

SECTION B / SHORT-ANSWER QUESTIONS

INSTRUCTIONS FOR SECTION B

Answer this section in pen.

Answer all questions in the spaces provided.

Question 1

The molecules that living organisms are composed of can be grouped into five principle classes. Interactions occur between these molecules constantly and ultimately their shapes determine their function. The functions of some of these molecules are outlined in the table below.

- a. Complete the table by identifying each of the biological molecules described.

Biological Function	Biological Molecule
solvent, support, turgor, site for metabolic reactions	
insulation, source of energy, structural	
provide information about construction and function	
structural, energy storage, cellular recognition	

2 MARKS

- b. What is one form of bonding that holds the tertiary structure together?

1 MARK

Proteins are produced in their simplest form at the ribosomes. They can, however, have other biological molecules added to them and they become modified to form conjugated proteins. An example of a conjugated protein is a glycoprotein.

- c i. What is a glycoprotein?

- ii. Describe **one** role of a glycoprotein.

1 + 1 = 2 MARKS

If its three-dimensional structure changes, the biological function of the protein is almost always permanently lost.

- d i. What is the name given to this process?

- ii. Identify **one** agent that can cause the loss of three-dimensional structure in a protein.

1 + 1 = 2 MARKS

TOTAL 7 MARKS

Question 2

Cardiovascular disease (CVD) is a complex disease state which the World Health Organisation cites as the principle cause of death in humans worldwide. CVD is caused by atherosclerosis in which fatty deposits build up along the endothelial lining of blood vessels resulting in formation of blood clots. CVD can occur in the form of heart attack, stroke and heart failure, and is related to factors such as lifestyle, diet, genetics, age and high blood pressure. During a heart attack or a stroke, blood flow to surrounding tissue is blocked; however, the cells which make up the tissue continue to metabolise for some time.

- a. Explain how cellular function can continue during a heart attack or stroke.

1 MARK

If blood flow to the affected area is restored, reactive oxygen species (radicals) form. The presence of these free radicals can cause serious damage to essential cellular components because they can form preferential bonds with nucleic acids, lipids and proteins. Knowledge of this aspect of the molecular mechanism associated with CVD means that it is possible to develop a drug to treat it.

- b i. What is the name given to this process of drug development?

- ii. What is a disadvantage associated with this process?

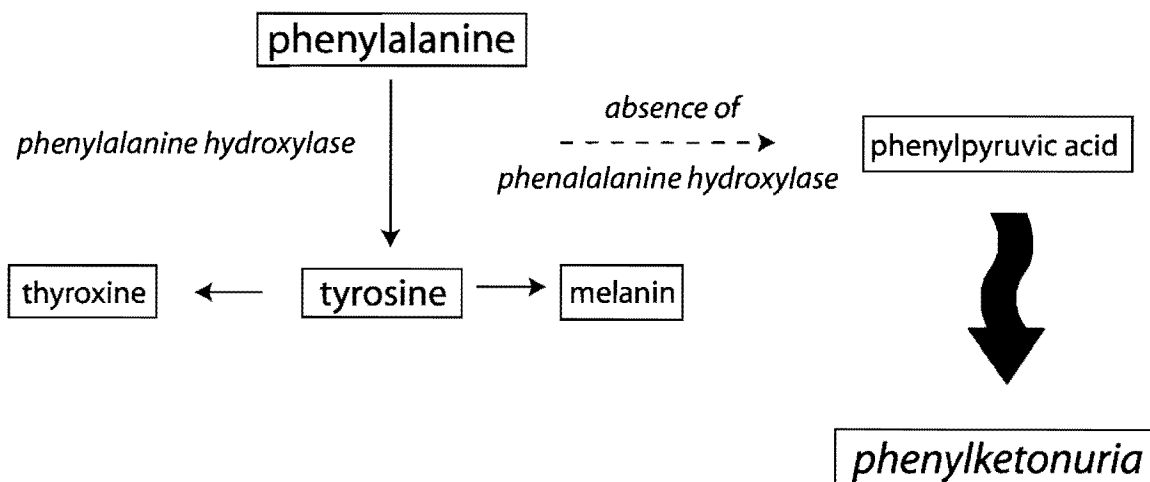
1 + 1 = 2 MARKS

- c. Using the information provided above, explain on a molecular basis, how foods rich in flavonoids might contribute to the low incidence of CVD?

