VICTORIAN CURRICULUM AND ASSESSMENT AUTHORITY

Victorian Certificate of Education 2008

SUPERVISOR TO ATTACH PROCESSING LABEL HERE

STUDENT NUMBER

									Letter
Figures									
Words									

BIOLOGY

Written examination 1

Wednesday 11 June 2008

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 22 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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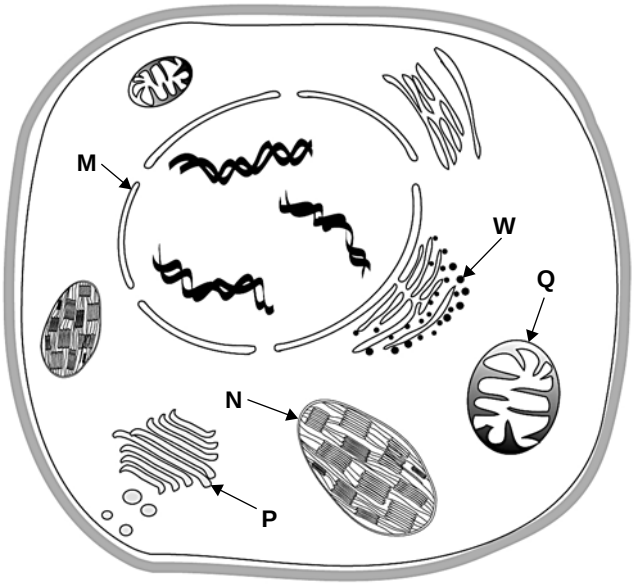
SECTION A – Multiple-choice questions

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.

The following information is relevant for Questions 1 and 2.

Consider the following plant cell.



Question 1

A process occurring at structure **W** in this plant cell would be

A. packaging of molecules.
B. aerobic respiration.
C. protein synthesis.
D. DNA replication.

Question 2

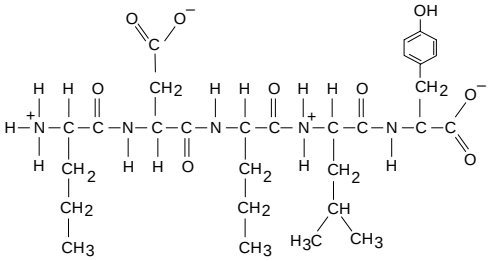
In this plant cell, the light-dependent reactions of photosynthesis occur in structure

A. N.
B. M.
C. Q.
D. P.

Question 3

The secondary structure of a protein is represented by

A.



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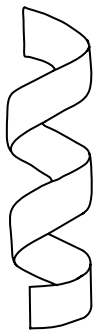

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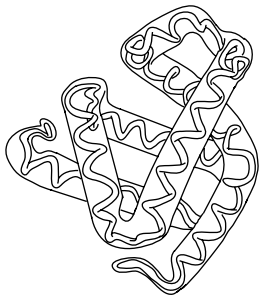

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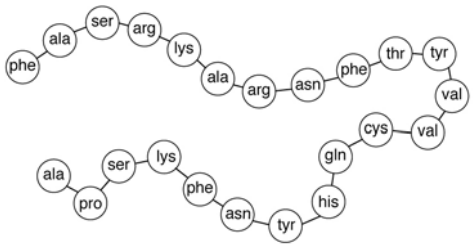


Question 4

The four main types of biomacromolecules in a cell are

A. monomers, polymers, DNA and RNA.

B. proteins, carbohydrates, DNA and RNA.

C. nucleic acids, proteins, carbohydrates and lipids.

D. monosaccharides, disaccharides, polysaccharides and proteins.

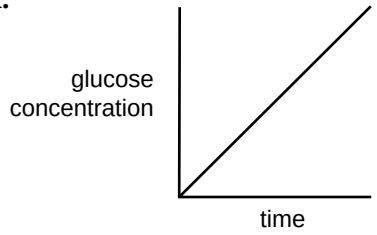
Question 5

The enzyme maltase catalyses the breakdown of maltose into glucose.

Maltase was added to a tube containing a solution of maltose in water and incubated at 37°C. The amount of glucose produced was monitored over a period of time. No maltose remained at the end.

The graph showing the change in glucose concentration in the tube is

A.



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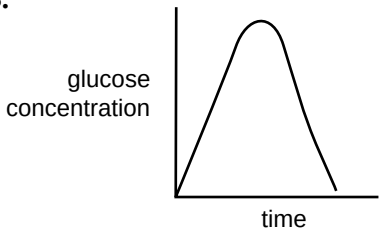
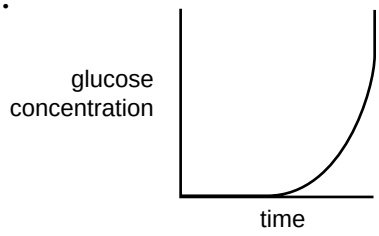


C.



