Neap:

Trial Examination 2014

VCE Biology Unit 3

Written Examination

Question and Answer Booklet

Reading time: 15 minutes
Writing: 1 hour 30 minutes

Student's Name: _____

Teacher's Name: _____

Structure of Booklet

Section	Number of questions	Number of questions to be answered	Marks	Suggested time (minutes)
A Multiple-choice	25	25	25	30
B Short-answer	7	7	50	60
			Total 75	Total 90

Students are permitted to bring into the examination room: pens, pencils, highlighters, erasers, sharpeners and rulers.

Students are NOT permitted to bring into the examination room: blank sheets of paper and/or white out liquid/tape.

No calculator is allowed in this examination.

Materials supplied

Question and answer booklet of 19 pages.

Answer sheet for multiple-choice questions.

Instructions

Please ensure that you write your name and your teacher's name in the space provided on this booklet and in the space provided on the answer sheet for multiple-choice questions.

All written responses must be in English.

At the end of the examination

Place the answer sheet for multiple-choice questions inside the front cover of this booklet and hand them in.

Students are NOT permitted to bring mobile phones and/or any other electronic communication devices into the examination room.

Students are advised that this is a trial examination only and cannot in any way guarantee the content or the format of the 2014 VCE Biology Units 3 & 4 Written Examination.

SECTION A: MULTIPLE-CHOICE QUESTIONS

Instructions for Section A

Answer **all** questions in pencil on the answer sheet provided for multiple-choice questions.
Choose the response that is **correct** for the question.
A correct answer scores 1, an incorrect answer scores 0.
Marks will **not** be deducted for incorrect answers.
No marks will be given if more than one answer is completed for any question.

Question 1

Water is an important biomolecule that makes up the majority of a cell's volume because

A. it always needs to be hypotonic to the external environment.

B. water's polarity enables it to bind to the cell membrane and hold the cell together.

C. water's low viscosity allows efficient movement of molecules throughout the cell.

D. water allows hydrophobic molecules to dissolve in it.

Question 2

The main components of a nucleotide are

A. phosphorous, carbon, hydrogen, oxygen and nitrogen.

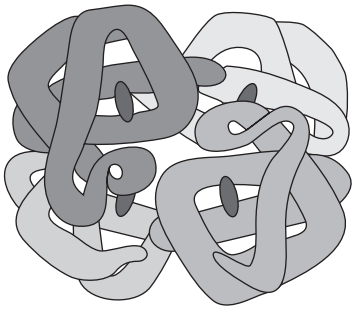
B. phosphate, 5-carbon sugar and fatty acid.

C. amino acid, R group and fatty acid.

D. phosphate, 5-carbon sugar and nitrogenous base.

Question 3

The highest level of protein structure illustrated in the diagram below is



A. primary.

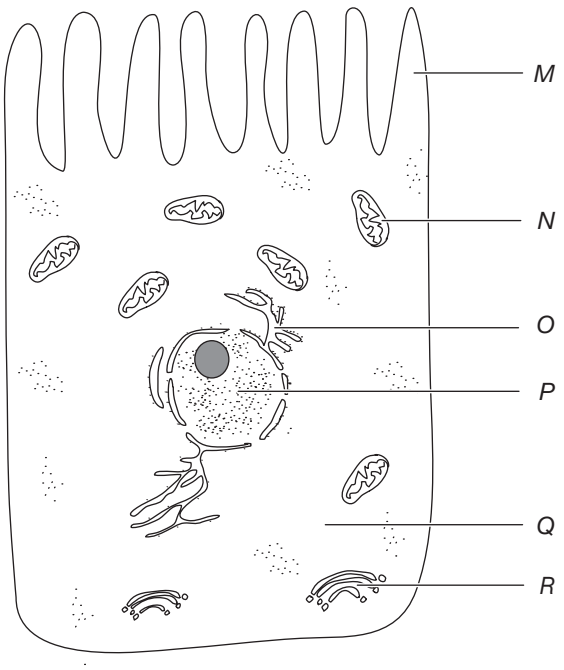
B. secondary.

