VICTORIAN CURRICULUM AND ASSESSMENT AUTHORITY

Victorian Certificate of Education 2009

SUPERVISOR TO ATTACH PROCESSING LABEL HERE

STUDENT NUMBER

									Letter
Figures									
Words									

BIOLOGY

Written examination 1

Tuesday 9 June 2009

Reading time: 9.00 am to 9.15 am (15 minutes)
Writing time: 9.15 am to 10.45 am (1 hour 30 minutes)

QUESTION AND ANSWER BOOK

Structure of book

Section	*Number of questions*	*Number of questions to be answered*	*Number of marks*
A	25	25	25
B	8	8	50
			Total 75

- 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 book of 25 pages.
- Answer sheet for multiple-choice questions.

Instructions
- Write your **student number** in the space provided above on this page.
- Check that your **name** and **student number** as printed on your answer sheet for multiple-choice questions are correct, **and** sign your name in the space provided to verify this.
- 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 book.

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

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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

Prions are composed of

A. carbohydrates.

B. nucleic acids.

C. proteins.

D. lipids.

Question 2

mRNA is

A. a double-stranded molecule.

B. found only in eukaryotic cells.

C. found exclusively in the nucleus.

D. formed during transcription of DNA.

Question 3

An important structural carbohydrate in plants is

A. chitin.

B. glucose.

C. cellulose.

D. glycogen.

Question 4

Eukaryotic cells have membrane-bound organelles that result in the formation of compartment-like structures.

This is useful for a cell because it

A. enables particular molecules to selectively enter and exit the cell.

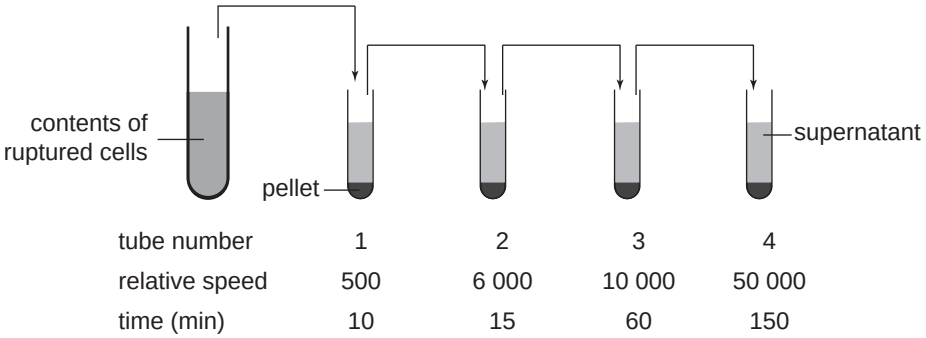
B. maintains the total isolation of the nucleus from the cytosol.

C. provides a structural network that acts to support the cell.

D. creates a variety of intracellular environments.

Question 5

Cells can be ruptured and their contents collected after a series of centrifugation at different speeds. The largest components sediment and form a pellet at a relatively slow speed. The supernatant is then centrifuged at a greater speed than previously and more sedimentation into pellets occurs. The process is repeated as outlined in the following diagram.



tube number	1	2	3	4
relative speed	500	6 000	10 000	50 000
time (min)	10	15	60	150

The sequence of pellets obtained in tubes 1, 2, 3 and 4 would be

A. ribosomes, endoplasmic reticulum, mitochondria, nuclei.

B. ribosomes, mitochondria, nuclei, endoplasmic reticulum.

C. nuclei, mitochondria, endoplasmic reticulum, ribosomes.

D. nuclei, endoplasmic reticulum, ribosomes, mitochondria.

Question 6

Lipids are

A. used as an energy source.

B. involved in active transport.

C. part of glycoprotein molecules.

D. transported by rough endoplasmic reticulum.

The following information is required for Questions 7 and 8.

The enzyme lactase digests lactose.

Two test tubes where set up using 5 mL of lactose syrup and 0.5 mL of lactase. Test tube **one** was incubated at 37°C, while test test tube **two** was incubated at 15°C. Both tubes were incubated for 10 minutes.

Question 7

At the end of 10 minutes, the amount of glucose produced in test tube **two** when compared to test tube **one** would be

A. lower as the enzyme's active site would have denatured at this temperature.

B. equal as lowering the temperature does not affect digestion of lactose.

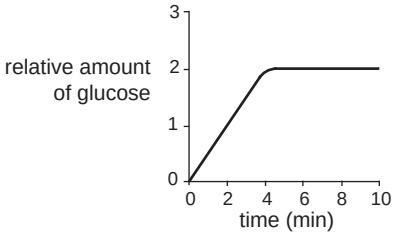
C. lower as there would be fewer collisions between the substrate and the enzyme.

