustained wakefulness of around 24 hours decreases performance in cognitive psychomotor tasks equivalent to a BAC of around 0.10%.

10 Identify two advantages and two limitations of using a within-subject design such as this.

Advantages: better control of subject variability, requires fewer subjects, improves statistical confidence

Disadvantages: can cause order effects because subjects can become bored, guess the intention of the experiment or alter their behaviour/responses to meet the expectations of the researcher (experimenter effect)

11 Briefly discuss the real-world implication of these results for drivers.

Drivers who are sleep deprived should carefully consider their ability to drive safely because these results suggest their ability to respond to driving hazards may be seriously diminished, making them more likely to be involved in a car accident. Such information should form part of a government awareness program, especially for young drivers who may be staying up very late at night.

ACTIVITY 7.4

Analysing circadian rhythm sleep disorders

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 prime minister Margaret Thatcher, former US president Bill Clinton, Madonna, George Clooney and Lady Gaga.

Lady Gaga is believed to suffer from delayed sleep phase syndrome (DSPS). 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 DSPS, describe the key symptoms Lady Gaga is likely to be experiencing if she has DSPS, and 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.

Circadian rhythm sleep disorders are:

Sleep disorders involving sleep disturbance that is due to a mismatch between an individual's sleep-wake pattern and the pattern that is desired or required for good health.

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 7.5

Analysing circadian rhythm phase disorders associated with different life experiences

Two groups of individuals that are particularly susceptible to circadian phase disorders are adolescents and shift workers. Compare these two groups by filling in the table below.

 Adolescents 	  Shift workers  
Type of circadian phase disorder most likely to be experienced	
Delayed sleep phase syndrome	Shift work disorder
Explanation of why this group is more at risk of developing a circadian rhythm phase disorder	
Hormonal changes such as delay in body's production of melatonin, and social and school-related pressures causing them to stay up late, using social media via computer screens later in the evenings, exercising their adulthood (wanting to stay up later than in childhood), disruption to body synchronisation to 24-hour normal day–night schedule due to re-synchronisation of SCN via artificial sources of light	Shift work can involve work times and therefore awake hours that are outside of normal/habitual sleep hours at night. 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).

Effects on circadian rhythm	
Delay – 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'.	Constant requirement to change shifts can result in mismatch between body's circadian rhythm and normal 24-hour day/night periods, difficulty falling asleep when they can sleep and difficulty awakening, fractured sleep cycles, sleep–wake cycles advancing to earlier hours of evening or later hours of evening depending on shifts being worked.

Effects on behaviour and functioning	
Difficulty getting up early in the morning	Difficulty getting up early in the morning
Daytime fatigue	Difficulty maintaining sleep
Difficulty falling asleep earlier in the evenings	Reduced quality and quantity of sleep
Difficulty concentrating in school	Daytime fatigue (excessive sleepiness)
Decreased emotional regulation	Difficulty falling asleep earlier in the evenings
The attempt to make this up (e.g. during weekends) can	Difficulty concentrating at work
further disrupt the sleep–wake cycle (e.g. shift it further	More accident prone
forward).	Decreased emotional regulation
	Accumulated sleep debt

Possible treatments	
Improve sleep hygiene such as maintaining a regular bedtime that is not too late	Increasing duration of particular shifts (keeping workers on the same shift time for more days in a row so their body can adjust)
Avoiding exposure to bright light late in the evening	Increasing days off between shifts, and rotating shifts forwards and not backwards (e.g. moving from a morning shift onto an afternoon shift and then onto a night shift is more aligned with the body's natural tendency to adjust sleep-wake cycles than rotating shifts earlier)
Possible use of bright light therapy to recalibrate SCN and hormonal release to better coincide with daily schedule.	Improving sleep hygiene during the day by decreasing noise, light and other disturbances
To shift circadian rhythm earlier they could use BLT early in the morning.	Possible use of bright light therapy to help re-synchronise when adjusting between shifts
Increase exercise to promote feelings of fatigue in the early evening	

ACTIVITY 7.6

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.

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.

Within-groups design (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 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 7.7

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.

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 7.8

Thinking about sleep hygiene practices

1 Define 'sleep hygiene'.

Involves practices that tend to improve and maintain good sleep and full daytime alertness. This includes behaviours and environmental factors that can be adjusted to help with a good night's sleep and waking feeling rested and ready to take on the day's activities.

2 For each of the practices relating to sleep hygiene, provide examples of behaviours that can improve and degrade their effect on quality of sleep.

Sleep hygiene practice	Behaviours that can improve sleep hygiene	Behaviours that can degrade sleep hygiene
Establish a regular sleep schedule and bedtime routine	Maintaining a regular sleep–wake schedule, particularly a regular wake-up time in the morning (set an alarm). Avoiding sleep-ins on weekends. Trying to go to bed at the same time most nights.	Random bedtimes Staying up very late Sleeping in on weekends Not prioritising your sleep–wake schedule
Associate your bed and bedroom with sleep	To strengthen the association with sleep: • Only use your bed for sleep • Only use your sleeping pillow for sleep • Do not study on your bed.	Using your bed to work, catch up on social media, watch TV or play video games weakens the association with sleep.
Avoid stimulating activities before bed	Avoiding stimulating activities later at night such as exercise, sport, using digital devices or upsetting conversations. Avoid dwelling on worries or concerns. Meditating, reading and relaxing can help.	Engaging in stimulating activities later at night, such as exercise, sport, using digital devices or upsetting conversations. Dwelling on worries or concerns.

Sleep hygiene practice	Behaviours that can improve sleep hygiene	Behaviours that can degrade sleep hygiene
Get up when you cannot sleep	Getting out bed when sleep is not forthcoming (e.g. sit in a chair and read, etc.)	Remaining in bed when sleep is not forthcoming (e.g. dwelling on concerns while lying in bed etc.)
Avoid napping during normal waking periods	Even when feeling tired, trying to remain awake as much as possible during normal waking periods to avoid disrupting the body's circadian rhythm. Do not nap for more than 20 minutes maximum.	Allowing yourself to fall asleep during normal waking periods. Napping for longer than 20 minutes.
Avoid stimulants close to bedtime	Avoiding caffeine, nicotine and alcohol close to bedtime. Possibly replacing caffeine with a caffeine-free alternative, etc.	Consuming caffeine, nicotine and alcohol close to bedtime. This might happen due to late-night study or being at a party.
Exercise during waking periods	Exercising vigorously during a normal waking period but at least 4–5 hours before bedtime.	Exercising close to bedtime can increase arousal, making sleep more difficult.
Avoid food late at night	Not eating close to bedtime, especially large meals. Trying to keep the evening meal at least two hours before the onset of sleep.	Eating and snacking until late into the evening, especially right before bedtime.

Sleep hygiene practice	Behaviours that can improve sleep hygiene	Behaviours that can degrade sleep hygiene
Improve your sleeping environment	Keeping bedroom between 17 and 19 degrees, making sure room is darkened, reducing noise	Rooms that are too cold or too hot, excessive background noise, excessive levels of light from windows, lamps or devices, etc.
Get exposure to natural light	Heading outside each day to be exposed to natural sunlight. This decreases production of melatonin and increases wakefulness.	Remaining indoors all day, especially in rooms with insufficient levels of light, especially natural light coming in through windows, etc.

ACTIVITY 7.9

Adaptation to zeitgebers to improve sleep–wake patterns and mental wellbeing

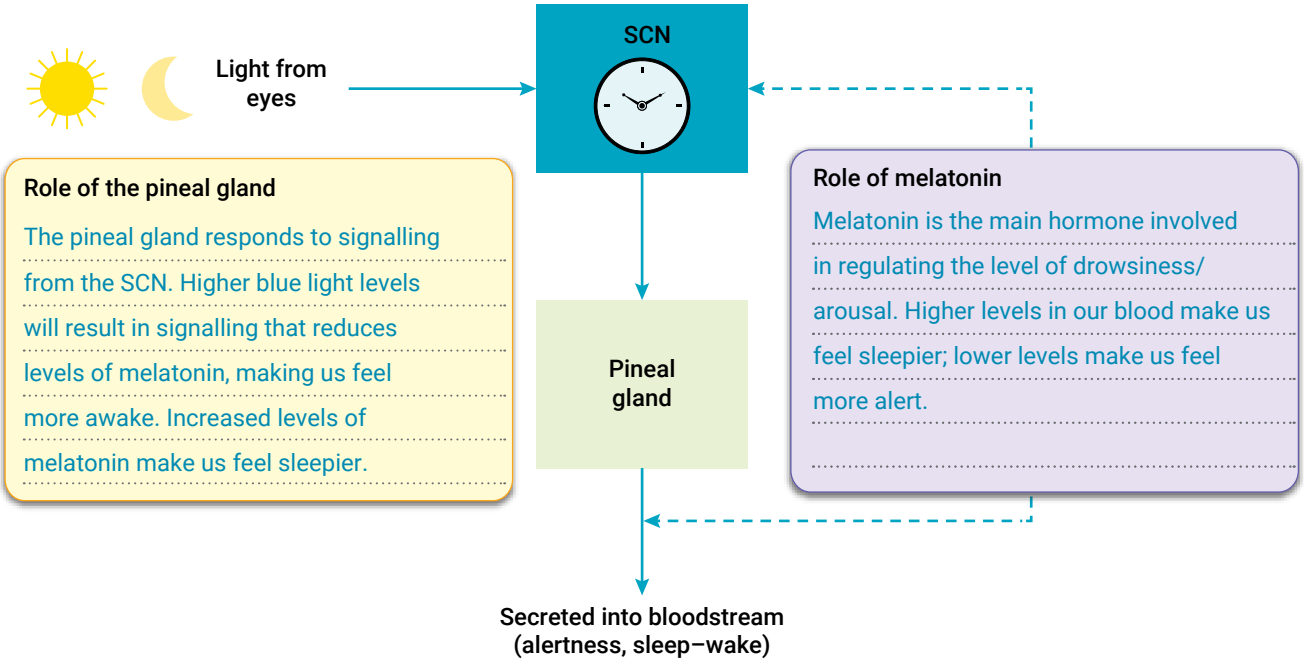
Fill in each box to explain how exposure to light and other factors can influence the body's 24-hour sleep–wake pattern.

Light hits the eye

Blue frequencies of visible light hit the eye. This can happen even when eyelids are closed. This frequency can also be emitted by LED lights and flat screens.

Function of the suprachiasmatic nucleus

Light influences activity of the SCN, which plays a key role in regulation of production of melatonin by signaling the pineal gland. More exposure to blue frequencies of light will cause a higher level of stimulation of the SCN.



Role of the pineal gland

The pineal gland responds to signalling from the SCN. Higher blue light levels will result in signalling that reduces levels of melatonin, making us feel more awake. Increased levels of melatonin make us feel sleepier.

Role of melatonin

Melatonin is the main hormone involved in regulating the level of drowsiness/arousal. Higher levels in our blood make us feel sleepier; lower levels make us feel more alert.

Summarise how our body becomes entrained to zeitgebers

Zeitgebers are environmental time cues. There are numerous zeitgebers in addition to light. These include clocks, alarms, school bells, timetables, workplace routines, eating and drinking patterns, social routines, newsfeeds and notifications, noises, exercise routines, medications, temperature and other atmospheric conditions, and anything else that can signal time. Zeitgebers in the external environment are used by the SCN to adjust circadian rhythms to a 24-hour day. The SCN is believed to do this on a daily basis. When the SCN adjusts or resets the sleep–wake cycle to match the environmental day–night cycle through the influence of a zeitgeber, the circadian rhythm is said to be *entrained*, and the process is called *entrainment*. For example, all our circadian rhythms are entrained to the regular 24-hour, day–night cycle of our external environment.