1 MARK**TOTAL 4 MARKS**

Question 3

Metabolic pathways form a complex network in the regulation of homeostasis in an organism. Metabolic disorders arise when there are errors in the normal pathway. Phenylketonuria (PKU) is a condition that occurs when the amino acid phenylalanine (phe) is not converted to tyrosine and affects one in every 10,000 babies. Instead, the unconverted phenylalanine becomes metabolised to another compound known as phenylpyruvic acid. The accumulation of phenylpyruvic acid causes various symptoms including mouse-like body odour, light skin colour, pronounced muscle tension and activity and eczema. A partial description of the metabolism of phenylalanine is presented in the following diagram.



- a i. In which group of biomacromolecules is phenylalanine found?

- ii. Phenylalanine hydroxylase is a specific biological compound. What is the name given to this compound?

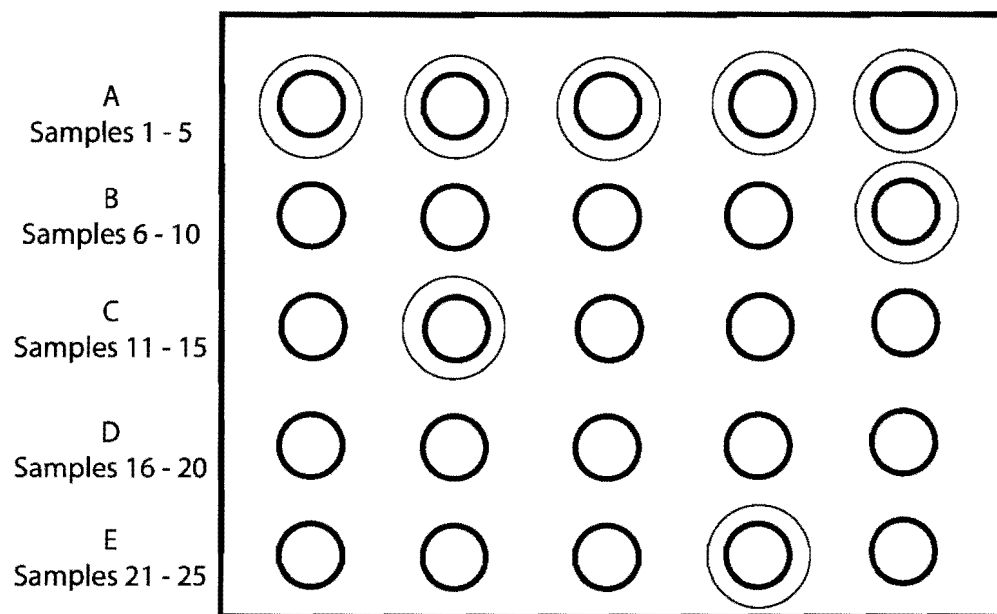
1 + 1 = 2 MARKS

After birth, the accumulation of phenylpyruvic acid in the body, particularly in brain tissue, can cause severe damage in a developing child.

- b. Why does this disorder only develop in infants after birth?

2 MARKS

To determine whether a newborn has PKU, a heel prick blood test is performed shortly after birth and the levels of phenylalanine in the blood are determined. A technique that was previously used to diagnose the condition involved the use of Guthrie plates on which discs containing blood samples were tested for high levels of phenylalanine. The plates were coated with agar which contained a strain of bacteria that would only grow in the presence of phenylalanine. Growth occurred in a ring around the disc which was placed on the agar. The diagram shows the results of a series of tests.



The discs in Row A all show a distinct band of growth around them.

- c i. Explain the likely purpose of the discs in Row A and indicate what is known about them.

- ii. What conclusion can be drawn about Samples 10, 12 and 24?

2 + 1 = 3 MARKS

Once a diagnosis of PKU is made, the condition can be managed.