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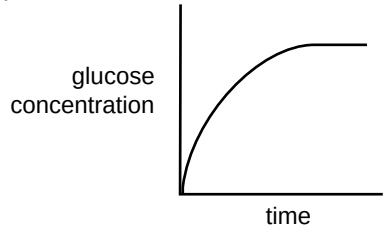
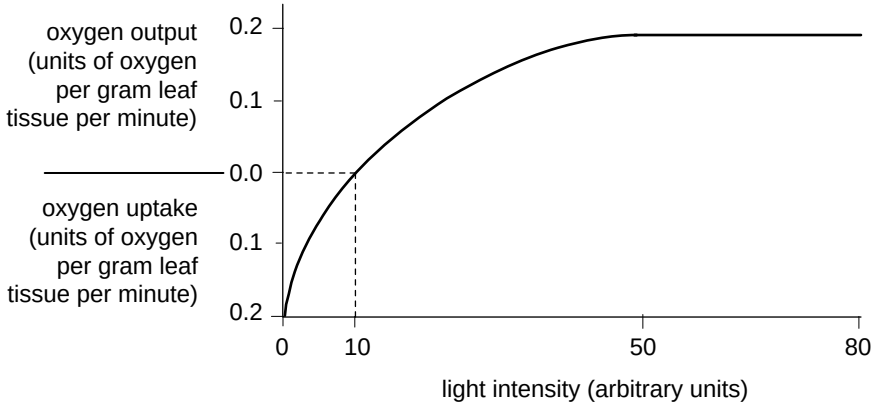


Question 6

The following graph shows the relationship between light intensity and net oxygen uptake or output by a particular green plant.



At a light intensity of 10 units

A. the rate of photosynthesis is zero.

B. the rate of aerobic respiration is zero.

C. oxygen produced by photosynthesis is equal to the oxygen used by aerobic respiration.

D. oxygen produced by photosynthesis is equal to twice the oxygen used by aerobic respiration.

Question 7

Glycogen is

A. a polysaccharide found in animal cells.

B. an energy-storing lipid molecule.

C. a molecule in which plants store sugars.

D. a polysaccharide found in plant cell walls.

Question 8

Lipids characteristically

A. are hydrophobic.

B. catalyse reactions.

C. have a low energy content.

D. are information-storage molecules.

Question 9

The lymphatic system

A. controls blood clotting.

B. contains red blood cells.

C. has vessels with thick muscular walls.

D. contains phagocytic cells.

Question 10

In a multicellular organism, the term ‘internal environment’ refers to the

A. cytoplasm.

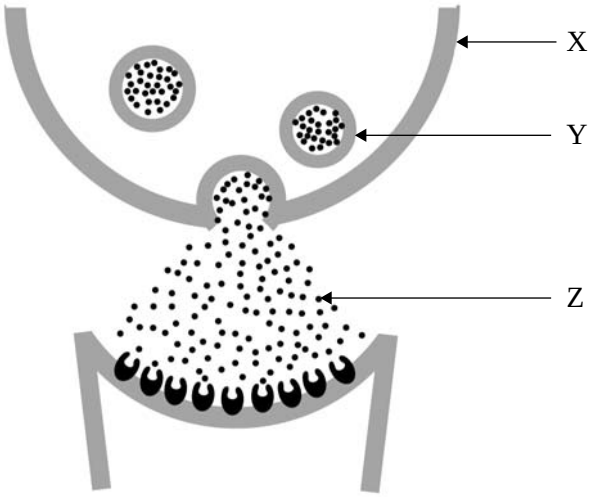
B. cell organelles.

C. nuclear regions.

D. extracellular fluid.

Question 11

The following diagram shows a synapse between two neurons.



The arrows **X**, **Y** and **Z** point respectively to a

A. pre-synaptic terminal, a Golgi body and acetylcholine.

B. pre-synaptic terminal, a vesicle and a neurotransmitter.

C. post-synaptic terminal, a vacuole and a neurotransmitter.

D. post-synaptic terminal, a mitochondrion and acetylcholine.

Question 12

Insulin is a complex protein that is said to have a quaternary structure.

This means that insulin

A. cannot be denatured.

B. lacks disulphide bridges.

C. contains all the known amino acids.

D. has more than one polypeptide chain.

Question 13

First-line defences that mammals have against invasion by disease-causing bacteria include

A. lysozymes.

B. interferons.

C. antibodies.

D. killer T cells.

Question 14

Diphtheria is a disease caused by the bacterium *Corynebacterium diphtheriae.*

A six-month old baby boy, whose mother and father both had diphtheria as children, will develop active immunity against diphtheria if he

A. is being breast-fed by the mother.

B. receives a blood transfusion from the father.

C. receives an injection of dead diphtheria bacteria.

D. receives injections of gamma globulin from the mother.

Question 15

Facilitated diffusion is a form of cell transport that

A. moves oxygen and carbon dioxide across membranes.

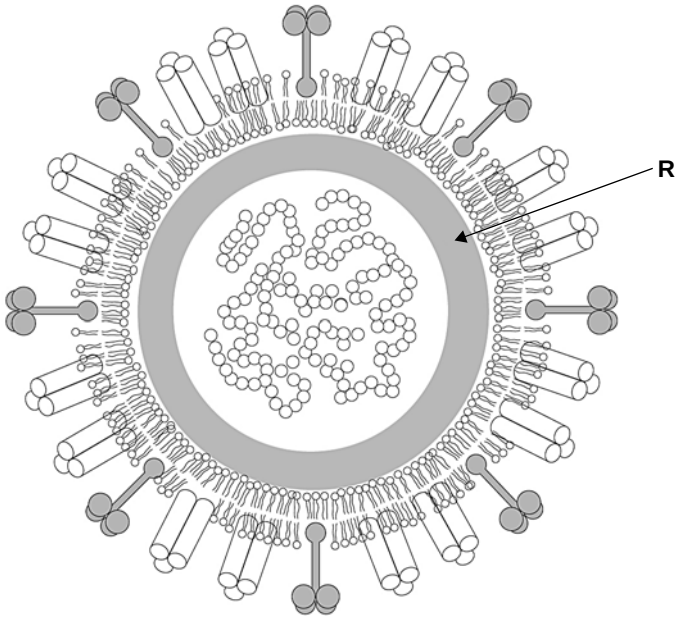
B. occurs against a concentration gradient.