ACTIVITY 7.10

Crossword on the importance of sleep in mental wellbeing

Across

5 Name of the process that describes when our 24-hour circadian rhythm is in sync with the day–night cycle

9 A general term used to describe a state caused by inadequate quantity or quality of sleep, either voluntarily or involuntarily

10 The abbreviation used to describe the sleep disorder that results when people have difficulty falling asleep earlier in the evening

13 The accumulated amount of sleep loss from insufficient sleep. It is sometimes described as the difference between the amount of sleep that is needed to function at an optimal level and the amount a person actually gets

14 The abbreviation used to describe the sleep disorder that results when people feel very sleepy early in the evening and often wake up very early in the morning

15 An abbreviation used to describe the amount of alcohol in a person's bloodstream represented as a percentage

Down

1 Environmental time cues that are used by the SCN to adjust our circadian rhythm to the 24-hour day

2 Using the timed expose of specific frequencies of light to shift the circadian rhythm

3 Includes basic lifestyle habits that influence sleep onset, good quality sleep and alertness during the normal waking period

4 A general term used to describe when people have problems remaining asleep or falling asleep

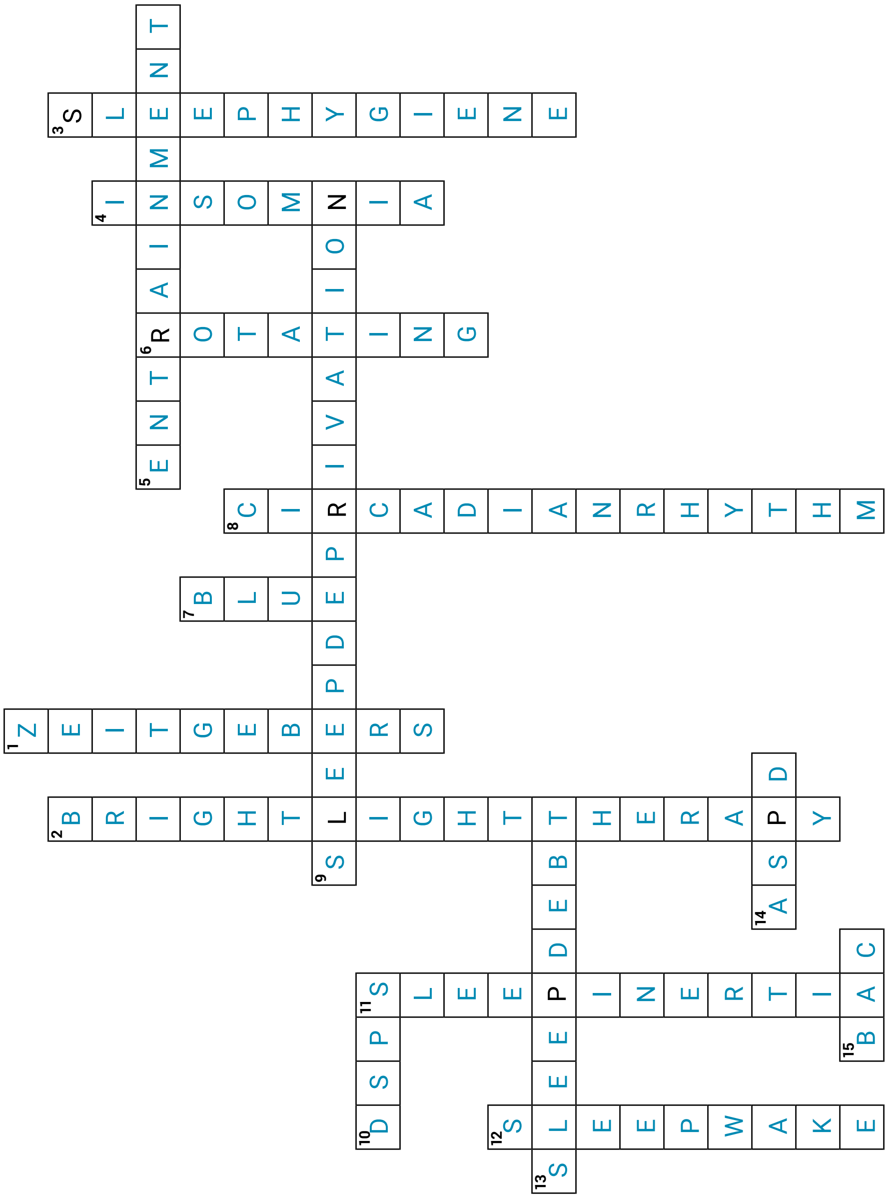
6 The name of scheduling of shift work that keep changing

7 Frequency of visible light that is believed to play an important role in the timing of our sleep–wake cycle

8 The name used to describe the cycles of the body that occur over a 24-hour cycle

11 A temporary period of reduced alertness and performance impairment that occurs immediately after awakening

12 The name of the 24 cycle that summarises when we are awake and when we are asleep


1 ZEITGEBERS
2 BRIGHT LIGHT THERAPY
3 SLEEP HYGIENE
4 INSOMNIA
5 ENTRAINMENT
6 ROTATING
7 BLUE
8 CIRCADIAN RHYTHM
9 SLEEP DEPRIVATION
10 DSPS
11 SLEEP INERTIA
12 SLEEP WAKE
13 SLEEP DEBT
14 ASPD
15 BAC

ACTIVITY 7.11

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/F
1 A sleep disturbance refers to any sleep-related problem that disrupts a person's normal sleep-wake cycle.	T
2 Some sleep disturbances can be life threatening.	T
3 A secondary sleep disorder is a persistent sleep disturbance that cannot be attributed to another condition such as an underlying medical health condition.	F
4 Normal healthy sleep requires the correct quantities of both REM and NREM sleep.	T
5 A person's ability to divide their attention is unaffected by sleep deprivation.	F
6 Experiencing a sleep disturbance means a person must be suffering from a sleep disorder.	F
7 Delayed sleep phase syndrome (DSPS) is characterised by a tendency to go to sleep later and to get up later than what is expected in society.	T
8 The level of performance on a cognitive task after remaining awake for 17 hours is equivalent to performing the same task with a BAC of 0.05%.	T
9 Most sleep disorders are associated with partial sleep deprivation rather than total sleep deprivation.	T
10 The best way for a person who suffers from sleep-onset insomnia to improve their ability to fall asleep is to go to bed earlier.	F
11 A sleep debt must be entirely repaid in order for the body to function normally following a period of sleep deprivation.	F
12 A primary sleep disorder is a persistent sleep disturbance that cannot be attributed to another condition such as an underlying medical health issue.	T
13 Advanced sleep phase disorder (ASPD) does not result in daytime sleepiness because people with this condition will fall sleep earlier in the evening.	F
14 Shift work disorder is characterised by two primary symptoms: insomnia and excessive sleepiness when the person needs to be awake.	T
15 Emotional reactivity is more strongly associated with REM sleep deprivation than NREM sleep deprivation.	T
16 It is considered more beneficial for a worker to be on a shorter period for a shift than a longer period.	F
17 It is generally easier for workers to adapt to a changing shift roster when the shifts are moved forwards rather than backwards.	T
18 If you wake up in the middle of the night and cannot fall back to sleep it is best to get up and do a relaxing activity until you feel sleepy again.	T
19 In order for bright light therapy to be effective, the person must look directly into the light source.	F
20 The internal biological clocks of adolescents can keep them awake later in the evening and wake them earlier in the morning.	T

Statement	T/F
21 To treat delayed sleep phase syndrome using bright light therapy, the exposure to the light should take place in the early hours of the evening.	F
22 Exercise can promote better quality sleep.	T
23 Awakening during NREM stage 3 sleep produces more sleep inertia than awakening during stage 1 or 2.	T
24 Heightened irritability is not linked to sleep deprivation.	F
25 The level of performance on a cognitive task after remaining awake for 24 hours is equivalent to performing the same task with a BAC of 0.10%.	T
26 To treat advanced sleep phase disorder using bright light therapy, the exposure to the light should take place in the early hours of the evening.	T
27 Lifestyle factors such as staying up late gaming, using social media or drinking caffeinated beverages can cause sleeping disorders.	T
28 Zeitgebers are environmental cues that entrain our sleep-wake cycle.	T
29 The main behavioral effect of sleep deprivation over a long period of time is excessive sleepiness when awake.	T
30 Sleep inertia only lasts a few minutes in all individuals.	F

TOPIC 8

Defining mental wellbeing

	Activities								
Key knowledge	8.1	8.2	8.3	8.4	8.5	8.6	8.7	8.8	8.9
• ways of considering mental wellbeing, including levels of functioning; resilience, as the ability to cope with and manage change and uncertainty; and social and emotional wellbeing (SEWB), as a multidimensional and holistic framework for wellbeing that encapsulates all elements of being (body, mind and emotions, family and kinship, community, culture, country, spirituality and ancestors) for Aboriginal and Torres Strait Islander people	✓	✓	✓				✓	✓	✓
• mental wellbeing as a continuum, with an individual's mental wellbeing influenced by the interaction of internal and external factors and fluctuating over time, as illustrated by variations for individuals experiencing stress, anxiety and phobia				✓	✓	✓	✓	✓	✓
Key science skills					✓				

Source: © VCAA, *VCE Psychology Study Design: 2023–2027.* p. 40.

ACTIVITY 8.1

Media response/analysis

Consider the following cartoon about level of functioning and then answer the questions.

1 In terms of mental wellbeing, what does the term 'functioning' refer to?

The term functioning refers to how effectively an individual independently performs or 'functions' in their environment in various personal, interpersonal and community domains. Functioning can vary in level or degree and can be represented on a continuum from high to low.

2 What is the relationship between level of functioning and mental health/mental illness? Give examples in your answer.

Mentally healthy = high level of functioning; mental illness/disorder = can impair and lead to low levels of functioning

A mentally healthy person typically has a *high level of functioning*. This means that they tend to:

- be able to independently perform and operate at a high level in their environment (e.g. go to work, maintain a social life)
- cope well with stressors
- experience positive emotions

- effectively carry out usual everyday tasks well
- look after their physical health (e.g. exercise regularly, shower on a daily basis)
- take care of household responsibilities.

In contrast, a mental illness/disorder can impair a person's level of functioning and lead to *low levels of functioning*.

For example, they may:

- not attend to their personal hygiene (e.g. not shower or change their clothes)
- not leave the house or get out of bed for long periods of time
- not interact or socialise with others
- not go to work
- stop eating well-balanced meals, reduce their food intake and lose weight
- neglect household responsibilities (e.g. not do any laundry, gardening, feed pets, etc).

3 What is the relationship between level of functioning and adaptive and maladaptive behaviours?

High level of functioning = adaptive behaviour; low level of functioning = maladaptive behaviour

The behaviour of someone with a high level of functioning is primarily *adaptive*. Adaptive behaviour is any behaviour that enables the individual to adjust to the environment appropriately and effectively. The individual is able to 'adapt' to the demands and challenges of daily living.

In contrast, *maladaptive* behaviour is any behaviour that is detrimental, counter-productive or otherwise interferes with the person's ability to successfully adjust to the environment and fulfill their typical roles in society. Maladaptive behaviour is sometimes called *dysfunctional behaviour* because it disrupts or impairs everyday functioning. There is a reduced ability to do the things one normally does each day. Maladaptive behaviour is commonly associated with a low level of overall functioning.

4 On the continuum below, plot the level of functioning of the person in the cartoon by placing an 'X' in the appropriate place.

5 (a) Describe the level of functioning of the person in the cartoon. Justify your answer with examples.

The cartoon suggests that this person is functioning at a very low level.

The first indication is the fact that there is only one item on their 'to do' list. For a lot of people, there are often multiple things on a daily 'to do' list, otherwise they wouldn't need to write one.

The second indication is what that item is – to get out of bed. For people who are mentally healthy and functioning at a high level, getting out of bed each day is a simple and easy task to accomplish, and often even done 'automatically'. The person's facial expression suggests he is finding this one simple task a daunting, overwhelming prospect, thereby indicating that he is functioning at a very low level.

Lastly, the image suggests he has been in bed a while because he is depicted as unshaven, and his hair disheveled. This suggests that other areas of functioning are most likely also being neglected, such as personal hygiene (showering/getting dressed/brushing teeth/shaving), interacting with others, going shopping, cooking and preparing meals, going to work, exercising, etc.

(b) Explain what the level of functioning in the cartoon indicates about the person's current mental wellbeing.

This person has a low level of functioning and has been struggling to achieve a basic daily task – get out of bed – for a prolonged period. This indicates that he is likely to be experiencing challenges with his mental wellbeing and may even be experiencing a mental illness such as depression.

ACTIVITY 8.2

Thinking about resilience

1 What is resilience?

Resilience is the ability to successfully cope with and manage change and uncertainty. It means 'bouncing back' from adversity or difficult experiences.

2 Complete the following table with the characteristics of resilient people. Refer to Topic 8 of Psychology VCE Units 3 and 4 for guidance. Also give your own example of each characteristic.

Characteristics of resilient people	Examples
High self-efficacy (strong belief in abilities to accomplish tasks and succeed)	e.g. a pregnant woman, who is nervous about caring for her newborn baby, but believes that she has the ability to succeed, no matter how difficult or scary it is
High self-esteem	e.g. a young man who asks a girl he likes out on a date, because he thinks she will say yes
Approaches adversity with optimism, opportunity and hope	e.g. a boss of a company who sees their employee's resignation as an opportunity to change their business model and what services they offer
Adaptable and flexible	e.g. a grandmother who plans to take her grandchildren to the playground, but there is a big thunderstorm. She makes an indoor obstacle course for them with broomsticks and blankets instead.
Organised	e.g. a student ensures they have everything they need for all of their classes the next day, including their clean PE uniform
Good problem-solving skills	e.g. when a person's car won't start in the morning, they look up the bus and train timetables to find the best alternative way to get to work
The ability to make realistic plans and carry them out	e.g. in order to get into the university course of their choice, a student aims for a certain ATAR score and devises and closely follows a study plan to achieve it

3 Read each of the scenarios below and decide whether the person is displaying resilient characteristics or non-resilient characteristics by circling the correct response.