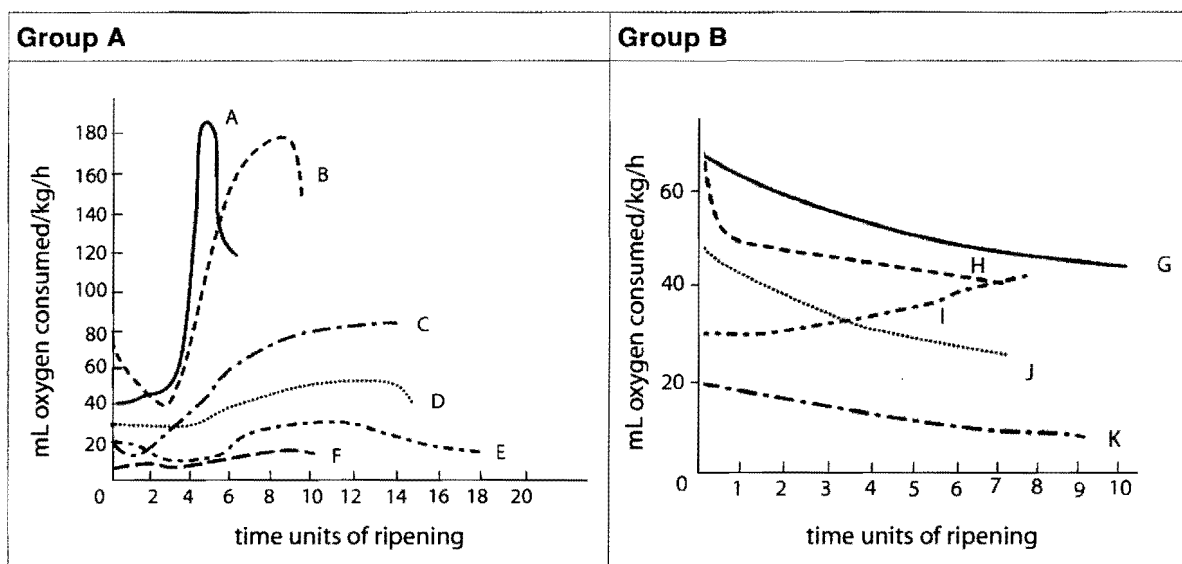
- d. Suggest **one** strategy that can be used in the management and treatment of PKU.

1 MARK

TOTAL 8 MARKS

Question 4

The ripening of many different types of fruit is associated with the production of a chemical, the gas ethylene. Ethylene acts to increase the levels of certain enzymes, including amylase and pectinase, within plant tissue. A researcher made a series of observations of a group of fruiting plants. In particular, the volume of oxygen consumed per kilogram per hour during the ripening process was recorded. The results were divided into two distinct groups and are shown in the following table.



- a. Why has the researcher made a distinction between Group A and Group B when presenting the results of the observations?

2 MARKS

- b. i. The consumption of oxygen is associated with a specific biochemical process in plants that occurs whether fruit is ripening or not. What is the name given to this biochemical process?

- ii. What is the balanced chemical equation for this biochemical process?

1 + 2 = 3 MARKS

- c. Identify the specific role that oxygen plays in the biochemical process referred to in Question 4bii. What happens to it?

2 MARKS

TOTAL 7 MARKS

Question 5

The ripening of many different types of fruit is associated with the production of a chemical, the gas ethylene. Certain other aspects of plant growth and development are also controlled by chemical substances.

- a. What is the name given to the chemical substances that control plant growth and development?

1 MARK

Auxins such as indoleacetic acid (IAA) is a group of hormones which are produced by the growing tips of plants and are associated with a number of different processes, depending on their location and concentration. A synthetic auxin 2,4-dichlorophenoxyacetic acid (2,4-D) is a known selective herbicide to which dicotyledon weeds are generally susceptible. It is sprayed over crops and pastures in which the weeds grow, killing the dicotyledons but not the monocotyledons.

- b i. What is a selective herbicide?

-
- ii. Suggest **one** way that 2,4-D is effective in controlling growth of weeds.
-

1 + 1 = 2 MARKS

Despite previous success with controlling weeds, 2,4-D has become less effective at killing weeds over time. Funding for further research on the commercial use of the herbicide has been made available.