C. requires specific protein channels.

D. uses energy supplied by ATP.

The following information is relevant for Questions 16 and 17.

The following diagram shows a cross section through an influenza virus.



Question 16

The part of the virus labelled R is its

A. antigenic marker.

B. lipid envelope.

C. protein coat.

D. viral genome.

Question 17

A typical characteristic of such a virus is that it

A. is destroyed by antibiotics.

B. releases toxins into the body of the host.

C. evades detection by the host's immune system.

D. manipulates the host cell's DNA to produce copies of itself.

Question 18

Sucrose (cane sugar) is a disaccharide used by plants as a transport molecule. Sucrose is formed in the following reaction

$$\text{glucose + fructose} \xrightarrow{\text{enzyme}} \text{sucrose}$$

With reference to this process it can be stated that

A. glucose and fructose are polysaccharides.

B. the production of sucrose is an endergonic reaction.

C. sucrose is a reactant and glucose is a product of the reaction.

D. a molecule of fructose contains more stored energy than a molecule of sucrose.

Question 19

Activation energy in a biological reaction

A. increases in the presence of an enzyme.

B. increases with an increase in temperature.

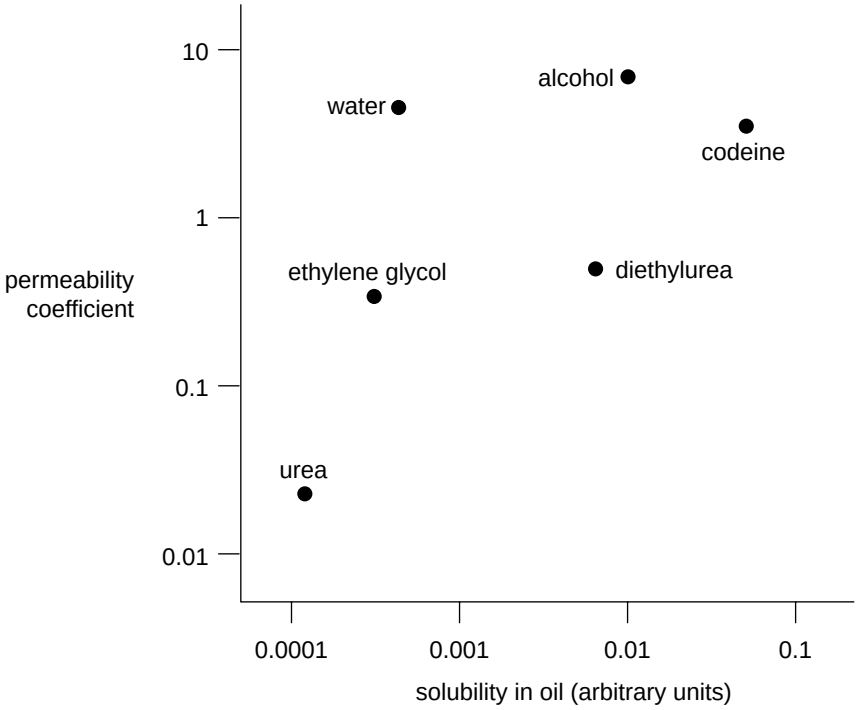
C. is the energy required to start the reaction.

D. is involved in the formation of complex molecules only.

Question 20

Materials are constantly exchanged between a cell and its surroundings. The ease with which a molecule passes through a plasma membrane can be represented by a permeability coefficient.

The graph below shows the permeability coefficients for a range of molecules plotted against their solubility in oil (lipid).



From the graph you can conclude that

A. water is more lipid-soluble than alcohol.

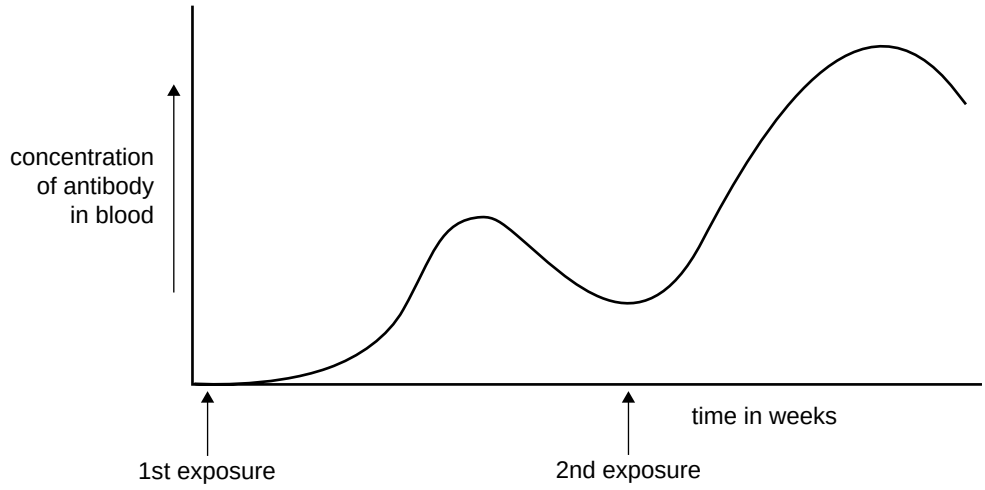
B. a cell gets rid of urea more slowly than excess water.