C. tertiary.

D. quaternary.

Use the following information to answer Questions 4 and 5.

The following diagram is of a proximal tubule cell (absorptive cell from the kidney) viewed with an electron microscope at 10 000 times the normal size.



Question 4

There are many structure *N* organelles within the cell.

The best reason for this is that

A. energy is required for endocytosis from structure *R*.

B. ATP is required for protein pumps to actively transport material into the cell.

C. energy is required for protein synthesis and eventual secretion from the cell.

D. structure *M* does not provide a large enough surface area for diffusion.

Question 5

The most accurate statement relating to the structure and function of the various components would be

A. structure *O* is involved in the transport of polypeptides.

B. structure *N* carries out transcription.

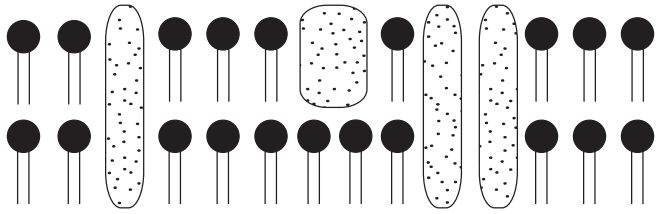
C. structure *P* is involved with the translation of DNA.

D. structure *Q* is the site of the light-independent reaction.

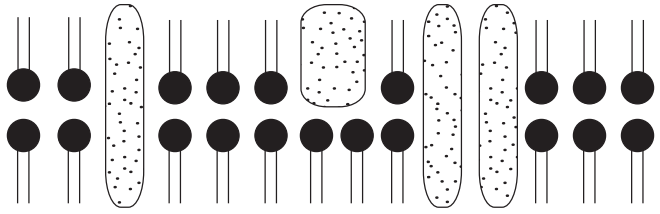
Question 6

The structural arrangement that best represents membrane structure is

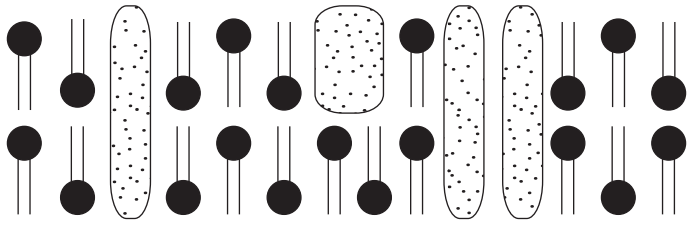
A.



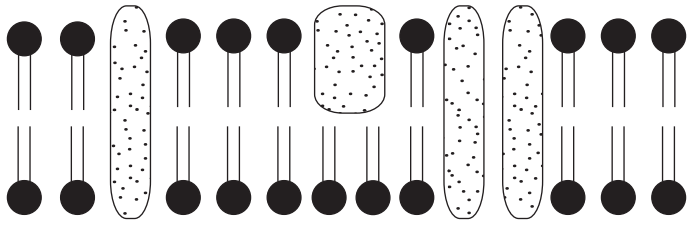
B.



C.



D.



Question 7

A DNA template strand has the following sequence

5′ GATACAGG 3′

The best interpretation of this information is

A. The complementary strand would have the sequence of 5′ CTATGTCC 3′.

B. The 3′ represents the joining point of the nitrogen base on the deoxyribose sugar.

C. That reverse transcription would produce the sequence 3′ CTATGTCC 5′.

D. The complementary mRNA strand would have the sequence of 3′ CUAUGUCC 5′.

Question 8

Glycogen is broken down within muscle cells when glycogen phosphorylase is activated by the hormone glucagon.

The action of glycogen breakdown is

A. a hydrolysis reaction that is catabolic.

B. anabolic and exergonic.

C. a condensation reaction that is anabolic.

D. catabolic and endergonic.

Use the following information to answer Questions 9 and 10.

Catalase converts the toxic hydrogen peroxide into harmless water and oxygen gas. This is a biologically important enzyme in many cells.