Henry makes sure he finds the time to walk his dog every night after work, even if he is tired.	(resilient)	non-resilient
Paola was on her way to work when a bird pooped on her suit from the tree above. Paola laughed and hoped this was a sign of good luck.	(resilient)	non-resilient
James was on his way to a job interview when he got a flat tyre. He immediately became downhearted and thought, "Why do terrible things like this always happen to me?"	resilient	(non-resilient)
Nayonika was on her way to a job interview when she got a flat tyre. She immediately tried to think of ways to solve the problem so that she could still get to her job interview on time.	(resilient)	non-resilient
Waru and Jarrah had been dating for two years, but Jarrah suddenly decided to break things off. Waru was devastated. He stayed in his room, didn't shower, eat or talk to anyone.	resilient	(non-resilient)
Helen and Mithi had a heated conversation because their views differed on a human rights issue. Mithi told Helen she didn't want to be her friend anymore.	resilient	(non-resilient)
Shirley received a devastating medical diagnosis. However, she believed that the treatment she was about to receive would help her and that she would be OK.	(resilient)	non-resilient

ACTIVITY 8.2 *continued*

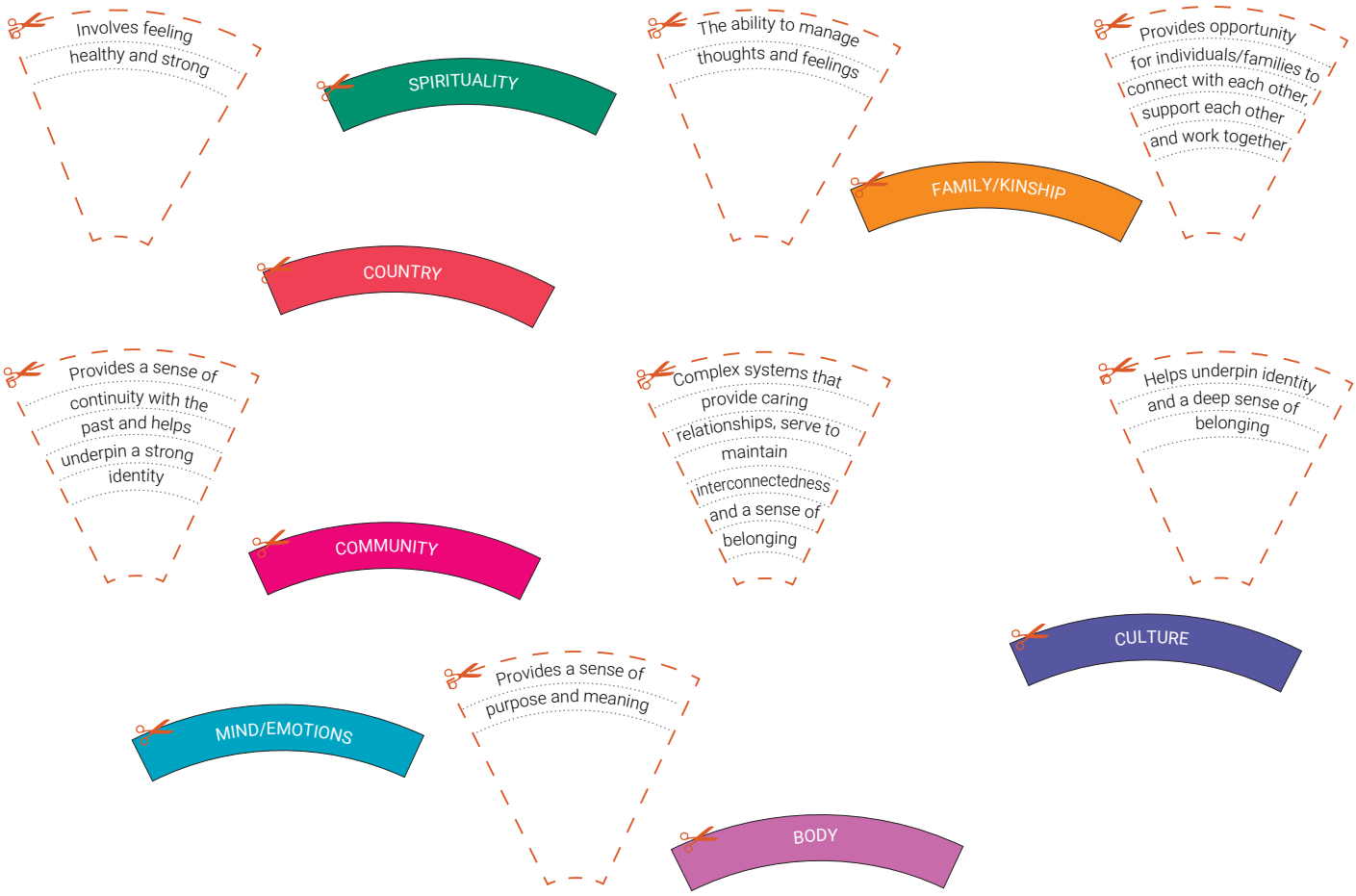
4 Read each of the statements below and decide whether they are true or false based on the information provided in Topic 8 of Psychology VCE Units 3 and 4. Circle the correct response.

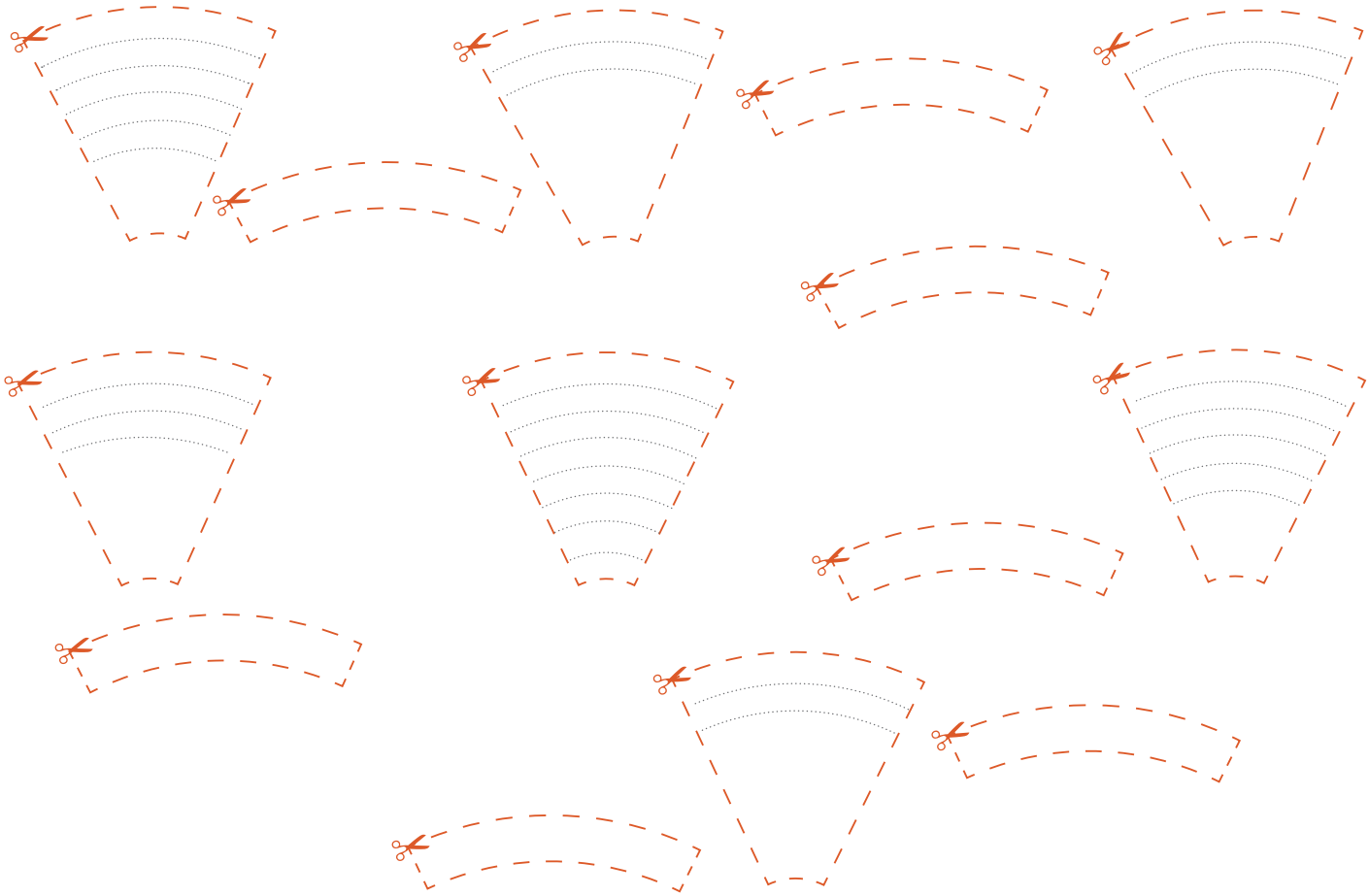
People who are mentally healthy are commonly described as 'not resilient'.	True	**False**
Approaching adversity with a sense of optimism and hope is a sign of resilience.	**True**	False
Our resilience is not significantly influenced by external factors.	True	**False**
Resilience is not a "fixed" ability that cannot be developed or enhanced.	**True**	False
Being able to laugh at yourself when things go wrong is an important aspect of resilience.	**True**	False
One of the characteristics of non-resilient people is low self-esteem.	True	**False**
Cognitive rigidity is helpful when dealing with difficulties and a sign of resilience.	True	**False**
Some people have more or less resilience than others.	**True**	False
Having a lot of resilience means that a person never experiences distress.	**True**	False
Resilient people are more likely to seek and ask for help in difficult times than non-resilient people.	**True**	False

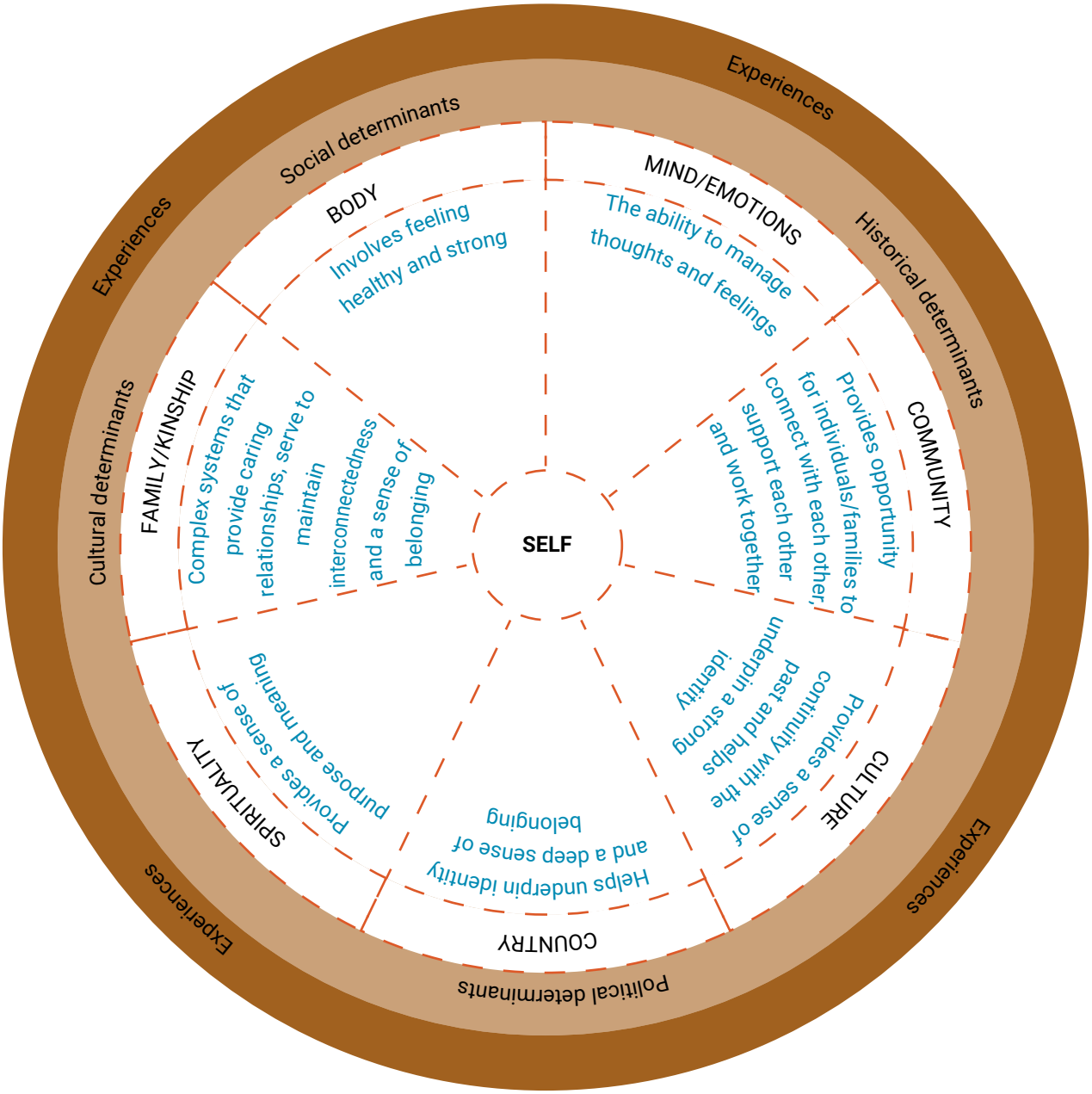
ACTIVITY 8.3

Social and Emotional Wellbeing (SEWB) from an Aboriginal and Torres Strait Islander perspective

Cut and paste the following words and descriptions in the correct places to complete the circular diagram about the seven overlapping and interrelated domains of SEWB from an Aboriginal and Torres Strait Islander perspective.