C. drugs like alcohol and codeine enter cells more slowly than ethylene glycol.

D. ethylene glycol passes through the plasma membrane more easily than diethylurea.

Question 21

The graph below shows the antibody levels in the blood after a person has been exposed twice to the same pathogen.



With regard to this pathogen, we can conclude that

A. the person has a deficient immune response.

B. the virulence of the pathogen increased between the 1st and 2nd exposures.

C. antibodies are only produced after a second exposure to the pathogen.

D. memory cells for antibodies against the pathogen exist at the time of the second exposure.

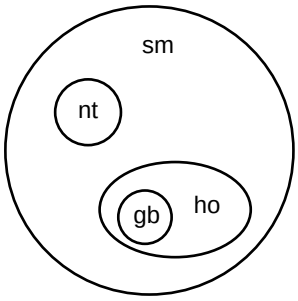
Question 22

Consider the following list of biological molecules and their abbreviations.

hormones	ho
neurotransmitters	nt
gibberellins	gb
signalling molecules	sm

The Venn diagram that best represents the relationship between hormones, neurotransmitters, gibberellins and signalling molecules is

A.



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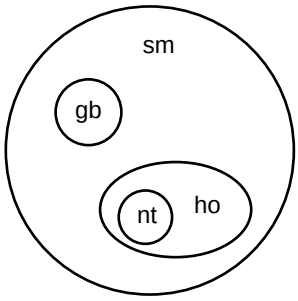
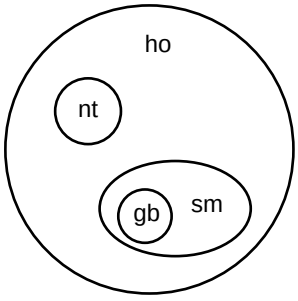
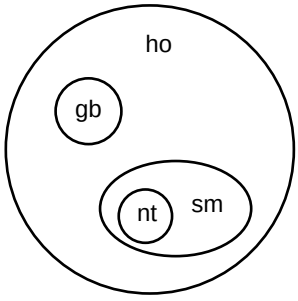


C.



D.



Question 23

In mammals the parathyroid gland secretes parathyroid hormone (PTH). PTH is involved in regulating the concentration of calcium in blood plasma. Parathyroid hormone increases the amount of calcium in plasma by causing calcium to move from bone to the plasma, and by assisting the uptake of calcium from the alimentary canal. PTH also stimulates the kidney to activate vitamin D.

The concentration of calcium in plasma acts directly, in negative feedback, to regulate the output of parathyroid hormone.

From this information it would be expected that

A. increased production of PTH results in reduction of vitamin D activation.

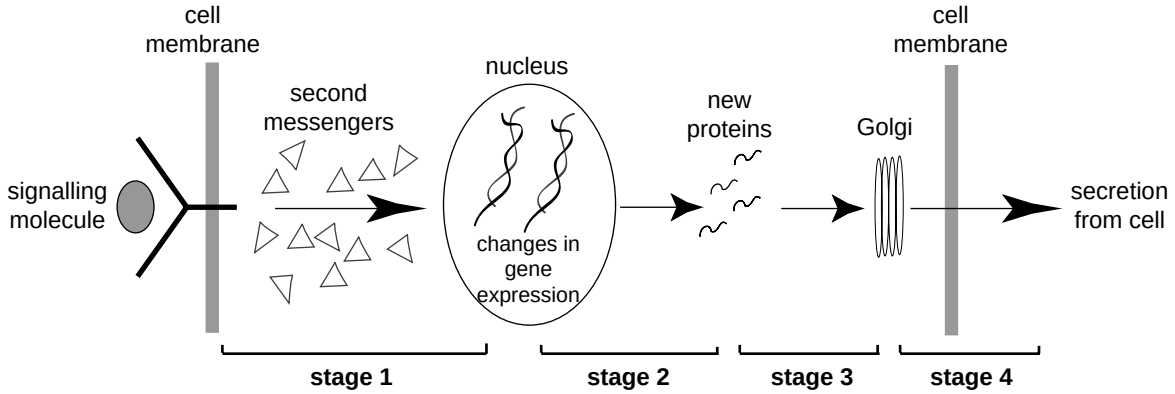
B. reduced production of PTH results in increased calcium in the faeces.

C. sustained overproduction of PTH results in strengthened bones.

D. high levels of blood calcium stimulate release of PTH.

Question 24

The following diagram outlines the events that occur as a result of a particular signalling molecule.