- c i. What is the most likely reason for the re-emergence of weeds in crops after spraying with 2,4-D?

-
- ii. Identify **one** other reason that agricultural scientists might want to investigate 2,4-D.
-

1 + 1 = 2 MARK

TOTAL 5 MARKS

Question 6

Neurons are an essential means of communication within multicellular organisms. They form part of a complex system which also includes the brain and spinal cord. The brain and spinal cord form the central nervous system (CNS) while the nerve cells that lie outside the brain and spinal cord form the peripheral nervous system (PNS) which has both sensory and motor divisions.

The table presents a summary of the peripheral nervous system.

a. Complete the table.

sensory nervous system		conveys information to CNS from the external environment
	visceral sensory neurons	
motor nervous system	somatic nervous system	
		conveys signals that regulate internal environment

4 MARKS

Neurons act by transmitting information in the form of an electrical impulse. In order for this to occur, the cell membrane of a nerve cell must be polarised.

b i. Explain what is meant by 'polarised'.

ii. How is a polarised state achieved in nerve cells?

1 + 1 = 2 MARKS

TOTAL 6 MARKS

Question 7

Until recently, all infective agents were thought to contain some form of nucleic acid.

- a i. Identify **two** basic forms of nucleic acid commonly found in infective agents.
-

- ii. Draw a labelled diagram of a monomer of **one** of the nucleic acids.

1 + 3 = 4 MARKS

Transmissible spongiform encephalopathies (TSEs) are a group of degenerative nervous diseases which affect mammals. They are caused by infective agents lacking nucleic acid and are comprised entirely of protein. These agents are capable of replication and causing infection in previously uninfected tissue.

- b. What is the name given to these infective agents?
-

1 MARK

TOTAL 5 MARKS

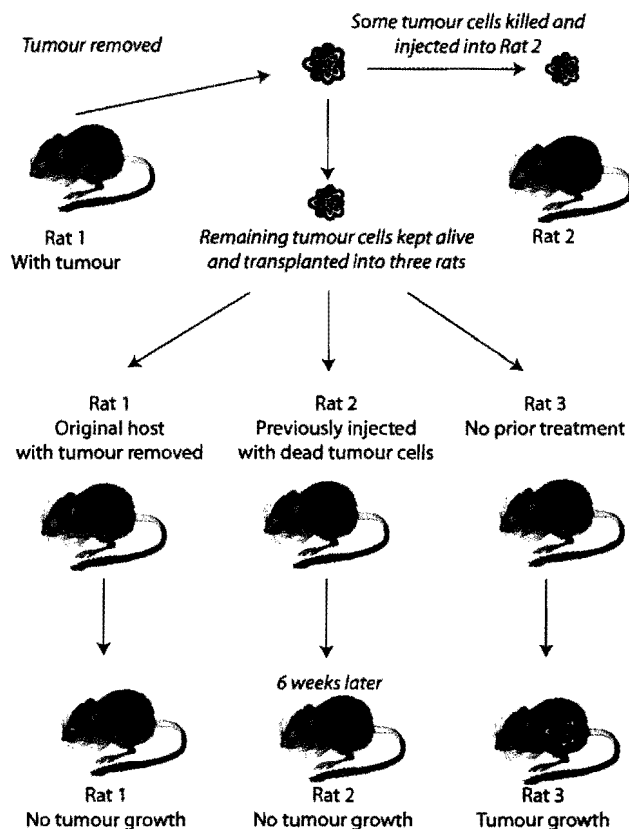
Question 8

In healthy living tissue, cell death and cell production are regulated. Sometimes when regulation is interrupted, tumours or cancers can form in living tissue and can present life-threatening conditions.

- a. What is the name given to the group of molecules that controls whether a cell lives or dies?
-

1 MARK

Using laboratory rats bred from the same parents, research was carried out to determine if the development of tumours could be prevented by vaccination. Growth of a tumour was induced in a single laboratory rat (Rat 1). The tumour was then removed and some of the cells were killed and the rest were kept alive in tissue fluid for four weeks. Some of the dead cells were injected into another rat (Rat 2). After four weeks the living tumour cells were divided into three groups and administered to Rat 1, Rat 2 and a new rat (Rat 3). Observations were made of the rats over 6 weeks. The process is described in the following diagram.