An experiment was carried out that investigated the effect of substrate concentration on the action of this enzyme. The results are illustrated below.

Hydrogen peroxide (%)	Rate of oxygen gas produced (g/min)
1	0.01
2	0.05
5	0.15
10	0.21
20	0.22

Question 9

The dependent variable in the experiment is the

A. percentage of hydrogen peroxide.

B. rate of production of oxygen gas in g/min.

C. concentration of catalase used.

D. temperature of the solutions used in the experiment.

Question 10

A valid conclusion for this experiment is that

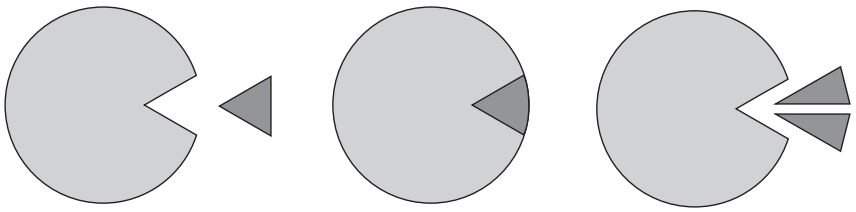
A. 20% hydrogen peroxide is the optimum amount of substrate.

B. when the hydrogen peroxide percentage is high, the amount of catalase is limiting the rate of its breakdown.

C. the amount of hydrogen peroxide is limiting the action of the enzyme.

D. if the hydrogen peroxide percentage was further increased, a greater rate of oxygen gas would be observed.

Question 11



The diagram above best depicts the

A. interaction between an enzyme and a substrate.

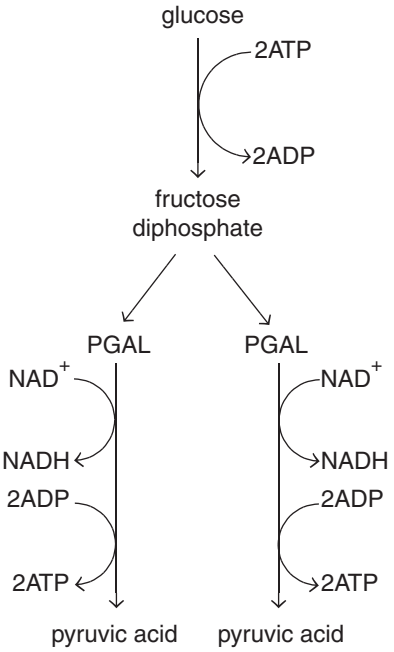
B. interaction between an antigen and an antibody.

C. interaction between a receptor and a signalling molecule.

D. action on a non-competitive drug to slow down metabolism.

Use the following information to answer Questions 11 and 12.

The following chemical pathway proceeds in virtually all cells.



Question 12

The name of the above chemical pathway is

A. the Kreb's cycle.

B. the electron transport chain.

C. the link reaction.

D. glycolysis.

Question 13

The products and by-products of this reaction are

A. pyruvic acid, ATP, ADP and NADH.

B. 2 pyruvic acid, 2ATP and 2NADH.

C. 2 pyruvic acid.

D. 2ATP and 2NADH.

Question 14

The process of programmed cell death is known as

A. necrosis.

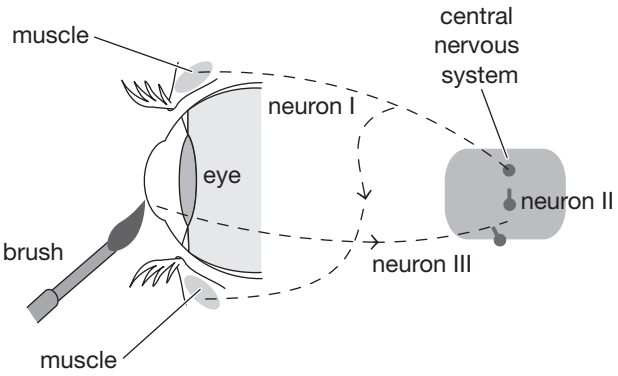
B. osmosis.