Signal transduction is represented by stage

A. 1

B. 2

C. 3

D. 4

Question 25

Female mosquitoes require blood as a source of protein for egg development. If a mosquito carries a disease-causing agent, such as a virus or a protozoan parasite, it can be transmitted to a human (or other animal) during a bite. The life cycle of mosquitoes depends on a ready source of water. Mosquito larvae hatch from eggs laid on the water and develop into pupae, which have a small air tube that attaches to the water surface to obtain oxygen.

The most commonly reported mosquito-transmitted disease in Australia is the Ross River virus (RRv) disease and occurs in all states of Australia. Health departments produce pamphlets that advise people on actions to reduce the number of mosquitoes.

The advice is likely to include directions to

A. keep swimming pools free of chlorine.

B. stock any garden pool with fish that eat mosquito larvae.

C. keep windows and doors open and uncovered to allow airflow.

D. keep well away from animals that may have been bitten by mosquitoes.

END OF SECTION A
TURN OVER

SECTION B – Extended response questions

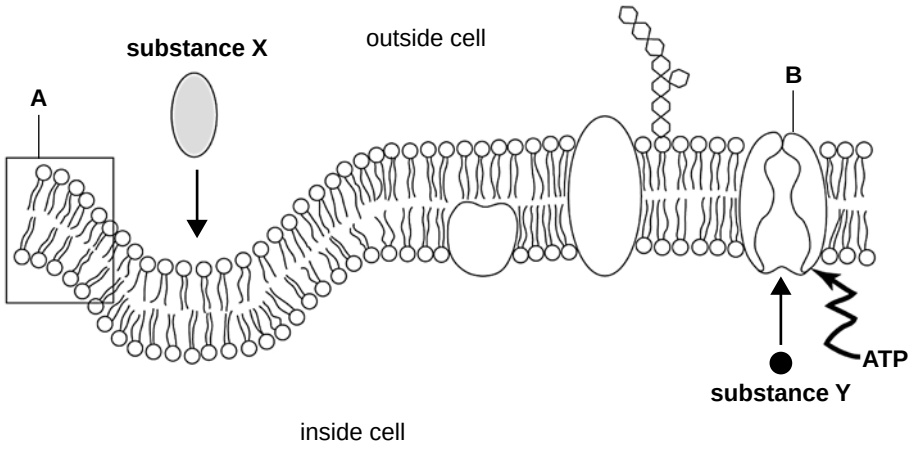
Instructions for Section B

Answer this section in **pen**.

Answer all questions in the spaces provided.

Question 1

The diagram below shows a cross section of part of the plasma membrane of a typical mammalian cell. The substances labelled X and Y are about to be transported across the membrane in the directions shown by the arrows (⟶).



i. Structure A

Chemical composition _____

Explain how the chemical composition of structure A facilitates its role.

_____

_____

ii. Structure B

Chemical composition _____

Explain how the chemical composition of structure B facilitates its role.

_____

_____

1 + 1 = 2 marks

Question 2

There are structural differences between molecules of DNA and RNA.

a. Outline two of these differences by completing the following table.

	DNA	**RNA**
Difference 1		
Difference 2		

2 marks

b. Name one kind of RNA and state its function.

Type of RNA _____

Function _____

_____

1 mark

Proteins may be classified as fibrous or globular depending on their 3-dimensional shape.

In fibrous proteins, the polypeptide chains are arranged in parallel to form long fibres or sheets. In globular proteins, the polypeptide chains are folded into compact spherical or globular shapes.

c. Name the subunit of a polypeptide.

_____

1 mark

Keratin, found in fingernails and claws, is an example of a fibrous protein.

d. Name another example of a fibrous protein and briefly outline its function.

_____

1 mark

e. Describe a distinctive property of a fibrous protein and explain how this property is due to the arrangement of its polypeptides.