Experiences
Social determinants
Historical determinants
Cultural determinants
Experiences
Experiences
Political determinants
SELF
BODY
Involves feeling healthy and strong
MIND/EMOTIONS
The ability to manage thoughts and feelings
COMMUNITY
Provides opportunity for individuals/families to connect with each other, support each other and work together
CULTURE
Provides a sense of continuity with the past and helps underpin a strong identity
COUNTRY
Helps underpin identity and a deep sense of belonging
SPIRITUALITY
Provides a sense of purpose and meaning
FAMILY/KINSHIP
Complex systems that provide caring relationships, serve to maintain interconnectedness and a sense of belonging

ACTIVITY 8.4

Plotting mental wellbeing on a continuum

Read the following case studies and place each person on the mental wellbeing continuum using an 'X' and their name. Then, in the spaces provided underneath the continuum, 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 enjoys travelling with her friend Shirley who is also a widow. Helen walks her dog every day and volunteers two 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.

X

Mentally healthy **Mental health problem** **Mental disorder**

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 had 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.

Mentally healthy **Mental health problem** **Mental disorder**

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 because 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 two 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.

Mentally healthy **Mental health problem** **Mental disorder**

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 changes in her 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 and 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.

Mentally healthy **Mental health problem** **Mental disorder**

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, feelings 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.

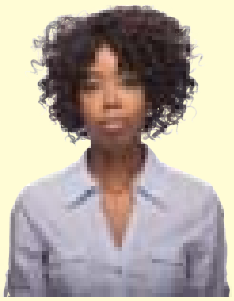
SIMON: Simon is 8 years old. He has severe difficulties concentrating, listening and following instructions. His parents and teachers report that he is physically restless and is 'constantly running around'. He often blurts out answers and interrupts other students in the classroom. Simon has been involved 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.

Mentally healthy **Mental health problem** **Mental disorder**

SIMON:

Simon is experiencing a diagnosable mental disorder, most likely attention deficit hyperactivity disorder (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.



X

Mentally healthy **Mental health problem** **Mental disorder**

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 8.5

Distinguishing between internal and external factors that can influence mental wellbeing

Our mental wellbeing can be 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.

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 healthcare		✔
9 biological 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 8.6

Comparing stress, anxiety and phobia

Tick whether each statement 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 They share a number of psychological and physiological characteristics and may co-occur in varying degrees.	✔	✔	✔
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 8.7

Matching exercise on mental wellbeing

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 only be used once.

(p)	**1** The ability to successfully cope with and manage change and uncertainty	**(a)** connection to Country
(c)	**2** Influences on mental wellbeing that originate within a person	**(b)** adaptive
(n)	**3** A positive state of mental health	**(c)** internal factors
(j)	**4** Influences on mental wellbeing that originate outside a person	**(d)** social and emotional wellbeing (SEWB)
(q)	**5** SEWB domain that connects the past, present and future and can be expressed in many ways including through art, song, story, ceremony and the Dreaming	**(e)** phobia
(b)	**6** Behaviour that enables an individual to adjust to the environment appropriately and effectively	**(f)** connection to family and kinship
(h)	**7** SEWB domain that involves all aspects of physical health and wellbeing	**(g)** stress
(o)	**8** SEWB domain that provides opportunities for individuals and families to connect/support each other and work together	**(h)** connection to body
(l)	**9** SEWB domain that emphasises a person's ability to manage thoughts and feelings	**(i)** wellbeing
(s)	**10** Behaviour that is detrimental and interferes with a person's ability to successful adjust to the environment	**(j)** external factors
(d)	**11** Holistic, multidimensional view of health used by Aboriginal and Torres Strait Islander peoples	**(k)** functioning
(a)	**12** SEWB domain that recognises the traditional and spiritual association to land	**(l)** connection to mind and emotions
(g)	**13** Psychobiological response produced by internal or external stressors	**(m)** connection to culture

ACTIVITY 8.7 *continued*

(e)	**14** Persistent, excessive and unreasonable fear of a particular object, person, animal, activity or situation	**(n)** mental wellbeing
(f)	**15** SEWB domain that emphasises the complex systems that serve to maintain interconnectedness through cultural ties and caring relationships	**(o)** connection to community
(r)	**16** A state of arousal involving feelings of apprehension or easiness that something is wrong or something unpleasant is about to happen	**(p)** resilience
(k)	**17** How well a person independently performs or operates in their environment	**(q)** connection to spirituality and ancestors
(m)	**18** SEWB domain that emphasises the importance of maintaining a secure sense of identity by participating in cultural traditions and practices	**(r)** anxiety
(i)	**19** Our sense of 'wellness' or how well we feel about ourselves and our lives	**(s)** maladaptive

ACTIVITY 8.8

Crossword on concepts and terms in mental wellbeing

Across

2 An influence on mental health sourced within a person
4 A short-lasting and temporary disturbance to mental health from which recovery is likely to occur when the cause passes
7 A person is described in this way if they are able to make the most of their potential, work productively and cope with the challenges of everyday life
8 Term used to describe the behaviour of someone with a high level of functioning
10 A positive state of mental health
13 Term used to describe how well an individual independently performs or operates in their environment
15 A term used to describe our sense of 'wellness'
17 SEWB domain that connects the spiritual world of the past with the present and the future
18 SEWB domain that provides a sense of continuity with the past and helps underpin a strong identity

Down

1 The SEWB domain 'connection to mind and emotions' primary focuses on this aspect of health
3 A typical characteristic of a mentally healthy person
5 A multidimensional and holistic framework that encapsulates all elements of being for Aboriginal and Torres Strait Islander peoples
6 The SEWB domain 'connection to body' primarily focuses on this aspect of health
9 A mental health condition involving thoughts, feelings and behaviour that typically impact on daily functioning
11 Term used to describe the diverse ways in which Aboriginal and Torres Strait islander peoples experience and express the various social and emotional (SEWB) domains throughout their lives
12 Term used to describe a persistent, excessive and unrealistic fear of an object, person, animal, activity or situation
14 Mental health is often represented this way
16 An influence on mental health sourced outside a person

1 M E N T A L
2 I N T E R N A L
3 R E S I L I E N C E
4 M E N T A L H E A L T H P R O B L E M
5 S O C I A L N E T W O R K I N G
6 P S Y C H I A T R I S T
7 M E N T A L I L L N E S S
8 A D A P T I V E
9 M E L L B E I N G
10 M E N T A L W E L L N E S S
11 C O N N E C T I O N
12 P H O B I A
13 F U N C T I O N A L I S M
14 C O G N I T I V E D I S S O N A N C E
15 W E L L B E I N G
16 E X T E R N A L
17 S P I R I T U A L I T Y
18 C U L T U R E

ACTIVITY 8.9

True/False quiz on mental wellbeing

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

Statement	T/F
1 The behaviour of someone with a 'high level of functioning' is likely to be maladaptive.	F
2 The main difference between having a mental health problem and having a mental disorder is the number of symptoms experienced.	F
3 The model of Social and Emotional Wellbeing (SEWB) from an Aboriginal and Torres Strait Islander perspective has six overlapping domains.	F
4 Internal factors are influences on mental wellbeing that originate inside or within a person.	T
5 Mental health can be represented on a continuum with 'mentally healthy' at one end and 'mentally unwell' at the other.	T
6 The terms mental illness and mental disorder may be used interchangeably.	T
7 It is not possible to learn how to become more resilient.	F
8 The experiences and expressions of social and emotional wellbeing (SEWB) is stable and does not change throughout an Aboriginal or Torres Strait Islander person's lifespan.	F
9 The location of an individual's mental wellbeing on a mental health continuum may vary and fluctuate over time depending on circumstances.	T
10 External factors are influences on mental wellbeing that originate outside a person.	T
11 When we are in a positive state of mental health, we are mentally healthy.	T
12 The symptoms of a mental disorder will usually resolve with time or when the source of the problem changes or passes.	F
13 For Aboriginal and Torres Strait Islander peoples, communities can be sources of support and resilience and this support can enhance and promote an individual's social and emotional wellbeing (SEWB).	T
14 Everyone has approximately the same level of resilience.	F
15 Experiencing anxiety for a prolonged period can indicate the presence of an anxiety disorder.	T
16 People with mental health problems are more likely to experience lower levels of functioning that those without mental health problems.	T
17 Mental wellbeing, functioning and resilience can all be represented on a continuum.	T
18 Most people experience stress, anxiety and phobias at some point in their lives.	F
19 The model of social and emotional wellbeing (SEWB) from an Aboriginal and Torres Strait Islander perspective has a domain called 'connection to self'.	F
20 People who are mentally healthy tend to have a high level of resilience, whereas people who are mentally unwell tend to have a low level of resilience.	T

TOPIC 9

Application of a biopsychosocial approach to explain specific phobia

	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	9.12
• the relative influences of factors that contribute to the development of specific phobia, with reference to gamma-amino butyric acid (GABA) dysfunction and long-term potentiation (biological); behavioural models involving precipitation by classical conditioning and perpetuation by operant conditioning, and cognitive biases including memory bias and catastrophic thinking (psychological); and 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 (GABA agonists) in the management of phobic anxiety and breathing retraining (biological); the use of cognitive behavioural therapy (CBT) and systematic desensitisation as psychotherapeutic treatments of phobia (psychological); and psychoeducation for families/supporters with reference to challenging unrealistic or anxious thoughts and not encouraging avoidance behaviours (social)				✓	✓	✓	✓		✓	✓	✓	✓
Key science skills								✓				

Source: © VCAA, *VCE Psychology Study Design: 2023–2027*. p. 40.

ACTIVITY 9.1

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.

In addition, long-term potentiation (LTP) is thought to contribute to phobic anxiety at a biological level, because this process **(strengthens/~~weakens~~)** the association between a phobic stimulus and a fear or anxiety response through its activity at the **(synapse/~~nucleus~~)**. The consequence is the development of 'fear pathway' in the brain.

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.

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 9.2

Classical conditioning

1 Steven Spielberg's 1975 movie ***Jaws*** is a thriller about a great white shark that terrorised tourists at a local beach. Each time, just before the frightening shark appeared, threatening music began playing. As the unseen shark came closer underwater, the tempo of the threatening music increased steadily. After the audience had experienced this a few times, the sound of the music alone triggered the emotional reaction of fear and anxiety in the audience even though the shark still had not appeared. Many people reported developing phobias of sharks and the ocean after watching this movie.

(a) In this scenario, the ***unconditioned response*** was

- **A** the sound of the music
- **B** fear and anxiety
- **C** the shark
- **D** developing a shark phobia.

(b) In this scenario, the ***unconditioned stimulus*** was

- **A** the sound of the music
- **B** fear and anxiety
- **C** the shark
- **D** the ocean.

(c) In this scenario, by the end of the movie, ***the sound of the music*** was a(n)

- **A** unconditioned response (UCR)
- **B** unconditioned stimulus (UCS)
- **C** conditioned response (CR)
- **D** conditioned stimulus (CS).