C. apoptosis.

D. lysis.

Use the following information to answer Questions 15 and 16.

The diagram below illustrates the blinking reflex when the eye is touched with a fine-tipped brush.



Question 15

The effector in this situation is the

A. surface of the eye.

B. central nervous system.

C. muscles controlling the eyelids.

D. peripheral nervous system.

Question 16

Neurons I, II and III are respectively

A. motor, sensory and interneuron.

B. sensory, interneuron and motor.

C. motor, interneuron and sensory.

D. interneuron, motor and sensory.

Question 17

Neurotransmitters are a type of

A. signalling molecule.

B. hormone.

C. pheromone.

D. plant growth regulator.

Question 18

Water regulation in the kidneys is controlled by a hormone called ADH. ADH stimulates the kidney to reabsorb water from the urine moving out so that water balance can be maintained. The diagrams below illustrate how this process occurs.

diagram 1

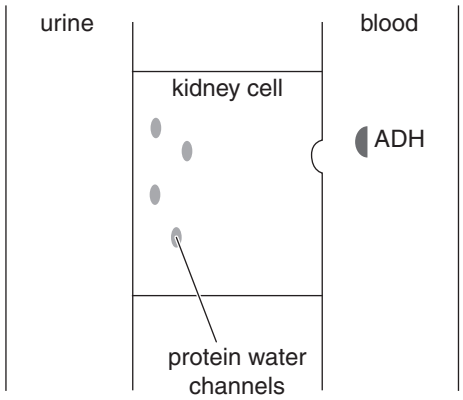
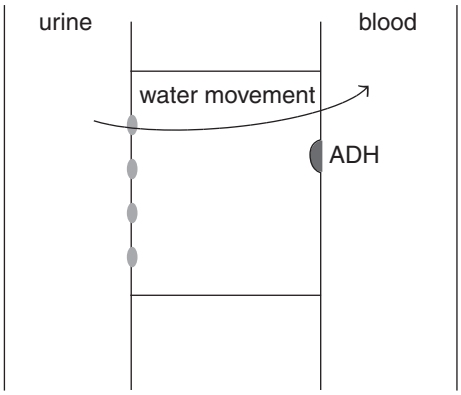


diagram 2



The final outcome of water movement across the cell in diagram 2 is brought about by

A. signal transduction.

B. rational drug design.

C. pheromones.

D. homeostasis.

Question 19

Bird flu is caused by the virus H5N1, which is transferred from bird to bird generally through contact within intensive farming environments. There have been some cases of farmers contracting H5N1 from the birds they are farming and the mortality within that group was over 50%.

It is reasonable to conclude from this information that

A. there is a vector that transfers the virus from bird to human.

B. the virus is a pathogen.

C. all of the birds that come in contact with H5N1 would die.

D. all of the humans that come in contact with H5N1 would die.

Question 20

Some of the vast array of chemical and physical barriers that prevent infection in plants and animals are listed in the table below.

Organism	Barrier	Prevents
human	stomach acidity	bacterial infection
eucalyptus tree	waxy cuticle on leaf surfaces	fungal growth
chimpanzee	ciliated lung bronchi	viral disease
tobacco leaf	nicotine within leaves	insect attack