_____

_____

1 mark

Total 6 marks

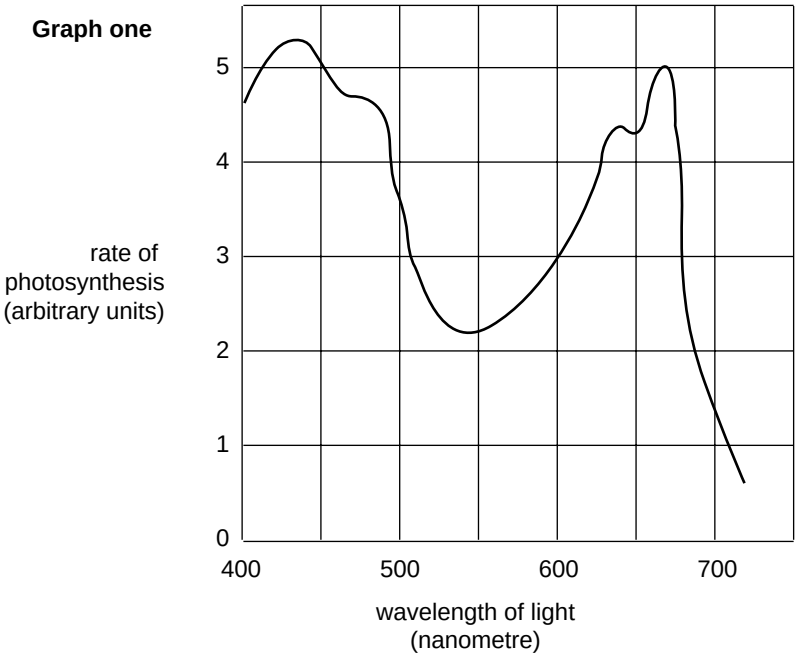
Question 3

The following diagrams show

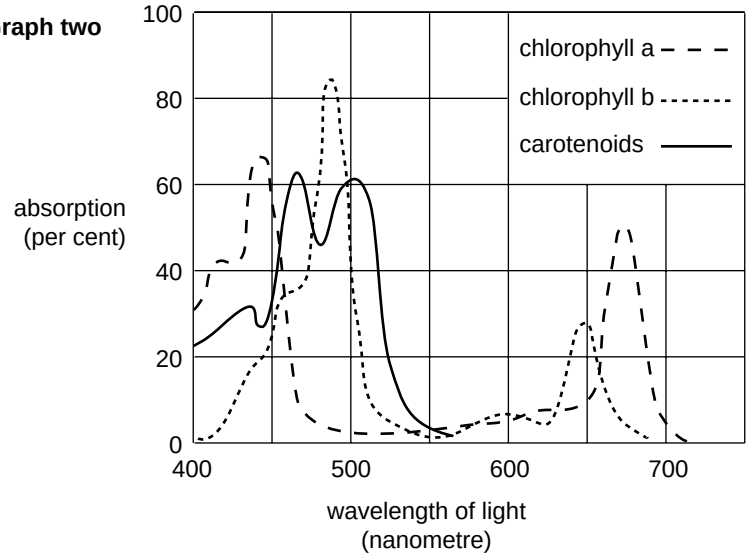
Graph one The rate of photosynthesis in a green plant at different wavelengths of light

Graph two The estimated absorption of the different wavelengths of light by the different plant pigments

Graph one



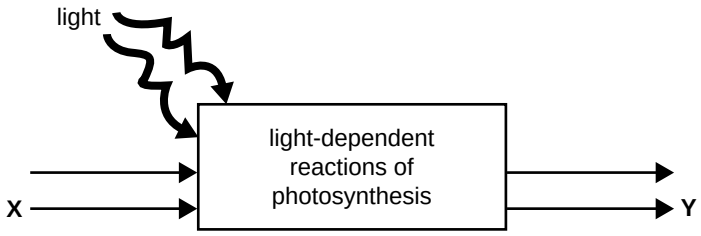
Graph two



a. Explain why the graph showing the rate of photosynthesis has approximately the same shape as the absorption graphs of the plant pigments.

1 mark

The following diagram shows a simplified representation of the first stage of photosynthesis.



b. **i.** Name one input item that **X** could represent.

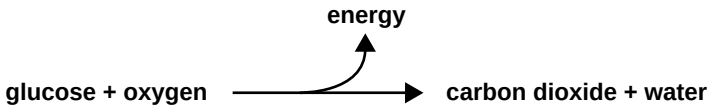
_____

ii. Name one output item that **Y** could represent.

_____

1 + 1 = 2 marks

The breakdown of glucose in aerobic respiration can be represented by the simplified equation

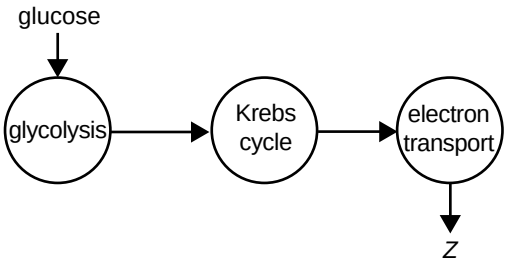


c. What is the energy yield per molecule of glucose as a result of aerobic respiration?

_____

1 mark

The breakdown of glucose in aerobic respiration can also be represented as occurring in three particular stages as indicated below.



d. **i.** Within a cell, where does the electron transport stage of aerobic respiration occur?

_____

ii. Describe what happens during the electron transport stage. In your answer include the name of product **Z**.

_____

_____

_____

_____

1 + 2 = 3 marks

Total 7 marks

SECTION B – continued
TURN OVER

Question 4

Living organisms cannot survive without the presence of enzymes.

a. Explain why enzymes are necessary in living organisms.

1 mark

b. Describe the 'active site' of an enzyme and explain its role.

2 marks

The blood pressure of an individual can change significantly to ensure an appropriate supply of water, nutrients and oxygen to cells and to remove wastes that may be harmful. However, people who have long-term high blood pressure develop characteristics that can be life threatening.

Scientists have decided that they may be able to treat patients suffering high blood pressure by designing and developing a drug to lower high blood pressure. This technique is called 'rational drug design'.

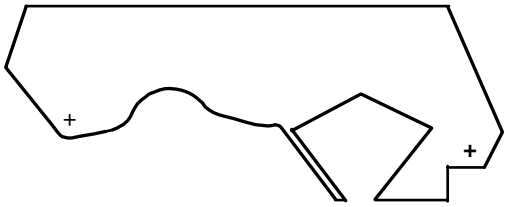
c. Write a short paragraph to explain the phrase **rational drug design**.