2 One night, Sophia and her friends went to the movies to see ***Psycho***, a classic 1960 horror film produced and directed by Alfred Hitchcock. Sophia was really looking forward to seeing the film, however, she experienced a 'jump scare' during one of the scenes where the main character, Marion, was in the shower. A jump scare is a technique often used in horror films, intended to scare the audience by surprising them with an abrupt change in image or event, usually co-occurring with a sudden, loud sound. During the 'shower scene' Sophia's breathing and heart rate increased rapidly. The next day, Sophia was getting ready for her shower and she suddenly had visions of the 'shower scene' pop in her head. Sophia quickly jumped out of the shower and ran out of the bathroom, her heart beating very quickly. Sophia now has a specific phobia of showers.

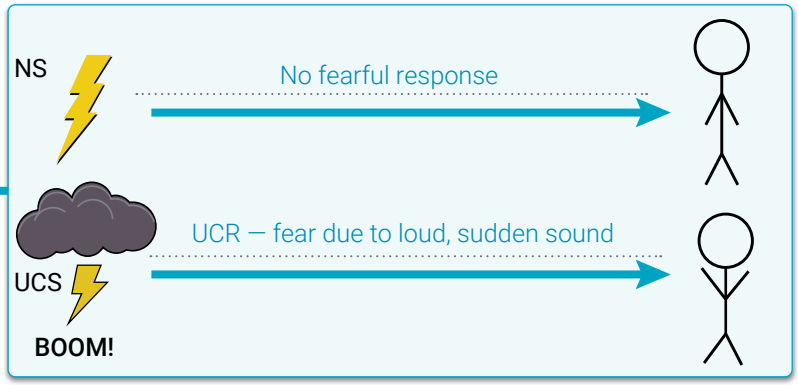
For this scenario, outline each of the following stimuli and responses.

Neutral stimulus	Shower
Unconditioned stimulus (UCS)	Shower scene in movie
Unconditioned response (UCR)	Fear/startle response
Conditioned stimulus (CS)	Shower
Conditioned response	Fear (of showers)

3 Usman has a specific phobia of lightning. Explain, using the classical conditioning process, how Usman could have developed his phobia of lightning by completing the boxes below.

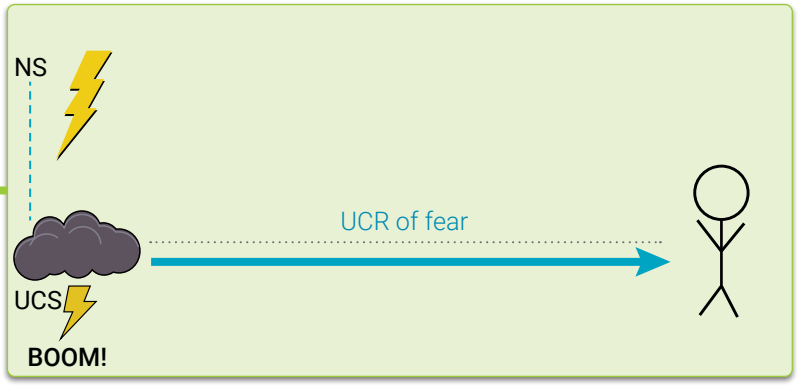
Before conditioning

Neutral stimulus of lightning produces no relevant response. Unconditioned stimulus of thunder produces reflexive unconditioned response of fear.



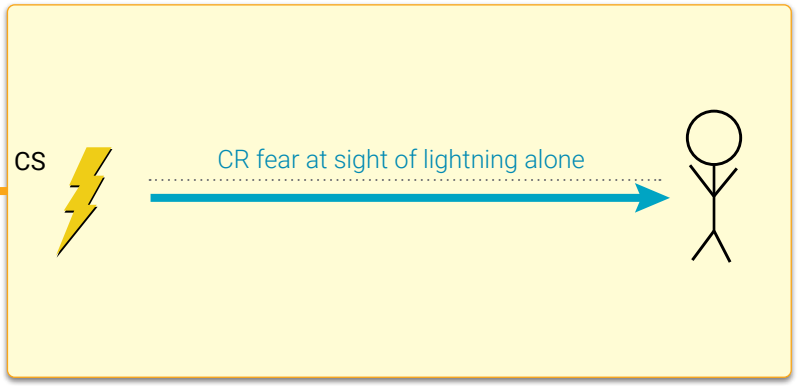
During conditioning

The neutral stimulus of lightning is repeatedly presented just before the unconditioned stimulus (loud sound of thunder). Produces UCR of fear.



After conditioning

The neutral stimulus of lightning has now become the conditioned stimulus which produces the conditioned response of fear.



4 Evelyn had just got her driver's licence but soon afterwards was involved in a terrible traffic accident at a large intersection. The accident terrified her because she thought the other passenger was seriously hurt. Evelyn has since developed a specific phobia of driving.

(a) According to classical conditioning theory, the unconditioned response (UCR) and conditioned stimulus (CS) in this scenario are

A driving; traffic lights
B fear; driving
C being injured; driving
D sounds at the accident site; fear.

(b) In this scenario, what was initially the neutral stimulus?

Driving (this initially did not cause any relevant response)

5 Use the following words to complete the paragraphs below.

neutral stimulus	unconditioned stimulus	unconditioned response
conditioned stimulus	conditioned response	

Charlize went for a bush walk with her family. She was not initially afraid of snakes, but while out on the walk she was bitten by a snake on the leg. The incident was extremely painful and frightening for her. After this, Charlize developed a specific phobia of snakes.

According to classical conditioning, the biting incident has meant that Charlize now associates the unconditioned stimulus (snake bite) with the once neutral stimulus (snake). Charlize's reaction of fear to the snake bite was a(n) unconditioned response. The snake has now become a conditioned stimulus. As a conditioned stimulus, the snake now evokes a conditioned response of fear.

Daron experienced a painful procedure during a dental visit and has since developed a phobia of the dentist.

In this scenario, Daron has developed an association between the dentist and the pain through classical conditioning. The dentist was initially a(n) neutral stimulus, however the painful procedure (unconditioned stimulus) caused a(n) unconditioned response of pain and fear. Through this association, the dentist is able to elicit a conditioned response, which is fear, because it has become a conditioned stimulus.

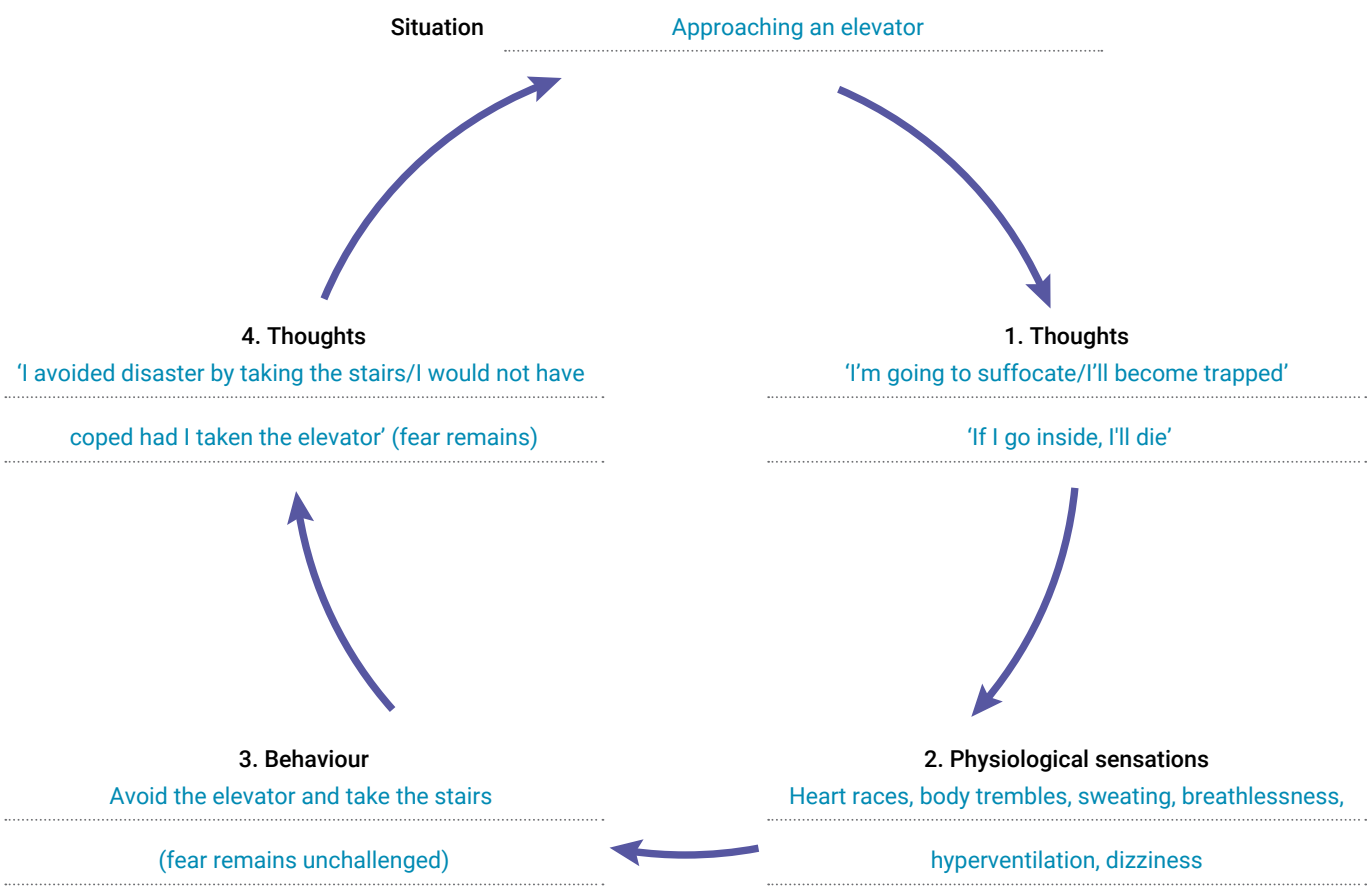
ACTIVITY 9.3

Psychological contributory factors

Various psychological factors can contribute to the development and perpetuation of specific phobias. One of these is a cognitive bias called 'catastrophic thinking'.

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.



ACTIVITY 9.4

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** Drugs that target 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)** GABA
(j)	**4** Term used to describe 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)** benzodiazepines
(c)	**7** Benzodiazepines work by acting selectively on these receptors in the brain.	**(g)** breathing retraining
(a)	**8** Term used to describe 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 9.5

Media response/analysis

Consider the following cartoon about a specific phobia and then answer the questions.

Source: CartoonStock

1 What specific type of intervention does the cartoon suggest the psychologist is using to treat the 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 client to first identify, then challenge unhelpful thinking patterns (particularly catastrophic thoughts) about the 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 the 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 and psychoeducation. 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.