Physical barriers would include

A. acidity and nicotine.

B. cuticle and acidity.

C. cilia and nicotine.

D. cilia and cuticle.

Question 21

The lymphatic system

A. allows for two-way movement of bacteria through the lymphatic ducts.

B. provides a greater chance of contact between immune cells and pathogens.

C. only provides a path for a virus to move through.

D. has many lymph nodes that contain immune cells which never leave that node.

Question 22

The cells directly involved in the humoral immune response include

A. B-cells.

B. cytotoxic T-cells.

C. macrophages.

D. T-helper cells.

Question 23

The transfer of antibodies through breast milk in mammals is an example of

A. active artificial immunity.

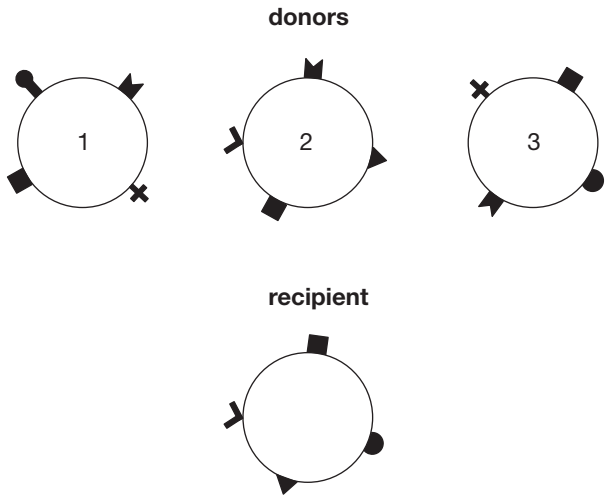
B. passive artificial immunity.

C. passive natural immunity.

D. active natural immunity.

Use the following information to answer Questions 24 and 25.

All humans have markers on the surface of their body cells that signal to the immune system that they belong, and so they are called self-markers. Sometimes humans need various cells transplanted into their body to extend their life expectancy. Potential donors need to have as many self-markers in common with the recipient as possible to maximise the success of the transplant. The diagrams below show the self-markers present within three potential donors and the self-markers present in the recipient.



Question 24

The donor with the most compatible cells for the recipient is

A. donor 1.

B. donor 2.

C. donor 3.

D. donor 2 or 3.

Question 25

The type of medication that would be required once the transplant is completed using the most appropriate donor is

A. antihistamines.

B. none, because it would be too expensive and unnecessary.

C. immunosuppressants.

D. antibiotics.

SECTION B: SHORT-ANSWER QUESTIONS

Instructions for Section B

Answer **all** questions in the spaces provided. Write using black or blue pen.

Question 1 (7 marks)

An emerging branch of biology is called proteomics, which revolves around the structure and function of proteins. This involves a thorough study of the proteome and is very closely related to the study of the genome.

a. Discuss the difference between the proteome and the genome of a single cell. 2 marks

b. There are many different types of proteins that function in a variety of ways to drive a cell's metabolism.

Describe how the structure of the following proteins relates to their function:

i. enzymes 1 mark

ii. channel proteins 1 mark

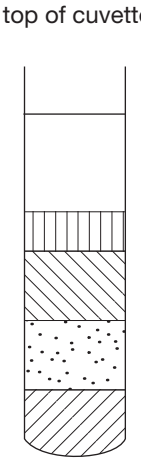
iii. receptors 1 mark

c. Discuss the link between the proteome and the genome within a particular cell. 2 marks

Question 2 (9 marks)

Photosynthetic cells from a leaf were isolated and then homogenised and centrifuged to separate out the different organelles according to size. Clear layers can be observed and this enables particular organelles (and other cellular materials) to be separated from the other cellular components according to size.

a. **i.** On the centrifuge cuvette in the diagram below, show where cytosol, ribosomes, the nucleus, mitochondria and chloroplasts would be positioned. 2 marks



ii. How does the cytosol assist in the function of photosynthesis? 1 mark

_____

_____

The chloroplasts can then be extracted as a purified sample and investigations can be conducted on them.

b. State two different groups of biomolecules that would be part of the chloroplast and give a specific example of their importance to the functioning of this organelle. 2 marks

_____

_____

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Several purified samples of chloroplasts were exposed to varying colours of light. The time taken for a specific amount of carbon dioxide to be removed from the solution was measured. The results of these tests are shown in the table below.