- b. What was the purpose of injecting dead tumour cells into Rat 2?

1 MARK

- c. What events occur in the immune system of Rat 2 after the injection of dead tumour cells?

2 MARKS

- d. In the experiment, Rat 1 and Rat 3 are both injected with live tumour cells; however, after 6 weeks only Rat 3 shows tumour growth. Explain why this occurs.

2 MARKS

Before the results of the research were ready to be published it was necessary to make some modifications to the experimental design.

- e. Explain clearly **one** modification that would need to be made to the experimental design and why it is required.

2 MARKS

TOTAL 8 MARKS

END OF PRACTICE EXAM 2

PRACTICE EXAM 3

SECTION A / MULTIPLE-CHOICE QUESTIONS

INSTRUCTIONS FOR SECTION A

Section A consists of 25 multiple-choice questions, each worth one mark.

You should spend approximately 30 minutes answering this section of the paper.

A correct answer scores 1 mark and an incorrect answer scores 0 marks.

Marks are not deducted for incorrect answers.

No marks will be awarded if more than one response is completed for any question.

Question 1

Macromolecules are grouped into four classes on the basis of their chemical composition and structure.

The four classes of macromolecules are

- A. complex carbohydrates, disaccharides, lipids and nucleic acids.
- B. complex carbohydrates, lipids, nucleic acids and proteins.
- C. complex carbohydrates, triglycerides, fatty acids and proteins.
- D. complex carbohydrates, monosaccharides, lipids and nucleic acids.

Question 2

Proteins are linear polymers that have been folded, twisted or coiled to arrive at their final structure known as a functional shape.

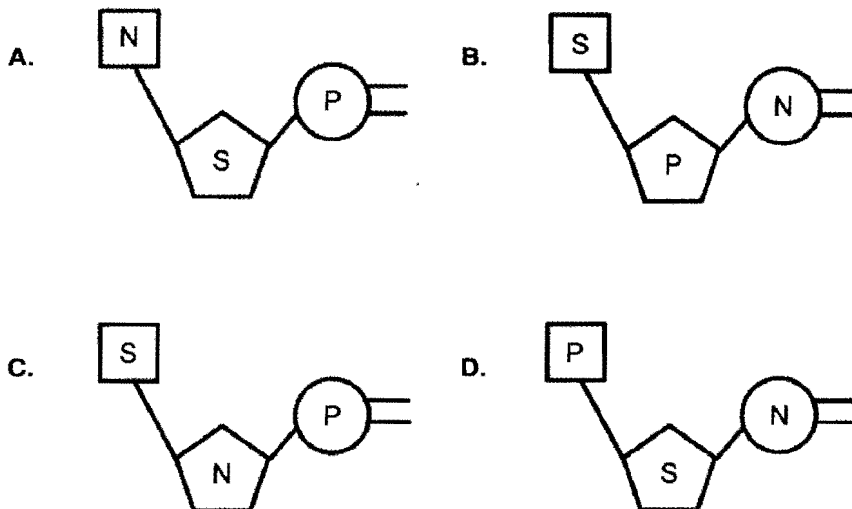
Which of the following is **unlikely** to result in a permanent change to the functional shape of a protein?

- A. exposure to strong salty solutions
- B. exposure to high temperatures
- C. exposure to low temperatures
- D. exposure to highly acidic or alkaline conditions

Question 3

Deoxyribonucleic acid (DNA) and ribonucleic acid (RNA) are nucleic acids comprised of subunits known as nucleotides. A nucleotide unit always consists of three essential components.

A nucleotide is best represented by



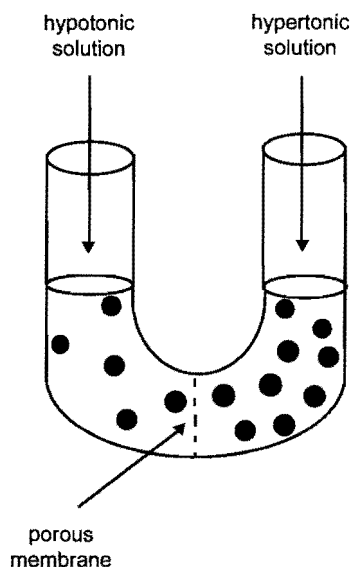
Question 4

A typical prokaryote cell is likely to have

- A. a distinct membrane-bound nucleus.
- B. plasmids.
- C. a single-stranded DNA molecule.
- D. membrane-bound organelles.