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

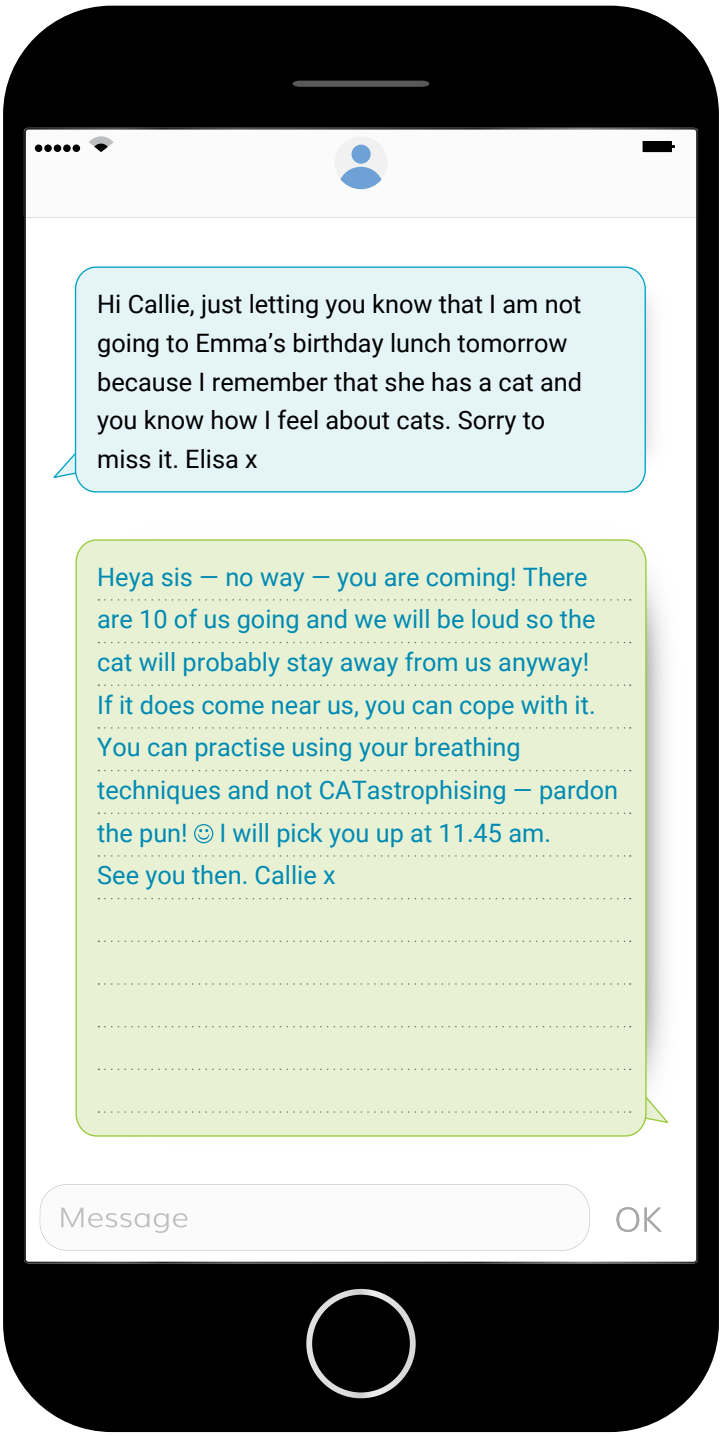
Holding a bowl of baked beans an arm's length away	Eating a spoonful of baked beans
Looking at a photo of a tin of baked beans	Eating one baked bean
Holding an open tin of baked beans	Touching a spoonful of baked bean to your lips
Looking closely at a bowlful of baked beans	Smelling a bowl of baked beans
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

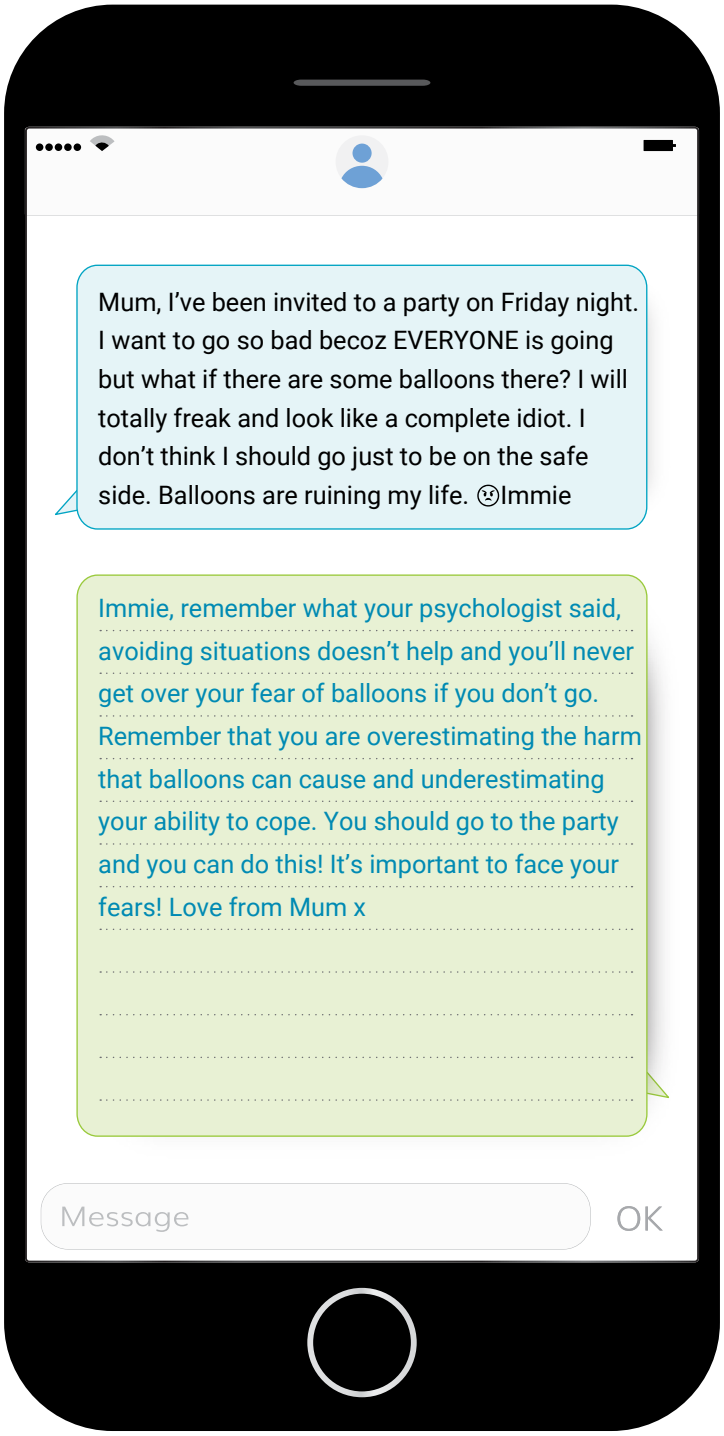
ACTIVITY 9.7

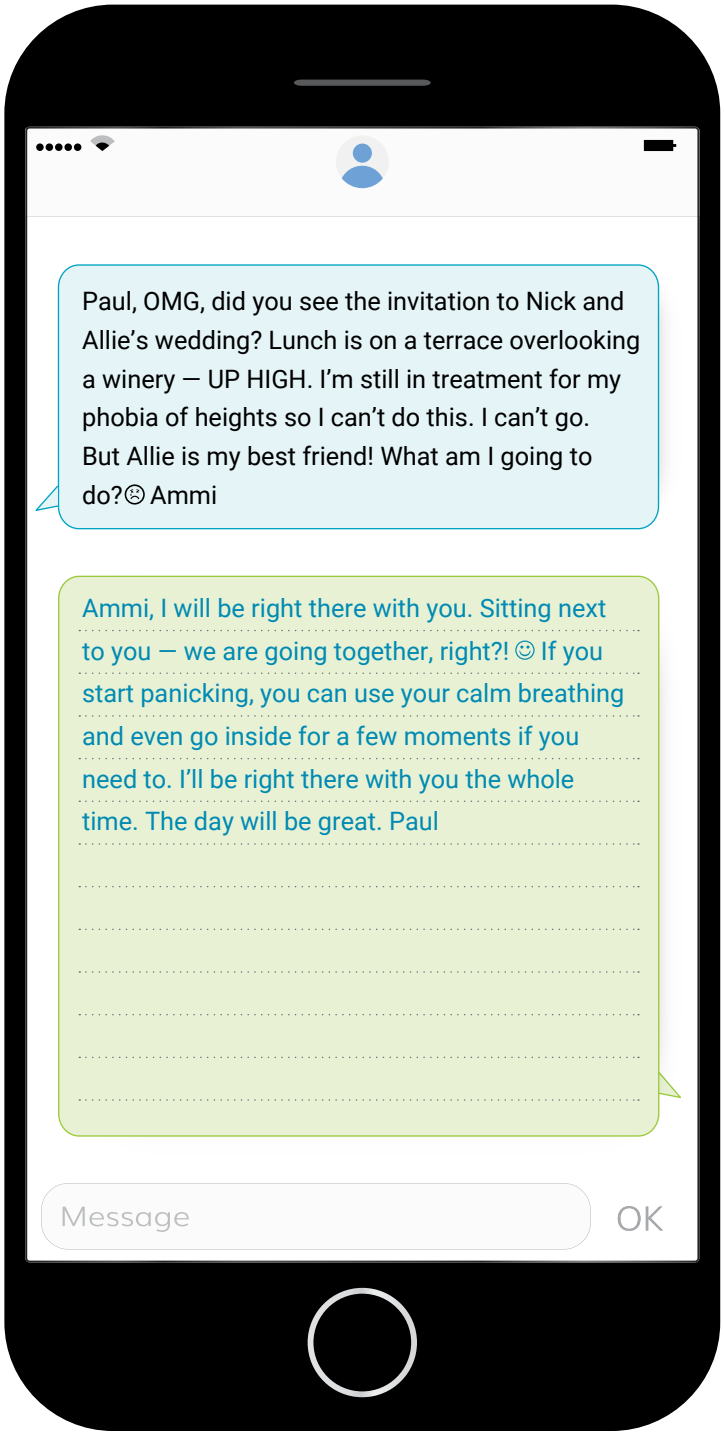
Evidence-based social interventions for specific phobias

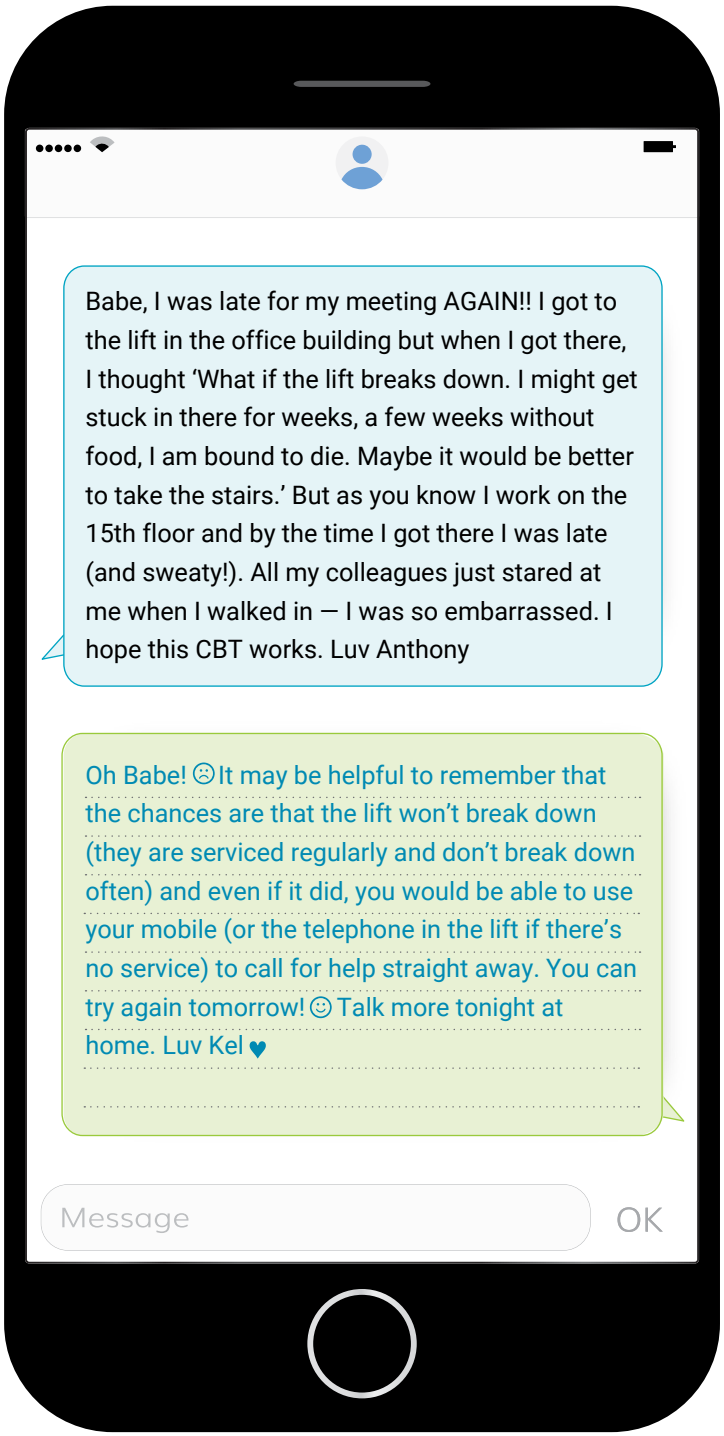
Suppose that you have a close relationship with a person who has a specific phobia and are therefore part of their social support network. In the spaces provided in the mobile phones below, write a reply to each of the text messages consistent with information that would have been given to you as part of the psychoeducation process.

Your reply does not necessarily have to be expressed formally.






Paul, OMG, did you see the invitation to Nick and Allie's wedding? Lunch is on a terrace overlooking a winery — UP HIGH. I'm still in treatment for my phobia of heights so I can't do this. I can't go. But Allie is my best friend! What am I going to do?☹ Ammi
Ammi, I will be right there with you. Sitting next to you — we are going together, right?! ☺ If you start panicking, you can use your calm breathing and even go inside for a few moments if you need to. I'll be right there with you the whole time. The day will be great. Paul
Message
OK



ACTIVITY 9.8

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) and women they are four times more likely to develop it than men. The specific phobia can significantly interfere with a person's everyday life because 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.