D. equal as the two test tubes contained the same amount of lactose and lactase enzyme.

Question 8

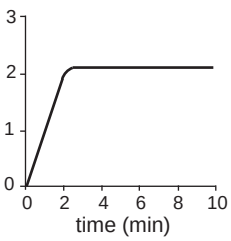
In another experiment, test tube **three** was compared with test tube **four**. Each tube contained 5 mL of lactose syrup. Tube **three** contained 0.5 mL of lactase and tube **four** contained 0.25 mL of lactase. The two tubes were incubated at 15°C and monitored for 10 minutes.

The result for test tube **three** is shown below.

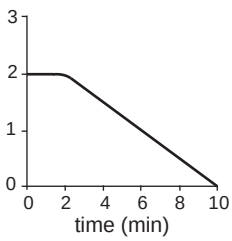


The graph of results for tube **four** would resemble

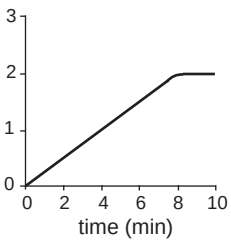
A.



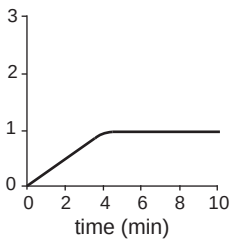
B.



C.



D.



Question 9

Examples of an exergonic (catabolic) reaction include the formation of

A. maltose from glucose.
B. fatty acids and glycerol from lipids.
C. ATP and water from ADP and inorganic phosphate.
D. glucose and oxygen from carbon dioxide and water.

Question 10

Fermentation in yeast

A. produces ethanol.
B. requires lactic acid.
C. involves the Kreb's cycle.
D. requires the presence of oxygen.

Question 11

Human and plant hormones are similar in that all are

A. composed of glycoproteins.
B. active on a single target tissue.
C. signalling molecules that act on receptor molecules.
D. transported around the organism by a circulating fluid.

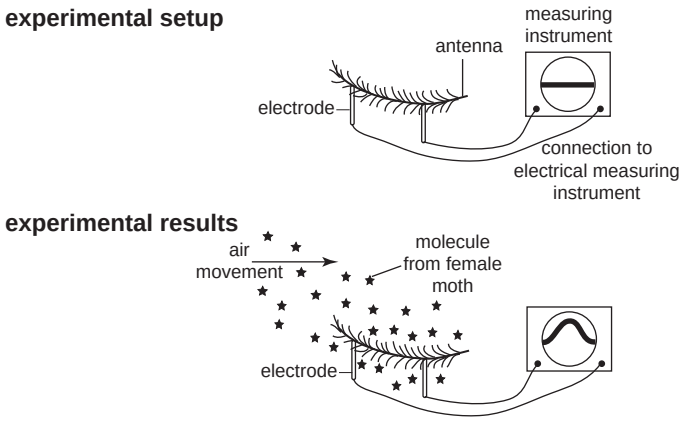
Question 12

In aerobic respiration the final product of the electron transport chain combines with

A. oxygen.
B. glucose.
C. pyruvate.
D. carbon dioxide.

Question 13

A scientist investigated the nature of the sexual attraction between male and female moths. He placed an antenna from a male silk moth between two electrodes. The electrodes were attached to a recording instrument. Air which contained molecules extracted from female silk moth reproductive organs was blown over the antenna. The experiment and results are summarised below.



The hypothesis being tested was most likely

A. the large surface area of a furry antenna from a male moth catches more molecules in the air than one which is not furry.

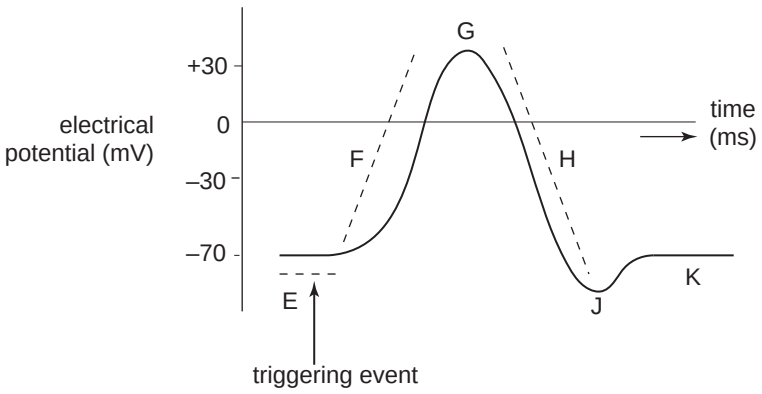
B. the female of the moth species produces a chemical that causes an electrical response in the male.