Type of light exposure	Time taken for a specific amount of CO_2 to be removed (seconds)
dark	no result
white	160
red	380
blue	450
green	no result

c. **i.** State two factors that would need to be controlled when conducting this experiment. 1 mark

_____

ii. Explain why there was 'no result' when the chloroplasts were exposed to green light. 1 mark

_____

iii. Discuss why carbon dioxide levels drop when chloroplasts are exposed to light other than green light. 2 marks

_____

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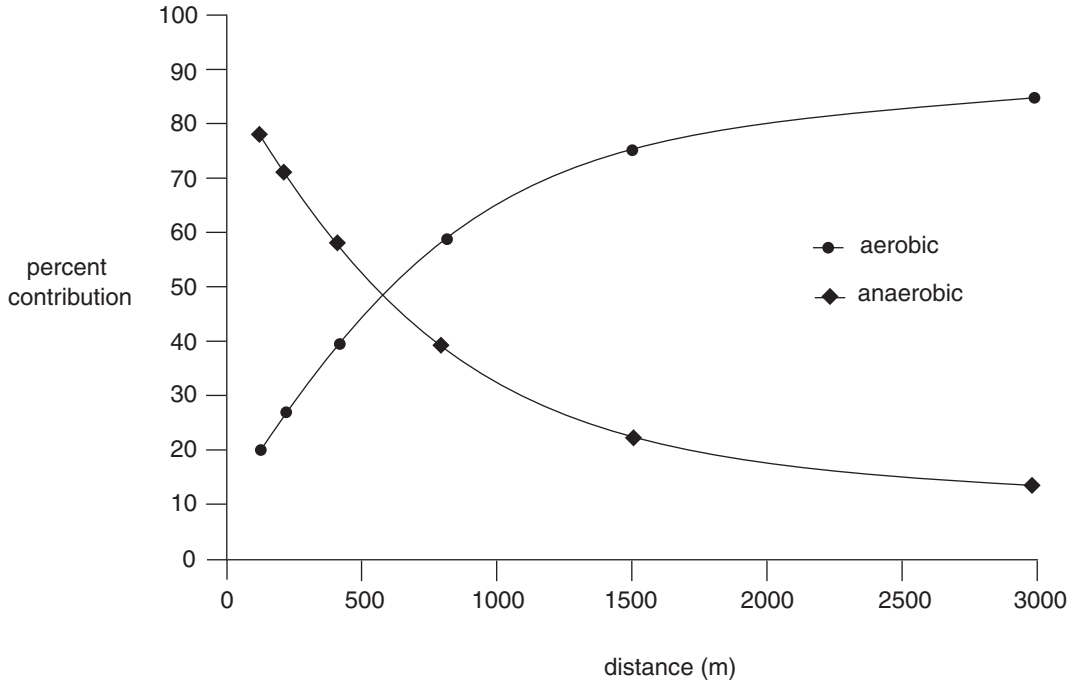
Question 3 (8 marks)

Elite runners use both anaerobic and aerobic systems to complete their running events. A series of measurements of the anaerobic and aerobic contributions over distances ranging from 100 m to 3000 m of elite male runners were made. The runners exercised as intensely as possible and the data gained is illustrated in the graph below.



a. **i.** What is the balanced chemical equation for aerobic respiration? Include any energy conversions that are part of the reaction. 2 marks

_____

_____

ii. Describe one difference between anaerobic and aerobic respiration. 1 mark

_____

_____

_____

iii. How far would an athlete need to run if he was depending equally on the contribution of aerobic and anaerobic respiration? 1 mark

_____

b. Explain which system elite athletes rely on when completing a 3000 m race. 2 marks