2 marks

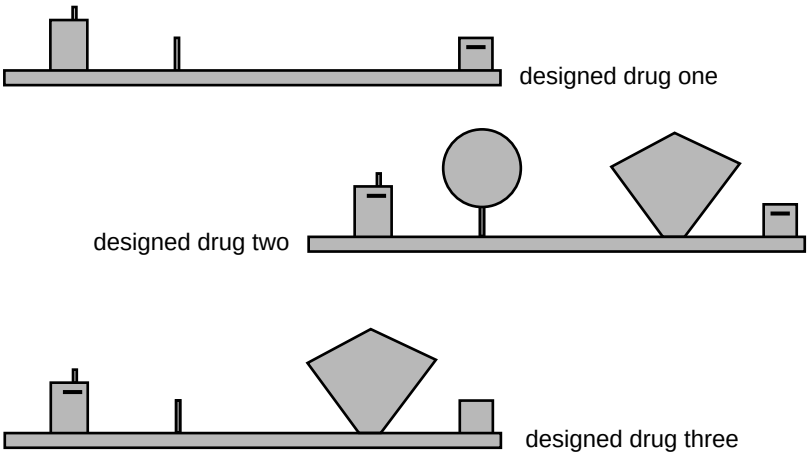
It is known that Angiotensin-converting enzyme (ACE) acts on the polypeptide Angiotensin I to produce Angiotensin II, a powerful blood-pressure raising agent.

People with long-term high blood pressure have raised blood levels of ACE.

The following diagram represents the active site of a molecule of ACE.



A range of drugs was designed and manufactured. A sample of the molecular shape of these is shown below.



d. **i.** Which drug is likely to be the most effective in preventing excessive high blood pressure?

_____

ii. Give the reasons for your choice in part **i.**

_____

_____

_____

iii. Explain the process by which this drug would contribute to lowering blood pressure in a person.

_____

_____

_____

_____

_____

1 + 1 + 2 = 4 marks

Total 9 marks

Question 5

Normally in mammals, if tissue from another individual enters the body, the foreign cells are recognised as 'non-self' by the immune system. The tissue is then rejected unless special drugs are used.

a. **i.** Which cells of the immune system are initially responsible for recognising **non-self** cells introduced by an organ transplant?

_____

ii. How do the cells you have named in part **i.** distinguish between **self** and **non-self** cells?

_____

_____

_____

1 + 1 = 2 marks

b. Describe the process of tissue rejection after recognition of the **non-self** cells has occurred.

_____

_____

_____

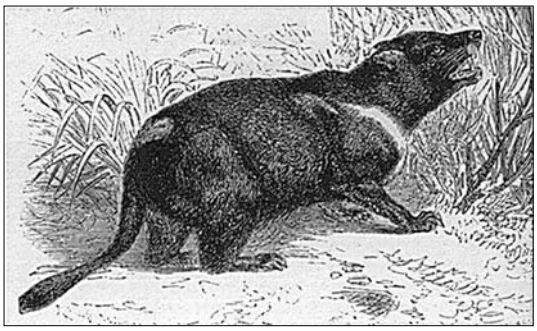
_____

_____

2 marks

The drawing below, made in 1886, shows the Tasmanian devil, *Sarcophilus harrasii*.

The Tasmanian devil is the largest surviving carnivorous marsupial in Australia. It is officially in danger of extinction due to the deadly Devil Facial Tumour Disease (DFTD), a type of cancer.



DFTD is an unusual type of cancer because it can be passed from one individual to another when deep wounds occur as they fight over food or as they mate. Tumour cells in the mouth or cheek of an infected animal break off and enter a deep wound on an uninfected animal. The tumour cells multiply in the body of the newly infected devil, eventually forming new tumours that kill the animal.

Recent research has shown that the immune system of an unaffected Tasmanian devil responds in the usual way to tissue from other mammalian species. However, a devil accepts tumour cells from another devil as if they are 'self' cells. The tumour cells are ignored, no immune response develops against them, and so the cancerous cells multiply.

c. Suggest why DFTD tumour cells are accepted as **self** cells by previously uninfected Tasmanian devils.

1 mark

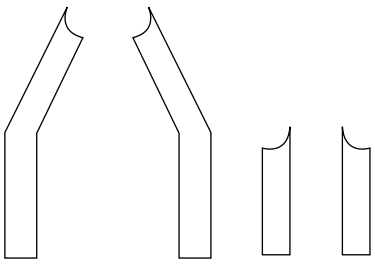
d. Would you consider tumour cells which have entered the body of an unaffected devil to be pathogens? Support your answer.

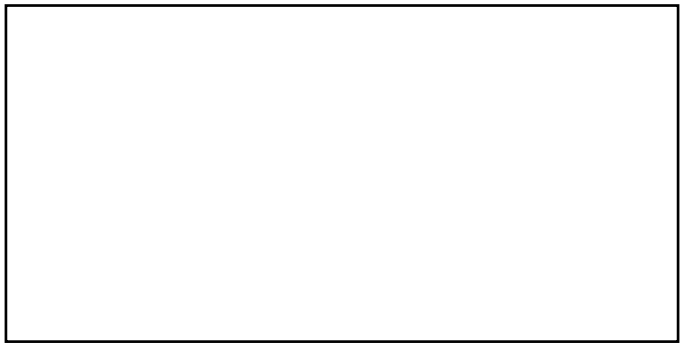
1 mark

Total 6 marks

Question 6

A typical antibody molecule comprises four polypeptide chains that are linked together. The following diagram shows the four fragments of a particular antibody molecule.





a. **i.** Redraw these fragments in the box above to show the typical representation of an antibody.

ii. On your answer to part **i.** in the box above, draw two arrows to indicate the two positions at which antigen would bind to the antibody.