C. male moth antennae respond to electricity when female moth chemicals are present in the air.

D. electricity is required for the detection of female moth sex attractants.

Question 14

The graph below shows the pattern traced by placing electrodes at a point on the axon of a nerve cell as it is stimulated.



It is reasonable to claim that

A. the lowest potential, J, represents the resting potential of the nerve.

B. during phase F, fewer sodium ions are leaving the cell than entering it.

C. during phase K, the membrane will fail to respond to further stimulation.

D. the stimulus applied only has an effect when the membrane potential is positive.

Question 15

Mitochondria

A. contain circular DNA.

B. are the site of glycolysis.

C. prepare proteins for the Golgi complex.

D. produce 2 ATP molecules per molecule of glucose.

Question 16

The lyrics of the popular song 'One Bad Apple' performed by the Jackson 5 include the line:

'One bad (over-ripe) apple don't spoil the whole bunch . . .'.

In fact, this statement is questionable because an over-ripe apple

A. secretes giberillin that diffuses into neighbouring cells causing them to shrivel and die.

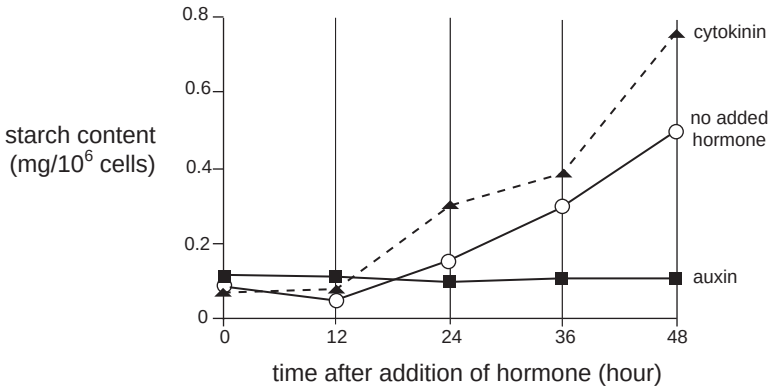
B. produces abscisic acid that penetrates the skin of neighbouring apples causing rapid decay.

C. produces ethylene gas that diffuses into neighbouring apples causing them to ripen more quickly.

D. produces indoleacetic acid that passes into neighbouring apples and stops cells from reproducing.

Question 17

An experiment was carried out to investigate the separate effects of two plant hormones on tobacco plant cells. The graphs below show results of the treatments in the 48 hours following addition of the hormones.



Analysis of these results reveals that

A. a lack of auxin results in no starch being accumulated over the 48 hours.

B. over 48 hours, cytokinin stimulates the accumulation of starch in tobacco cells.

C. the addition of each of the hormones resulted in an immediate effect on starch accumulation by tobacco cells.

D. the increase in starch during the second 12-hour period is greater than the increase in any other 12-hour period.

Question 18

Scientists have developed a technique of inserting a drug into red blood cells taken from a patient. These cells are then returned to the patient's bloodstream.

This technique results in the drug being enclosed in

A. phospholipids.

B. carbohydrates.

C. phosphates.

D. proteins.

Question 19

First-line defence mechanisms in humans include

A. development of fever.

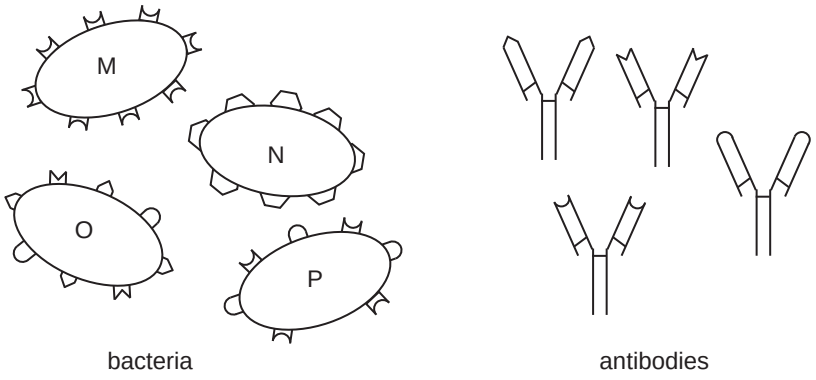
B. action of phagocytes.

C. use of antibiotics.

D. presence of cilia.

Question 20

A young woman stood on a dirty, rusty nail. The following diagrams show bacteria isolated from the wound and a range of antibodies that were already present in her body.