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 and control groups.

experimental group: Group 1 (i.e. with SPOV)

control group: Group 2 (i.e. without SPOV)

3 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

4 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

5 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.

6 On which type of long-term memory is the study dependent for its data?

episodic, explicit

7 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 9.9

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	Not encouraging avoidance behaviour
Type of intervention: biological	**Type of intervention:** psychological	**Type of intervention:** social
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:** As part of psycho-education family/supporters receive information about the importance of not encouraging avoidance behaviour.
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	**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	**Description:** Helena has not been on a plane for 23 years so she has clearly avoided this. Using this intervention, her family would encourage her to 'face her fear' of flying and not continue to avoid this.

ACTIVITY 9.9 *continued*

or panicking by using controlled breathing techniques. Maintaining correct breathing or correcting breathing patterns when experiencing or anticipating a phobic stimulus will help reduce anxiety-related symptoms.	cognitive biases about flying. At present, Helena is focusing only on the planes that crash and 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.	They would be supportive of her efforts to 'face her fear', in combination with other intervention.
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.

ACTIVITY 9.9 *continued*

Description: Helena's psychologist would educate Helena and her family/supporters 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 9.10

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	LTP	GABA	biological
classical conditioning	cognitive	conditioned response	fear	high
hyperventilate	low	memory	neural pathways	operant conditioning
psychoeducation	psychological	social	stigma	strengthen
avoid	systematic desensitisation	think	unconditioned response	weaken

1 People with specific phobias should be helped and encouraged not to avoid their feared object/situation.

2 The predominant symptom of a specific phobia includes excessive fear and anxiety.

3 LTP is a biological contributory factor for specific phobias.

4 A benzodiazepine agent is a GABA agonist that 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.

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 In the case of a specific phobia developed through classical conditioning, the newly learned fear response automatically produced is called the conditioned response.

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 9.11

Crossword on concepts and terms in specific phobia

Across

2 A psychotherapy that targets thoughts and behaviours that are perpetuating a phobia

9 Any treatment for specific phobias found to be valid on the basis of sound scientific research

11 Treats the symptoms but not the cause of anxiety induced by a phobic stimulus

12 An experience involving sudden onset of intense fear or terror typically accompanied by shortness of breath, a racing heart and dizziness

13 Models that explain phobias in terms of flawed information processing

14 A type of thinking that involves predicting the worst possible outcome

19 An agent used in medications that targets inhibitory receptors in the brain

20 Benzodiazepines work by stimulating GABA activity, meaning that they are classed as a GABA .....

21 A feeling of worry, uneasiness or apprehension

Down

1 An intervention for phobia treatment that targets breathing patterns

3 Type of cognitive bias that involves remembering a phobic experience more negatively than it actually was

4 A behavioural intervention for phobia involving a graduated exposure technique

5 A type of behaviour typical of all people with specific phobias

6 A type of conditioning that may perpetuate a phobia

7 Activity at the synapse that may neurologically strengthen the association between a phobic stimulus and a fear or anxiety response

8 Counterbalances the excitatory activity of neurotransmitters that contribute to arousal and anxiety

10 The provision of information to individuals about their phobia to assist their understanding

15 Models that explain phobias in terms of learning processes

16 This type of experience with a particular object or situation can contribute to the development of a specific phobia

17 A mental disorder characterised by excessive fear, anxiety and avoidance behaviour

18 A known barrier to seeking treatment for people with a specific phobia

1 B R E A T H I N G R E M E D I C A T I O N
2 C O G N T I V E B E H A V I O U R A L
3 M E M O R Y B I A S
4 S Y S T E M A T I C D E S E N S I T I Z A T I O N
5 A V O I D A N C E
6 O P
7 L O N G T E R M P O T E N T I A T E
8 G B A S E D
9 E V I D E N C E B A S E D
10 P S Y C H O D U C A T I O N
11 M E T A I N I N G
12 P A N I C A T T A C K
13 C O G N I T I V E P I N E A P P L E
14 C A T H A R S I S
15 B E H A V I O U R A L
16 T R A U M A T I C
17 P H O B I A
18 S T I G M A
19 B E N Z O D I A Z E P I N E
20 A G O N I S T
21 A N X I O L Y T I C

ACTIVITY 9.12

True/False quiz on specific phobia

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

Statement	T/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 GABA is the primary inhibitory neurotransmitter in the central nervous system.	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 In a phobia of a dog developed through classical conditioning, the 'dog' is the conditioned response (CR).	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 9.12 *continued*

Statement	T/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

TOPIC 10

Maintenance of mental wellbeing

	Activities								
Key knowledge	10.1	10.2	10.3	10.4	10.5	10.6	10.7	10.8	10.9
• the application of a biopsychosocial approach to maintaining mental wellbeing, with reference to protective factors including adequate nutritional intake and hydration and sleep (biological), cognitive behavioural strategies and mindfulness meditation (psychological) and support from family, friends and community that is authentic and energising (social)	✓	✓	✓	✓	✓		✓	✓	✓
• cultural determinants, including cultural continuity and self-determination, as integral for the maintenance of wellbeing in Aboriginal and Torres Strait Islander peoples						✓	✓	✓	✓
Key science skills		✓							

Source: © VCAA, *VCE Psychology Study Design: 2023–2027.* p. 40.

ACTIVITY 10.1

Summarising biological protective factors

Select terms from the shaded panel below to correctly complete the passage about the biological protective factors that contribute to good mental wellbeing. A term should be only used once but not all terms need to be used.

adversity	bad	balanced	cognitive	hydration
nutritional intake	feel	good	hours	individual
involuntary	mental wellbeing	mood	NREM	physical
strengthen	quality	quantity	ready	REM
resilience	resistance	restored	right	rumination
set	sleep	tasty	variety	voluntary
mental health problem	predictor	weaken	increase	reduce

While they cannot guarantee a mental health problem will not develop, biological protective factors strengthen a person's mental wellbeing and reduce the likelihood that mental ill-health will occur.

Adequate nutritional intake means eating a good amount of a variety of different foods that maintain 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 hydration). Most people know that eating well is vital to good physical health and contributes to an overall healthier lifestyle. However, research also shows that adequate nutritional intake can have a positive impact on our mental wellbeing, 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.

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 sleep 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 wellbeing 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 a certain number of hours.

ACTIVITY 10.2

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 10.2 *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 experimental and control groups.

experimental group: dietary support

control group: social support

4 Identify the operationalised independent and dependent variables.

independent variable: type of intervention received

dependent variable: score on anxiety test/number of anxiety symptoms

5 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.

6 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

7 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

8 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

9 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.

10 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).

11 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 10.3

Changing unhelpful thoughts as a psychological protective factor

When using cognitive behavioural strategies, individuals identify, assess and correct unhelpful 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 wellbeing.

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.

Mindfulness meditation

What is meditation?

The practice of sitting for a period of time in quiet stillness, your attention turned inward and focused on something specific; used to achieve an altered state of consciousness

What is mindfulness?

An awareness of one's internal states and surroundings without judgement; paying full attention and being present in whatever you're doing, moment to moment

What is mindfulness meditation?

- PROTECTIVE PSYCHOLOGICAL FACTOR to maintaining mental wellbeing
- It combines mindfulness with the practice ofmeditation. Type of meditation in which a person focuses attention on their breathing, while thoughts, feelings and sensations are experienced freely as they arise. It involves paying attention, noticing, experiencing, doing and being right here, right now

Purpose of mindfulness meditation

- To achieve a state of alert, focused relaxation by deliberately paying attention to thoughts and sensations without judgment
- To teach people how to slow down their racing thoughts, let go of negativity, avoid being distracted by negative thoughts and calm both their body and mind

Benefits of mindfulness meditation

Better mental health and wellbeing; relief from stress and anxiety; provides relaxation; therapeutic intervention for hypertension, chronic pain, insomnia and various other conditions

Media response/analysis

Dr Marny Lishman: Friends are good for your health

Social support is one of the most important ingredients in the recipe of a psychologically and physically healthy life.

I KNOW my friends are good for my health. Daily, I natter away to them on the phone, Facebook, email or catch up for a meal. Some of my besties would even argue I natter a little too much.

Social support is one of the most important ingredients in the recipe of a psychologically and physically healthy life.

Yet, for many people, maintaining friendships can be hard, especially when we become busy adults and everything else seems to get in the way.

For some, catching up with friends is often the first thing to go when they are feeling busy, stressed out or depressed.

I see it with workers, new parents, older parents and couples in new (or old) relationships.

Many people get caught up in dealing with life and friendships get relegated into the 'when I have the time' corner. I see it all the time.

But for a longer, happier and a more fulfilling life, hanging with your best buds is worth the effort.

The evidence even says so. In fact, with every client I work with, I make sure I give a verbal prescription of "talk to your mates".

PerthNow columnist Dr Marny Lishman

Here's why:

Stress is lowered

Being around friends increases the release of oxytocin (our cuddle hormone).

This has a calming effect which counteracts the fight or flight response that goes off when we are stressing out about stuff. Being around your buddies calms that nervous system of ours down, and also distracts us from the trigger that set us off in the first place. We know all of the nasty things that stress does to our bodies which is why another benefit is that friends are…

Good for your body

Friendship protects you against all sorts of nasty health conditions from the common cold through to cardiovascular conditions. Research has also shown that a strong support system can help in recovering from cancer and chronic pain as well as preventing debilitating conditions such as dementia.

Sense of belonging and purpose increases

Us human beings are pack animals. We like to belong. From an evolutionary perspective, we are wired to be a part of a group (if we weren't wired we would have been left wandering around being vulnerable and alone, and then promptly eaten by a wild animal).

Our mates help us feel safer, comforted, valued and needed.

Happiness Increases

Friends can help you celebrate the good times and provide support during the bad times. Research has even shown that often we are happier around our friends than our family. Some of you would beg to differ, but I bet many of you won't.

Your self-worth increases

Good friends make us feel good about ourselves (if they don't, you need newies). We are born with a strong natural sense of self-worth, we know what we want and believe we should have it (hence toddler tantrums). However, over time life wears our natural sense of self-worth down. By having friends who care about us, we are given positive reinforcement for just being, you know, us.

Friends help you cope with traumas

Separations, illness, job loss, death and other reality slaps happen to all of us at some point. Social support enhances resilience and protects against mental health disorders that can often develop through ongoing stressful times. I think we can all think of a time when we have debriefed over a cup of tea (or wine), and the weight of our problems has been gently lifted.

They help you stop your naughty habits

Yeah, one could argue this one a bit (sometimes we like to be a bit naughty). But in terms of some other unhealthy habits, there is nothing like an accountability partner to help you get on with changing your lifestyle. Thinking of doing more exercise? Then grab a mate to go with you. Starting a new healthy eating plan? Then buddy up with someone to compare notes with. You are more likely to stick to it if your friend does it with you.

Never underestimate the power of having a catch-up with friends.

Not prioritising your friendships at the moment? Feeling the effects of it? Chances are your friends you haven't seen for a while are feeling the same way. Start thinking of how you can reconnect with friends you haven't seen for a while.

Don't have many friends? Then create opportunities to establish new positive relationships — try and get into regular contact with groups of people.

What do you love doing? It is much easier to interact with people when involved in a new activity as you already have something in common. There are plenty of people that like to a) volunteer b) knit c) run d) dress up in Star Wars costumes and play games — you will meet someone like you, regardless of what you like to do in your spare time.

Never underestimate the power of having a catch-up, laugh, cry, whine (or a wine) with a mate.

Even when you don't feel like you have anything to offer them, perhaps someone needs you right now.

1 According to Dr Lishman, social support is one of the most important ingredients in the recipe of what?

A psychologically and physically healthy life. In other words, social support is important to both physical and mental wellbeing.

2 The article describes seven benefits of social support. Complete the table below by summarising the information on these benefits from the article.

Benefit	Description
1 Stress is lowered	Releases oxytocin, which counteracts the fight/flight response and calms the nervous system Distracts us from the trigger that sets us off in the first place.
2 Good for your body	Protective factor against health conditions from the common cold through to cardiovascular conditions Can help in recovering from cancer and chronic pain as well as preventing conditions such as dementia
3 Sense of belonging and purpose increases	Friends help us feel safer, comforted, valued and needed.

Benefit	Description
4 Happiness increases	Friends can celebrate the good times and provide support during the bad times. We are happier around our friends than our family.
5 Your self-worth increases	Good friends make us feel good about ourselves. They provide care and positive reinforcement for just being ourselves.
6 Friends help you cope with traumas	Social support enhances resilience and protects against mental health disorders that can often develop through ongoing stressful times.