_____

_____

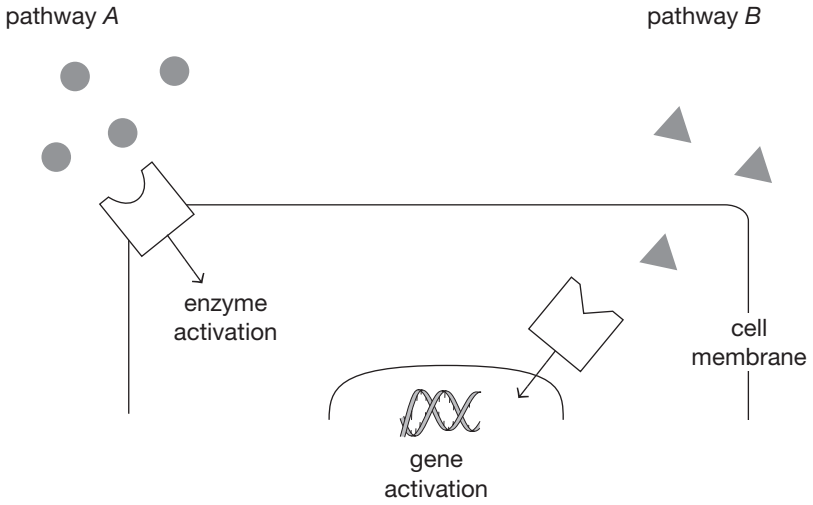
_____

Elite runners are always looking for new training strategies to improve their performance in particular running events. Coaches help to develop training schedules that provide an opportunity for better results.

c. Describe a training schedule that could be offered to an elite 100 m athlete to improve their performance. Use the data gained from the graph to support your answer. 2 marks

Question 4 (7 marks)

Hormones such as oestrogen and insulin are signalling molecules that are released in one part of the body and act in another part of the body. The diagram of the cell below illustrates the action of both these hormones on the same ovarian cell (shown by pathway *A* and *B*). Oestrogen stimulates cellular changes such as an increase in metabolism, and insulin stimulates cellular changes such as glucose uptake.



a. **i.** What can be concluded about the type of hormone involved in both pathways *A* and *B*? Explain your reasoning. 2 marks

ii. Discuss why pathway *B* would be longer lasting than pathway *A*. 2 marks

The table below illustrates the action of one molecule of the hormone involved in pathway *A*.

Part of signalling pathway	Number of molecules involved
receptor	1
activated G proteins	100
activated protein kinase	10000
activated glycogen phosphorylase	1000000

b. **i.** What type of signalling pathway is this an example of? 1 mark

_____

ii. What is the survival advantage to the organism of having a signalling pathway of this type? 2 marks

_____

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_____

Question 5 (6 marks)

Plant defence mechanisms reduce the impact of insect attack. One particular plant studied was a radish plant (*Raphanus sativus*) that is regularly eaten by the cabbage looper caterpillar (*Trichoplusia ni*). It was hypothesised that each time a radish leaf is damaged by the caterpillar, a chemical (glucosinolates) toxic to the caterpillar accumulated in the radish leaves.

a. Design an experiment to test this hypothesis. State which are the independent and dependent variables within your experimental design. 3 marks

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_____

Occasionally an understanding of chemicals such as glucosinolates can lead to commercially available products. The table below illustrates some of the chemicals that have been very profitable and the plant they were extracted from.

Plant	Drug	Use of the drug
Guggle tree	guggulsterone	fights heart disease
Feverfew	parthenolide	reduces inflammation
Cinchona tree	quinine	fights malaria
Pacific yew	taxol	anti-cancer treatment

Before these drugs can be used for treatment in the general population, intensive trialling must be undertaken. This ranges from exposure of the drugs to specific cell lines through to human trials.

b. What is the difference between these types of drugs and those introduced because of molecular drug design? 1 mark

_____

_____

c. State two factors that would need to be taken into account prior to the release of a drug into the market place. 2 marks

_____

_____

_____

Question 6 (9 marks)

AIDS was first recognised in 1981 and its cause – HIV (human immunodeficiency virus) infection – was identified soon after.