The microorganism most likely to cause a severe infection is

A. M.

B. N.

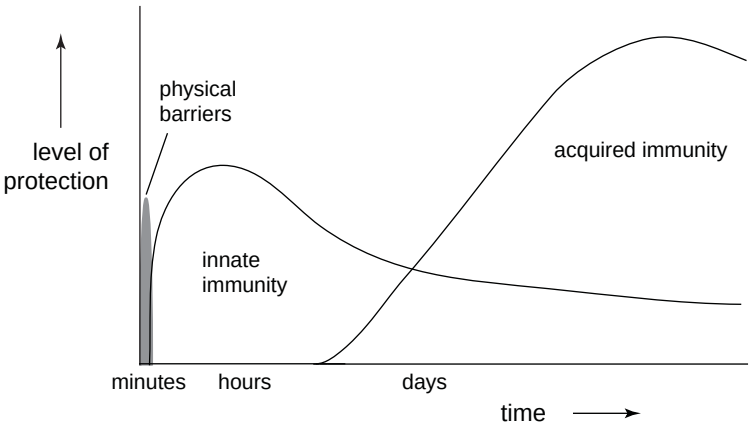
C. O.

D. P.

Question 21

After an individual is exposed to a microbial infection, the immune system increases its activities.

The following graph summarises the timeline of the level of those activities.



It is reasonable to conclude that

A. physical barriers involve macrophages.

B. innate immunity lacks involvement of living cells.

C. lymph nodes are involved in the acquired immunity phase.

D. the protection developed against the disease ceases at the end of the infection.

Question 22

HLA antigens trigger reactions against organ transplants. These antigens must be matched as closely as possible if a transplant is to succeed.

A young man required a kidney transplant. There were four people prepared to act as a donor. The HLA antigens of the young man and potential donors are given below.

young man requiring transplant

A1 B7 C3 DP11
A4 B6 C7 DP22

potential donor	mother	father	older brother	next-door neighbour
HLA antigens	A4 B6 C7 DP22 A3 B23 C6 DP12	A1 B7 C3 DP11 A7 B19 C12 DP20	A7 B19 C12 DP20 A3 B23 C6 DP12	A1 B7 C3 DP11 A4 B6 C1 DP22

The individual most likely to be used as a donor is the young man's

A. father.

B. mother.

C. older brother.

D. next-door neighbour.

Question 23

During antibody-mediated hypersensitivity

A. blood vessels constrict.

B. B cells release histamine.

C. macrophages destroy T cells.

D. IgE antibodies attach to mast cells.

Question 24

If the red blood cells of a blood donor clot when they enter a recipient patient, the patient will die. The blood of both recipient and donor has to be tested and typed. Humans are divided into four different groups with regard to the ABO blood-grouping system. The characteristics of these groups are summarised in the following table.

	group A	group B	group AB	group O
protein on red blood cells	A	B	A and B	neither A nor B
antibodies in plasma	antibodies to B protein	antibodies to A protein	no antibodies to either A or B protein	antibodies to both A and B proteins

A transfusion would be safe if a

A. group A person received blood from a group B person.

B. group B person received blood from a group O person.

C. group O person received blood from a group A person.

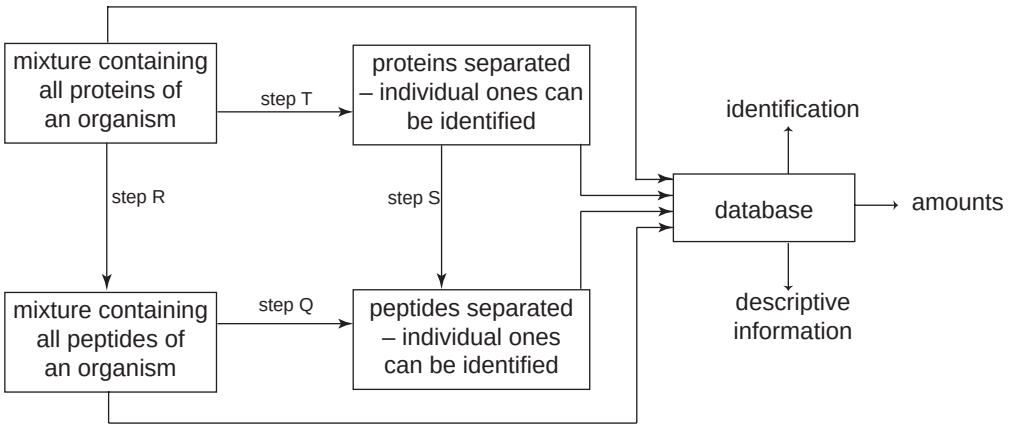
D. group A person received blood from a group AB person.

Question 25

The proteome is the complete collection of proteins in any given cell or organism.

The study of proteomics is concerned with the systematic, large-scale analysis of a proteome. A range of techniques are used to identify all proteins and their components, and the amount of each present. The information is stored in a database.