Question 5

Two sugar solutions of differing concentrations are separated by a porous membrane which is permeable to the solvent but not the solute.



Over time

- A. the water will diffuse from the hypotonic solution to the hypertonic solution.
- B. the water will diffuse from the hypertonic solution to the hypotonic solution.
- C. the sugar will diffuse from the hypotonic solution to the hypertonic solution.
- D. the sugar will diffuse from the hypertonic solution to the hypotonic solution.

Question 6

Cells produce many large molecular substances, including hormones and enzymes, which need to be relocated within, or exported from, the cell. In addition, cells are required to import large molecules. In these circumstances the cell membrane forms small sacs known as vesicles, which are used to contain and transport the molecular substances.

Which of the following processes is associated with the cellular transport of macromolecules by the fusion of vesicles with the plasma membrane?

- A. endocytosis
- B. pinocytosis
- C. exocytosis
- D. phagocytosis

Question 7

The sum of chemical processes within a living cell is known as metabolism. All these processes occur through complex pathways that are capable of altering molecules in a series of steps.

Photosynthesis is an example of a metabolic reaction that occurs in plants. Photosynthesis is both

- A. an anabolic and endogenic reaction.
- B. an anabolic and endergonic reaction.
- C. an anabolic and exergonic reaction.
- D. a catabolic and an endergonic reaction.

Question 8

Most living cells are unlikely to harness heat as a source of energy because

- A. heat denatures enzymes.
- B. cells produce as much heat as they require.
- C. heat is not a form of energy.
- D. heat is not a requirement for metabolism to occur.

Question 9

Most human enzymes have optimal temperatures of about 35°C to 40°C.

There are bacteria that live in hot springs where temperatures are 70°C or higher. These bacteria are able to remain metabolically active because

- A. their enzymes are insensitive to temperature.
- B. their enzymes have high optimal temperatures.
- C. the high temperatures facilitate active metabolism.
- D. they use molecules other than proteins as their main catalysts.

Question 10

Cellular respiration is a metabolic process that breaks the chemical bonds in glucose molecules to release free energy in the form of ATP. When oxygen is the final electron acceptor in the process, it is known as aerobic cellular respiration. Anaerobic cellular respiration (or fermentation) uses other molecules as the final electron acceptor.

Which of the following statements about cellular respiration is true?

- A. The end-products of anaerobic cellular respiration may include pyruvate, lactic acid or ethanol.
- B. In anaerobic cellular respiration, the products of fermentation are found in the mitochondria.
- C. Both aerobic and anaerobic cellular respiration produce the same net yield of 36 ATP molecules.
- D. Both aerobic and anaerobic cellular respiration use glycolysis to oxidise glucose and other organic fuels to pyruvate.

Question 11

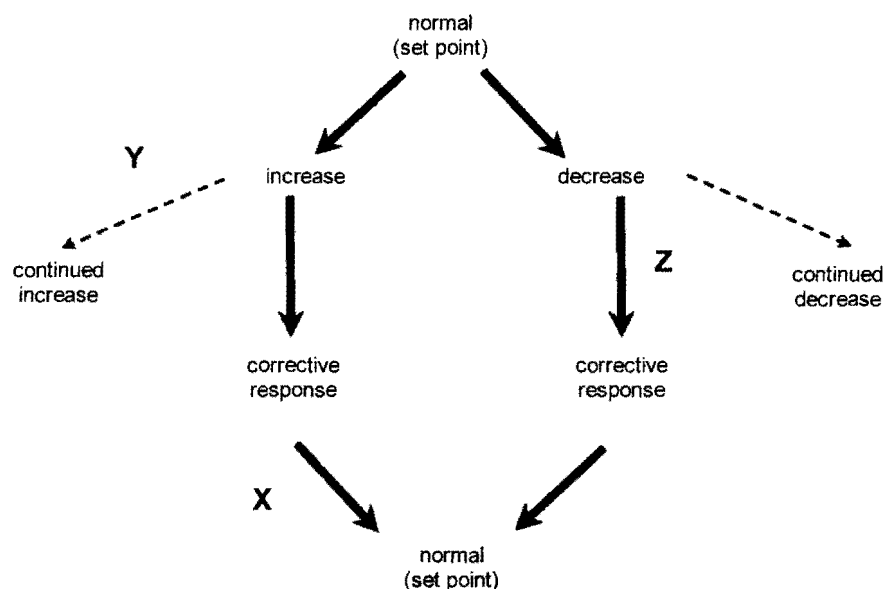
Krebs cycle is a stage in the process of cellular respiration. Pyruvate is converted to a compound called acetyl-CoA which then feeds into the Krebs cycle for further oxidation.