a. Describe the general method of viral reproduction. 2 marks

_____

_____

_____

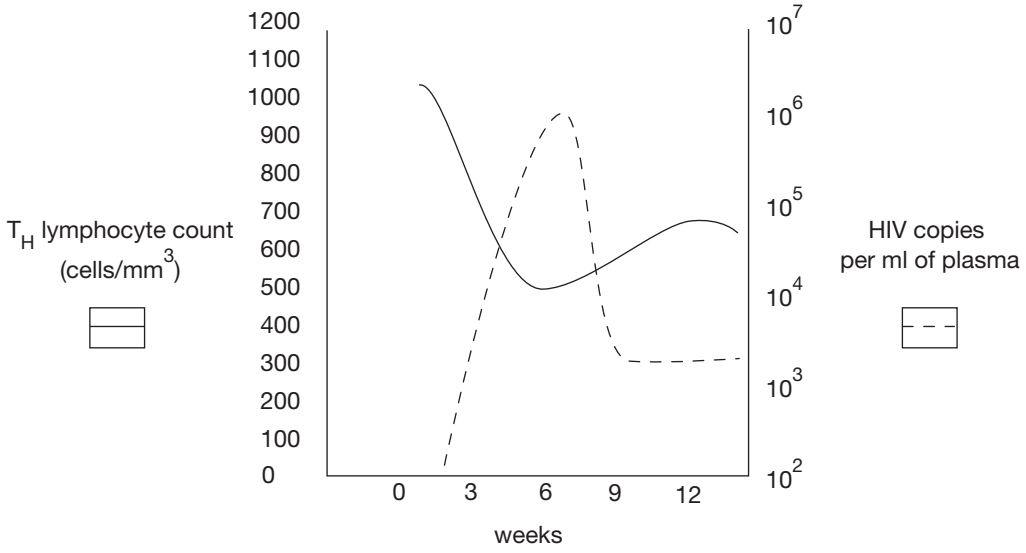
Since its discovery, AIDS has caused an estimated 36 million deaths and approximately the same number are living with HIV globally. HIV/AIDS is considered a pandemic.

b. Define a pandemic. 1 mark

_____

_____

The graph below illustrates the response of the body after initial infection with HIV.



c. **i.** Describe the body's response to HIV infection within the first six weeks of contracting the virus. 2 marks

_____

_____

ii. What impact would this response have on the body's immune system? 1 mark

_____

_____

A vaccine to protect individuals from contracting HIV has been in the research phase for many years. The virus has some antigens on its surface that are variable and some antigens on its surface that are less variable.

d. Why would a vaccine targeting the less variable antigens be potentially more successful than the more variable antigens? 2 marks

_____

_____

_____

Initially an attenuated form of the virus was used to develop a vaccine but, more recently, individual HIV peptides are being used.

e. Describe the difference between an attenuated form of the virus and individual peptides. 1 mark

_____

_____

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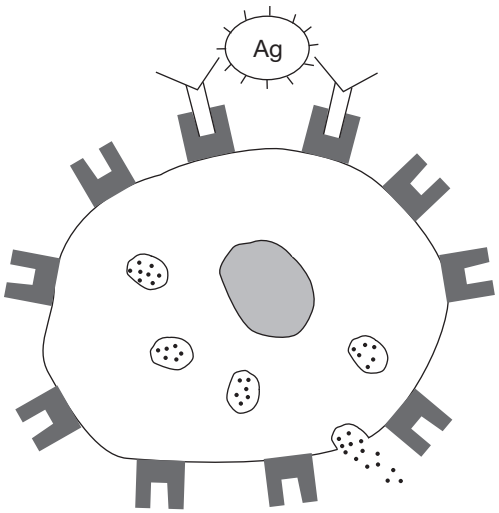
Question 7 (4 marks)

The occurrence of allergic reactions is increasing and some estimates are that one in five people (particularly from Western society) suffer an allergy of some type. The diagram below is of a mast cell which is central to an allergic reaction.



Ag: allergen

a. Label three key features on the mast cell above and describe their specific role in an allergic reaction. 3 marks

_____

_____

_____

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_____

There is a line of thought, which is reasonably substantiated with data, called the 'hygiene' hypothesis. It states that excessive cleanliness interrupts the normal development of the immune system, and this change leads to an increase in allergies.

b. Give a biological reason why cleanliness may lead to an increase in allergies. 1 mark

_____

_____

END OF QUESTION AND ANSWER BOOKLET