The following diagram outlines one approach to a study of the proteins in a cell. Steps T and R are alternative steps that can be taken.



From this information it is reasonable to conclude that

A. step Q involves the use of peptidases.

B. step R involves the joining of proteins to form polypeptides.

C. children with the same parents would have identical proteins.

D. the number of amino acids in the mixture containing all proteins is the same as the amino acids in the separated peptides.

END OF SECTION A

SECTION B – Extended response questions

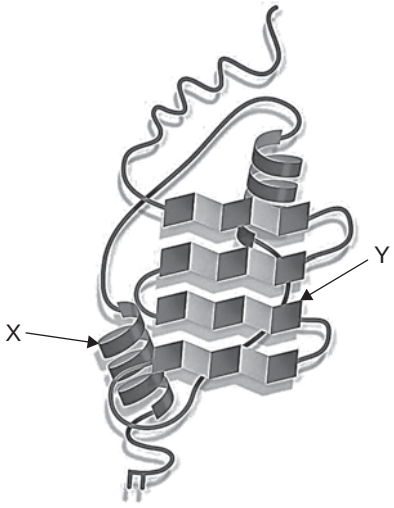
Instructions for Section B

Answer this section in **pen**.

Answer **all** questions in the spaces provided.

Question 1

The diagram below shows the structure of a particular protein molecule.



a. The protein contains two distinctive types of polypeptide chains labelled X and Y. What are the names of these two types?

Chain X _____

Chain Y _____

2 marks

b. Name a polysaccharide found in animals and describe its function.

Name _____

Function _____

2 marks

c. What is the function of cholesterol in cell membranes?

_____

_____

_____

_____

1 mark

Total 5 marks

Question 2

a. A section of one of the strands of a DNA molecule has the sequence of bases shown.

DNA: C T T A C A T T A C T C

In the spaces below, enter the sequence of bases in the corresponding mRNA which is complementary to this DNA.

mRNA												

1 mark

b. The percentage of base T in a molecule of DNA is 30%. What is the percentage of G bases in the same DNA molecule?

1 mark

Another type of nucleic acid is tRNA.

c. **i.** Where is tRNA found in a cell?

ii. Describe the role of tRNA.

1 + 1 = 2 marks

d. The table shows the names of six amino acids together with some of their DNA codes.

Amino acids	**DNA triplet(s)**
cysteine	ACA, ACG
glutamic acid	CTT, CTC
aspartic acid	CTA, CTG
asparagine	TTA, TTG
leucine	GAA, GAG, GAT, GAC
methionine	TAC

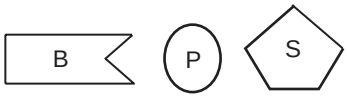
Use the information in the table and write the order of amino acids coded for by the DNA sequence given in part **a**.

1 mark

Nucleic acids are made up of nucleotides. Each nucleotide consists of three components, sugar (S), phosphate (P) and nitrogen base (B), linked together in a particular way.

e. In the empty box, draw a diagram to show the way the three components are joined to make a nucleotide.

Use the following symbols in your diagram.



1 mark

Total 6 marks

Question 3

As a result of the light-dependent stage of photosynthesis, charged (energy) carriers are produced.

a. Name one of these charged carriers.

1 mark

Availability of light is a limiting factor in photosynthesis.

b. Name one other limiting factor.

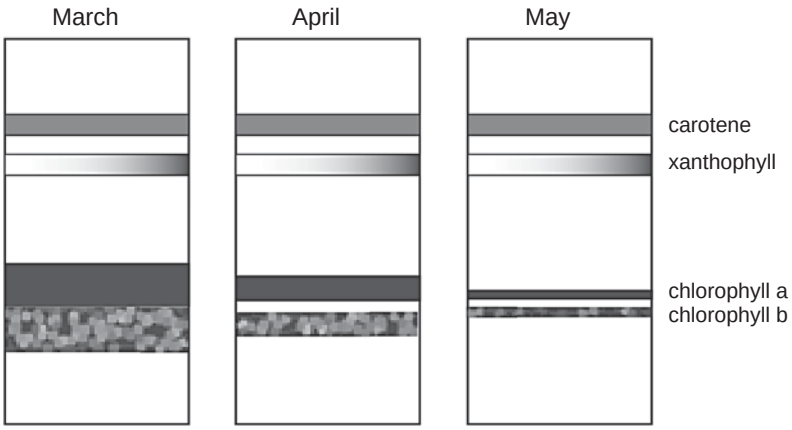
1 mark

All algae, cyanobacteria and plants that photosynthesise contain the pigment chlorophyll a. Some also contain additional pigments such as carotene and chlorophyll b.

c. What is the purpose of such additional photosynthetic pigments?