1 + 1 = 2 marks

Rheumatoid arthritis is an 'autoimmune disease' that can occur in humans and laboratory mice.

b. Outline the general characteristics of an **autoimmune disease**.

1 mark

Hormones are found in all multicellular organisms.

A hormone is sometimes defined as 'a chemical that is produced in one organ and transported by the blood to other cells where it causes a specific change'.

We now understand that this definition fails to account for all hormones found in multicellular organisms.

c. Write a new definition for a hormone, covering the majority of situations in which we know hormones are involved.

1 mark

The human hormone vitamin D is found in high levels in some immunological tissues. A scientist predicted that a deficiency of vitamin D may play a role in the development of rheumatoid arthritis and hence treatment with vitamin D tablets may reduce development of the disease. The scientist decided to test this idea by using a strain of laboratory mice that normally developed rheumatoid arthritis.

d. Design an experiment to test the scientist's prediction.

In your answer you should

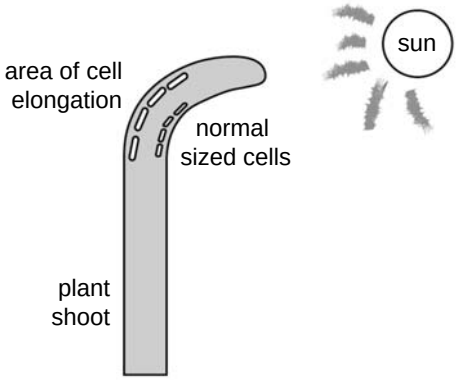
- state the hypothesis that you are testing
- outline the experimental procedure that you follow
- describe results that would support your hypothesis.

5 marks

Total 9 marks

Question 7

The diagram below shows a young plant growing with a sufficient supply of nutrients in normal light.



a. What type of growth response is being shown by the plant?

_____

1 mark

Some VCE students were asked to perform an experiment to test the effect of lack of sunlight on the growth of a sample of seeds of the same plant.

b. **i.** Name one controlled (fixed) variable that students should keep constant.

_____

_____

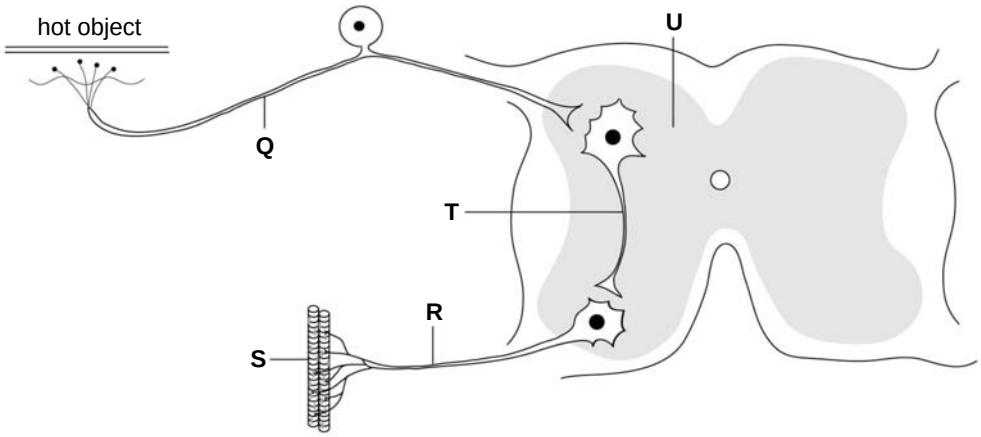
ii. Name the one experimental (independent) variable that students should change.

_____

_____

1 + 1 = 2 marks

The following diagram shows a nerve pathway that is activated when a person touches a very hot object.



c. Which part of the diagram represents an interneuron?

_____

1 mark

d. What is the general name given to the type of nerve pathway shown in the diagram?

_____

1 mark

The myelin sheath along structure Q can be damaged by disease.

e. Describe how such damage would affect the person involved.

_____

_____

1 mark

Total 6 marks

Question 8

a. Name a homeostatic system you have studied this year. Draw a labelled diagram outlining how the system operates.

3 marks

Copper is an essential trace element for most organisms. Over time, organisms have developed complex homeostatic mechanisms to regulate the uptake, distribution and removal of copper. These mechanisms, coordinated by the nucleus, involve the metal transcription factor (MTF-1).

In the fruit fly, *Drosophila*, MTF-1 acts as an activator under both high and low copper concentrations. Under high copper concentrations, MTF-1 activates metallothioneins that prevent additional copper entering the cell. Under low copper concentrations within a cell, MTF-1 activates the copper importer Ctr1B which enables more copper to enter the cell from the surroundings.

b. What is the stimulus for homeostasis of copper?

1 mark

c. Suggest why the level of copper in the cells of an organism is controlled.

1 mark

Total 5 marks

END OF QUESTION AND ANSWER BOOK