Benefit	Description
7 They help you stop your naughty habits	Can help us stay on track when changing our lifestyle to include more positive habits (e.g. exercising more, eating more healthily, etc) We are more likely to stick to it if our friend does it with us.

3 What **form** of social support(s) is being described in this article? Are there other forms that can be provided by friends? If so, outline what they are.

A lot of the benefits being described in the article appear to have been provided via 'emotional support' – support that allows individuals to feel valued, accepted and understood, through listening, empathising, showing care and compassion, etc.

In order to support a friend to 'stop a naughty habit', this might be more effectively achieved via another form of social support: 'practical help' (e.g. offering information and advice about the benefits of exercise, the harms of smoking, etc).

The other form of social support is 'tangible support', which involves giving money or other direct material assistance such as making meals, walking your friend's dog, providing transport, etc.

4 What does the article suggest people should do if they are lacking social support?

- Start thinking of how you can reconnect with friends you haven't seen for a while.
- Create opportunities to establish new positive relationships — try and get into regular contact with groups of people.
- Think about what you love doing. It is much easier to meet and interact with people when involved in a new activity because you already have something in common.

5 This article has focused on the role of friends in providing social support. Can social support be provided by anyone other than friends? If so, outline who.

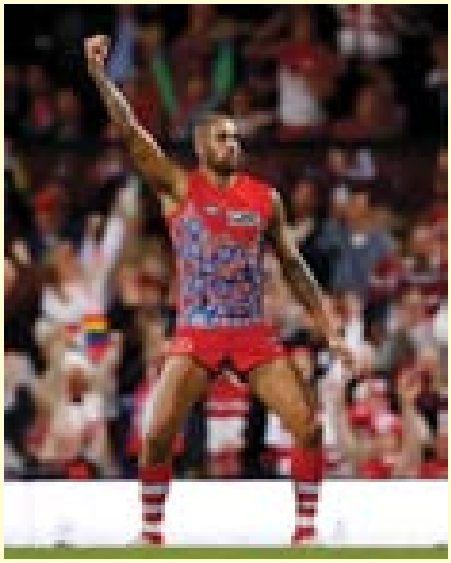
Yes, social support can also be provided by:

- Family members
- People in the local and wider community such as:
  - peers at school
  - neighbours
  - teachers we trust
  - work colleagues
  - members of a church or self-help group to which we belong
  - professionals (e.g. family doctor, psychologist)
  - people in the virtual community (online/chat rooms).

ACTIVITY 10.6

Maintenance of mental wellbeing in Aboriginal and Torres Strait Islander young people

Deadly Vibe was a 32-page monthly magazine for Aboriginal and Torres Strait Islander young people aged 6–18 years. The magazine featured high-profile Aboriginal and Torres Strait Islander people from music, the arts, sports, education and entertainment, and promoted Aboriginal culture, positive self-images and healthy lifestyle messages. Articles covered a range of issues including health and nutrition, education and career opportunities, legal aid, Aboriginal culture and sport. Magazines were distributed through schools, community radio stations, health and community centres, government offices, hostels and selected news agencies.



'Healthy Vibe'

Every issue contained a specific health section called 'Healthy Vibe', which ranged for three to four pages under the heading 'Wise advice on how to live a healthy life, plus information on who to call when you need help'. Over the years, this section featured some of the following themes: mental health (e.g. depression, anxiety disorders, stress); social health (e.g. getting along with family, tracing family); an 'Ask the Doctor' section; healthy recipes; and health promotion information such as healthy teeth, sleep, etc.

Indigenous culture/pride

Deadly Vibe was considered a powerful tool to promote and strengthen both traditional and modern Indigenous culture. Over the years, it included articles about the 'Aboriginal languages' program and how students at Melbourne's Thornbury Primary School had been learning Woiwurrung, the language of the Wurundjeri People; a piece about Australian Indigenous Fashion Week; and an upcoming cultural exhibition called 'From the Land'. Research conducted by the Australian Council for Educational Research (ACER) with *Deadly Vibe* readers indicated that after reading the magazine, 87 per cent said they learned more about their culture and 92 per cent felt 'proud' to be Indigenous.

Using appropriate psychological terminology, describe the ways in which the existence of the *Deadly Vibe* magazine contributed to the maintenance of mental wellbeing in Aboriginal and Torres Strait Islander young people.

Deadly Vibe magazine had a specific section on health and nutrition, called 'Healthy Vibe', which included healthy recipes. This would have educated Aboriginal and Torres Strait young people on the positive impact **adequate nutritional intake** (a 'balanced diet') and **adequate hydration** (drinking enough water) has on our physical and mental wellbeing.

This could potentially have encouraged them to consider changing their day-to-day nutritional habits in a positive way.

Adequate nutritional intake and hydration are *biological protective factors* in maintaining mental wellbeing.

The 'Healthy Vibe' section also included information on sleep. **Adequate sleep** is another *biological protective factor* in maintaining mental wellbeing. 'Adequate sleep' means getting enough sleep so that you wake up feeling rested, refreshed and positive. The amount of sleep time people need to achieve this varies in relation to several factors, including age. Receiving education via the magazine about how adequate sleep can help us think, feel and do better, as well as enhance our enjoyment of life in general, could have led Aboriginal and Torres Strait Islander young people to think more about the importance of their sleep and make some beneficial changes to their sleep patterns if needed. This in turn would have had positive impacts on their mental wellbeing.

Lastly, one of the purposes of *Deadly Vibe* was the promotion of Aboriginal and Torres Strait Islander culture. Culture generally refers to the way of life of a particular group, society or community. For Aboriginal and Torres Strait Islander peoples, 'cultural continuity' is a *protective factor integral to maintaining mental wellbeing*. **Cultural continuity** involves the preservation of all things to do with Aboriginal and Torres Strait Islander peoples' culture over time and the sense of history, identity and belonging this provides. It essentially means the continual passing on of cultural knowledge to future generations and keeping traditions 'alive'. Cultural continuity was able to be achieved through the various articles in the magazine and this would have enhanced the mental wellbeing of the readers. For example:

- young readers were informed about (and presumably encouraged to attend) cultural events occurring, such as exhibitions and Australian Indigenous Fashion Week. Attending and participating in cultural activities and events promotes a sense of community, connection, belonging and identity, which in turn enhances mental wellbeing.
- reading articles with information about Aboriginal and Torres Strait Islander cultures increases knowledge of culture, languages and traditional practices. This would have contributed to better mental wellbeing by increasing identity, their place in history, and social connectedness to a wider 'mob'.
- young readers were also exposed to a multitude of positive role models. This would have given them a further sense of cultural connection and kinship, and a sense that they 'belong' to a wider positive community and culture that they can be proud of.

ACTIVITY 10.7

Matching exercise on maintenance of mental wellbeing

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 only be used once.

(f)	**1** Eating a good amount of a variety of different foods that maintain good health	**(a)** cultural continuity
(d)	**2** The assistance, care or empathy provided by people to each other	**(b)** cognitive restructuring
(b)	**3** A cognitive behavioural strategy used to improve mental wellbeing	**(c)** risk factors
(k)	**4** The right amount and quality of sleep needed each night for optimal functioning	**(d)** social support
(l)	**5** A practice that involves a person focusing their attention on their breathing while thoughts, feelings and sensations are experienced freely as they arise	**(e)** cognitive behavioural strategies
(m)	**6** The right of Aboriginal and Torres Strait Islander people to freely control their political status and pursue their cultural, social and economic development	**(f)** adequate nutritional intake
(j)	**7** Characteristics or conditions that help protect mental wellbeing and reduce the likelihood that mental ill-health will occur	**(g)** activity scheduling
(e)	**8** Techniques used to improve mental wellbeing drawn from CBT	**(h)** authentic
(h)	**9** Social support is most effective and helpful when it is provided in this way.	**(i)** adequate hydration
(a)	**10** The preservation of Aboriginal and Torres Strait Islander peoples' cultures over time, and the sense of history, identity and belonging this provides	**(j)** protective factors
(i)	**11** The process of providing the right amount of liquid to bodily tissues to optimise physical and mental wellbeing.	**(k)** adequate sleep
(g)	**12** The process of identifying and scheduling activities that promote pleasure and enjoyment	**(l)** mindfulness meditation
(c)	**13** Characteristics or conditions that increase the likelihood of experiencing mental ill-health or can make existing mental health difficulties worse	**(m)** self-determination

Crossword on concepts and terms in maintenance of mental health

Across

4 CBT technique based on the premise that regularly engaging in pleasant activities may help elevate mood

8 Support from friends, family and others

10 Term used to describe the preservation of Aboriginal and Torres Strait Islander peoples' traditions and carrying them forward into the future

11 This factor increases the likelihood of experiencing mental ill-health or can make existing mental health difficulties more severe or long-lasting.

13 Term used to describe the right of Aboriginal and Torres Strait Islander peoples to make choices and manage their own lives

15 This factor helps enhance mental wellbeing and reduces the likelihood that mental ill-health will occur.

16 This protective psychological strategy aims to replace unhelpful thoughts with more helpful ones.

17 A practice used to help people calm both their mind and body

Down

1 Another term for 'cognitive restructuring'

2 Another term for 'behaviour activation'

3 Term used to describe a particular group's way of life, including their beliefs, values, language, customs and social behaviour

5 If a person is providing social support and they are being true to their own personality and values and being genuine, they are displaying this characteristic.

6 Another word to describe adequate nutritional intake

7 Protective factors that help maintain strong connections to culture, strengthen cultural identity and contribute to the maintenance of mental wellbeing

9 These habitual ways of thinking can adversely impact on mental wellbeing.

12 Adequate hydration is this type of protective factor.

14 A protective factor for mental wellbeing that is usually achievable without support from a professional

1 COGNITIVE DEFICIENCY
2 ACTIVE INTYSCHEDULING
3 CULTURE
4 BEHAVIOUR
5 AUTHENTICITY
6 BALANCED
7 CULTURALLY DETERMINED
8 SOCIALISATION
9 COGNITIVE DISSONANCE
10 CULTURALITY
11 RISK
12 BIOLOGICAL
13 SELF DETECTION
14 ADEQUATE SLEEP
15 PROTECTIVE FACTORS
16 COGNITIVE
17 MINDFULNESS

ACTIVITY 10.9

True/False quiz on maintenance of mental wellbeing

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

Statement	T/F
1 You can't protect yourself against developing a mental disorder.	F
2 Support from family and friends is considered important for maintaining mental wellbeing.	T
3 Adequate nutritional intake and hydration can help you 'snap out of' most mental health problems and disorders.	F
4 Aboriginal and Torres Strait Islander people believe that the preservation of their cultural traditions, and carrying them forward into the future, is important in maintaining their mental wellbeing.	T
5 What we eat may affect not just our physical health, but also our mental health and wellbeing.	T
6 Using cognitive behavioural strategies involves identifying and correcting unhelpful thinking patterns that may be affecting our mental health and wellbeing.	T
7 Self-determination is about creating a separate Indigenous 'state' away from the wider Australian community.	F
8 Mindfulness meditation involves stopping any intrusive thoughts from entering your mind.	F
9 An individual may use cognitive behavioural strategies to maintain their mental wellbeing without the need for specialist intervention.	T
10 There is a relationship between poor quality sleep and/or insufficient sleep with a variety of mental health problems and disorders.	T
11 The support provided by friends, family and the community can take different forms.	T
12 Mindfulness meditation can maintain mental wellbeing by providing relief from stress and anxiety.	T
13 Cognitive behavioural strategies are a social factor that can 'protect' against the development of a mental disorder.	F
14 Social support is more likely to be beneficial and contribute to mental wellbeing if you feel energised by the interaction.	T
15 When making decisions about Aboriginal and Torres Strait Islander people's mental health and wellbeing, it is not important to consider values and traditions, as defined by them, in a particular location or geographic area.	F
16 There are no good foods or bad foods, only good and bad diets.	F
17 Self-determination is a psychological risk factor for the mental wellbeing of Aboriginal and Torres Strait Islander people.	F
18 Having trouble with your sleep means that you have a mental health problem.	F
19 I can't help a person with a mental health problem or disorder.	F
20 Protective factors adversely impact a person's mental wellbeing while risk factors strengthen a person's mental wellbeing.	F
21 In exercising their right to self-determination, Aboriginal and Torres Strait Islander peoples have the right to autonomy or 'self-government' in matters relating to their mental wellbeing.	T

Statement	T/F
22 Meditation is a way of practising mindfulness.	T
23 The amount of sleep required for optimal mental wellbeing is the same for everyone.	F
24 The presence of protective factors always guarantees the prevention of the experience of a mental health problem or illness.	F
25 It is only possible for a person to use cognitive behavioural strategies under the supervision of a trained mental health professional.	F