1 mark

The leaves of a particular species, species X, of a tree in Victoria were investigated at monthly intervals and the following pigments were observed to be present in the months shown. The size of each band is proportional to the amount of pigment present.

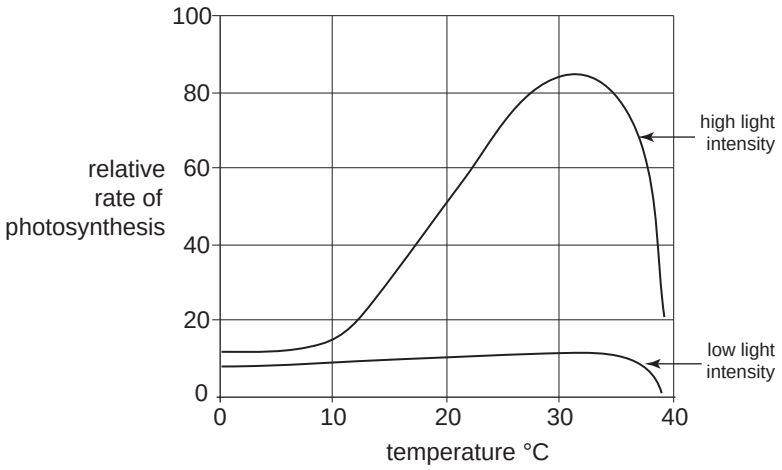


Some trees have leaves throughout winter while others shed their leaves.

d. Explain to which of these two groups species X belongs.

2 marks

Scientists exposed two groups of identical plants to a range of temperatures. One group was kept in a low light intensity and the other in a high light intensity environment. The following graph summarises the results obtained by the scientists.



e. Account for the difference in the rate of photosynthesis for the two groups of plants over the range of temperatures shown.

2 marks

Total 7 marks

Question 4

The beet caterpillar is an insect pest of the tomato plant. When a beet caterpillar starts to eat a tomato plant, the plant responds by producing a chemical known as jasmonic acid. Jasmonic acid and its derivatives have a variety of odours.

Some scientists have suggested that these odours attract wasps to the caterpillar-affected plants.

a. **i.** Outline an experiment you would carry out to test this hypothesis.

ii. Describe the results that would support the hypothesis.

3 + 1 = 4 marks

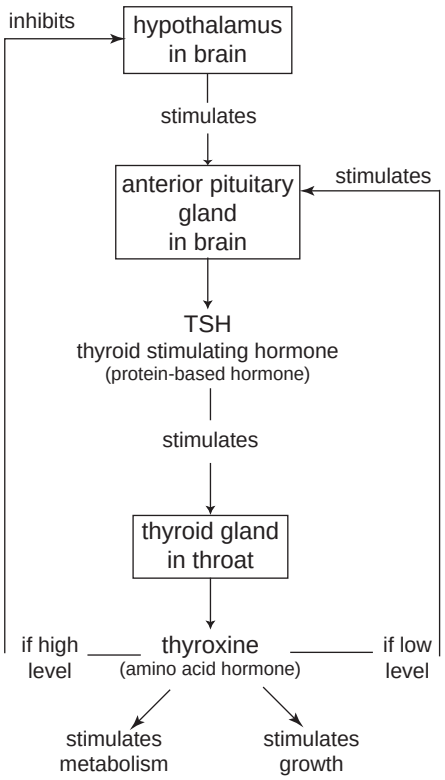
b. Explain why it could be an advantage to the plant to produce jasmonic acid when its leaves are being eaten by caterpillars.

1 mark

Total 5 marks

Question 5

Thyroid hormone, thyroxine, is produced by the thyroid gland, a gland in the throat region. The following diagram summarises the production and action of thyroxine in the body.



a. How does TSH travel to the thyroid gland?

_____

1 mark

The system shown in the diagram above is called a negative feedback system.

b. Write a general statement that outlines the principle of a negative feedback system.

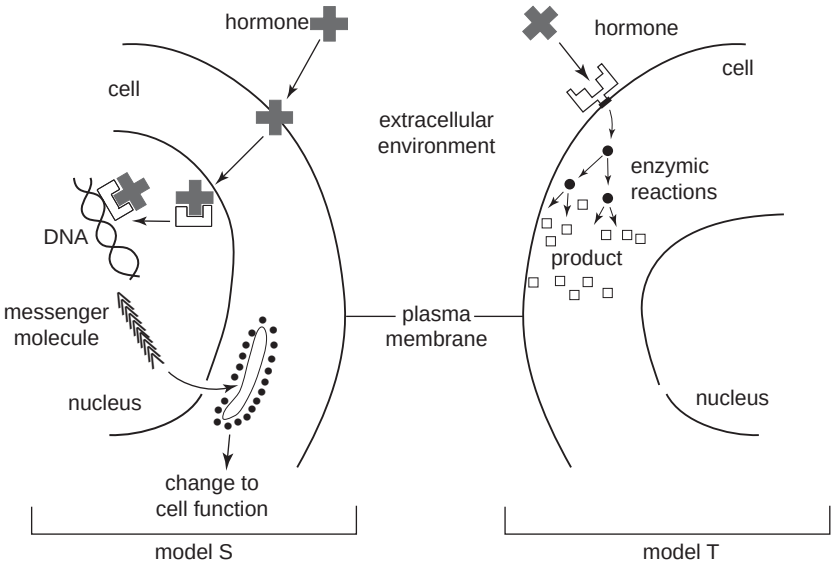
_____

_____

_____

1 mark

The two diagrams shown below are general models for signal reception and transduction.



c. **i.** Which model, model S or model T, best corresponds to the mechanism of TSH?

ii. Explain your choice.

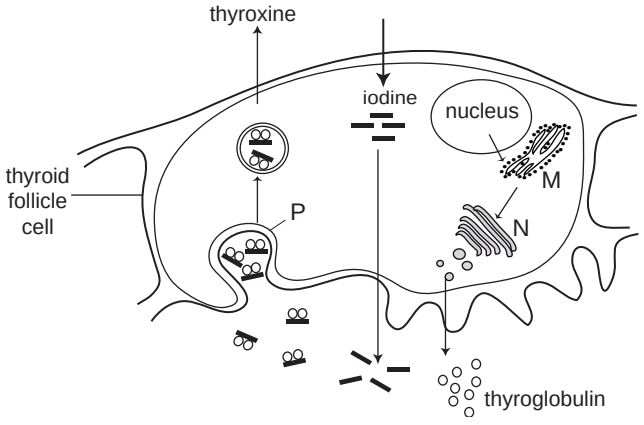
1 + 1 = 2 marks

Testes and brain tissue do not respond to thyroxine.

d. What is the most likely explanation for this condition?

1 mark

The following diagram shows some detail of a cell from a thyroid gland.



e. Name structure M.

_____

1 mark

f. Name structure N.

_____

1 mark

g. Name the process occurring at site P.

_____

1 mark

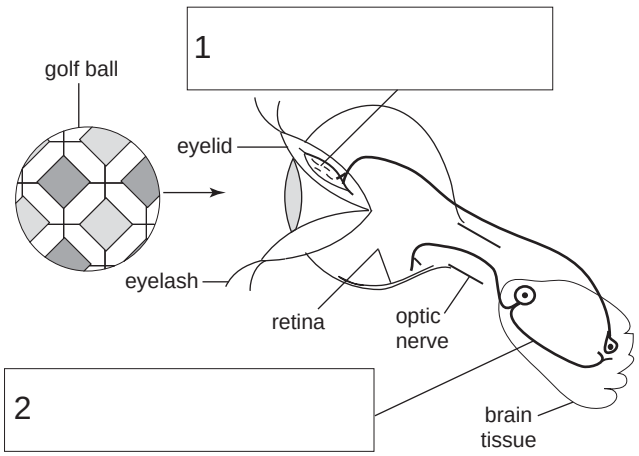
Total 8 marks

Question 6

The diagram below has two parts.

Part X – shows a high-speed golf ball approaching an eye and part of the pathway of an automatic blinking response.

Part Y – comprises six boxes, each containing the name of a general component of an automatic regulatory system that operates in the human body.



part X

connecting neurone

receptor

efferent (motor) neurone

effector

afferent (sensory) neurone

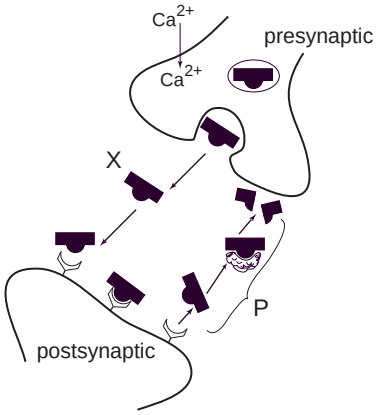
integration centre

part Y

a. Select the two most appropriate words from the list given in part Y and complete the labels 1 and 2 in the spaces provided on the diagram.

2 marks

The following diagram shows a synapse between the end of one neurone and the dendrite of another.



b. What is the general name for molecule X?

_____

1 mark

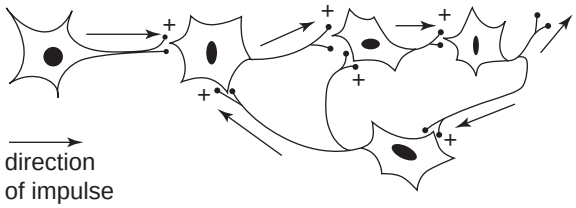
c. Describe what occurs at stage P.

_____

_____

1 mark

The following diagram shows the arrangement of a network of five neurones that form part of a pathway. The + signs indicate that these are excitatory synapses.



Circuits such as this are part of the system for the nervous control of rhythmic breathing.

d. **i.** Explain how the circuit works.

_____

_____

ii. Why are such networks important to rhythmic breathing?

_____

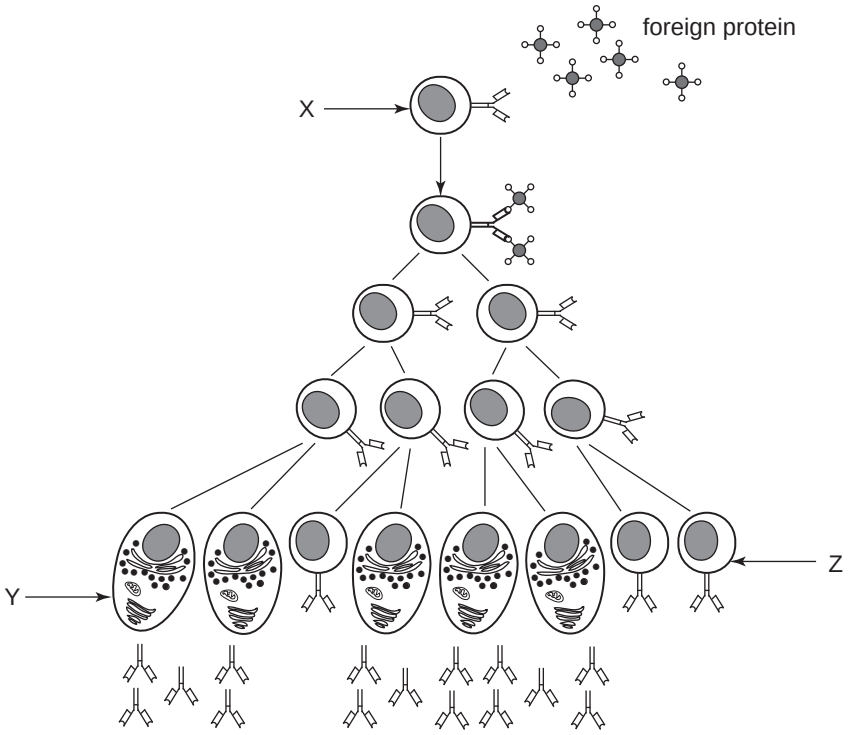
_____

1 + 1 = 2 marks

Total 6 marks

Question 7

In 1960, Australian Sir Frank Macfarlane Burnet was awarded the Nobel Prize for Medicine for correctly predicting how the body's immune system responds to infection. A diagrammatic summary of Burnet's [Clonal Selection] theory is shown below.



a. Name cell X.

_____

1 mark

b. **i.** Name cell Y.

_____

ii. What is the function of this type of cell?

_____

1 + 1 = 2 marks

c. **i.** Name cell Z.

_____

ii. What is the function of this type of cell?

_____

_____

1 + 1 = 2 marks

d. Name an autoimmune disease.

_____

1 mark

e. Outline the events that lead to the development of an autoimmune disease.

2 marks

Total 8 marks

Question 8

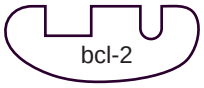
Cancer is a disease characterised by the rapid multiplication of cells. It is often treated with the use of chemicals, however damage may occur to non-cancer cells.

a. Explain how damaging bone marrow cells could be life threatening.

2 marks

Normally, a protein called BH3 combines with bcl-2 protein to prevent uncontrolled cell production. Cancer patients have very low levels of BH3 protein in their cells.

Scientists established the structure of the bcl-2 protein, represented below.



They developed three chemicals that had the potential to have the same action as BH3. The structure of these is shown below.

Each chemical was investigated to test its effectiveness to combine with bcl-2.

b. **i.** Suggest which chemical is likely to be the most successful in combining with bcl-2.

ii. Give a reason for your choice.

1 + 1 = 2 marks

A fourth form of BH3 was developed and found to be more successful than the best of chemicals 1, 2 and 3. Chemical 4 is shown below.

chemical 4

c. Outline a possible reason why chemical 4 could be more successful in treatment of the patients than the previously tested chemicals.

_____

_____

1 mark

Total 5 marks

END OF QUESTION AND ANSWER BOOK