Likely products of this oxidation process are

- A. NADH, FADH₂, ATP and O₂.
- B. NADH, FADH₂, ATP and CO₂.
- C. NAD, FADH₂, ATP and CO₂.
- D. NAD, FAD, ATP and CO₂.

The following information is required for Questions 12 to 16.

All living organisms respond to signals from their external and internal environments. Responding to such signals is essential in order to maintain homeostasis. The diagram below represents a schematic summary of any homeostatic control process.



Question 12

Which of the following statements is **not** true of homeostasis?

- A. Homeostasis is a dynamic state.
- B. Homeostasis is the maintenance of a relatively constant internal environment.
- C. Homeostasis maintains internal conditions within narrow limits of tolerance, despite changes in the external environment.
- D. Due to its self-regulating nature, homeostasis cannot fail.

Question 13

In the diagram

- A. X represents positive feedback, Y represents negative feedback.
- B. X represents negative feedback, Y represents positive feedback.
- C. X represents positive feedback.
- D. Y represents negative feedback.

Question 14

Control of blood glucose in a non-diabetic person follows a negative-feedback response. Using the model in the diagram, if a deficiency of blood glucose is detected, the most likely response at Z would be that

- A. the pancreas secretes more insulin, which enhances the conversion of glucose to glycogen and fat.
- B. the pancreas secretes less insulin, which enhances the conversion of glucose to glycogen and fat.
- C. the pancreas secretes more insulin, which inhibits the conversion of glucose to glycogen and fat.
- D. the pancreas secretes less insulin, which inhibits the conversion of glucose to glycogen and fat.

Question 15

In the case of control of blood glucose, the corrective response resulting from Z would be

- A. a rise in blood glucose level
- B. a fall in blood glucose level.
- C. a decrease in glucagon level.
- D. an increase in glycogen level.

Question 16

Control of blood glucose is maintained

- A. principally by the nervous system.
- B. principally by the endocrine system.
- C. through homeostasis whether an individual has diabetes or not.
- D. by the hypothalamus and the pituitary gland.

Question 17

The ability of an organism to defend itself against pathogens depends on whether its immune system is capable of recognising and distinguishing 'self' from 'non-self'. 'Self' refers to materials or markers that are produced within an organism. If 'non-self' material enters an organism, B-cells and T-cells recognise them as foreign and an immune response is initiated.

Which of the following materials or markers would **not** stimulate an immune response from a B-cell or a T-cell in an organism?

- A. an antibody
- B. an antigen
- C. pollen
- D. a virus

Question 18

An epitope is the region on the surface of an antigen that is recognised by an antibody.

An epitope binds specifically with the

- A. antibody-binding site.
- B. constant heavy-chain regions in an antibody only.
- C. constant light-chain regions in an antibody only.
- D. variable regions of the combined heavy chain and light chain.

Question 19

Plants are susceptible to attack from pathogens which can cause disease. Viruses commonly infect plants and can be transmitted between plants by organisms such as insects, fungi and nematode worms. Plants have physical mechanisms for defence against pathogenic infections; however, these are not always effective.

A second line of defence could involve

- A. leaves with a thick cuticle or waxy surface.
- B. growth of hairs and thorns to deter vectors.
- C. sunken stomata.
- D. secretion of chemicals known as phytoalexins.

Question 20

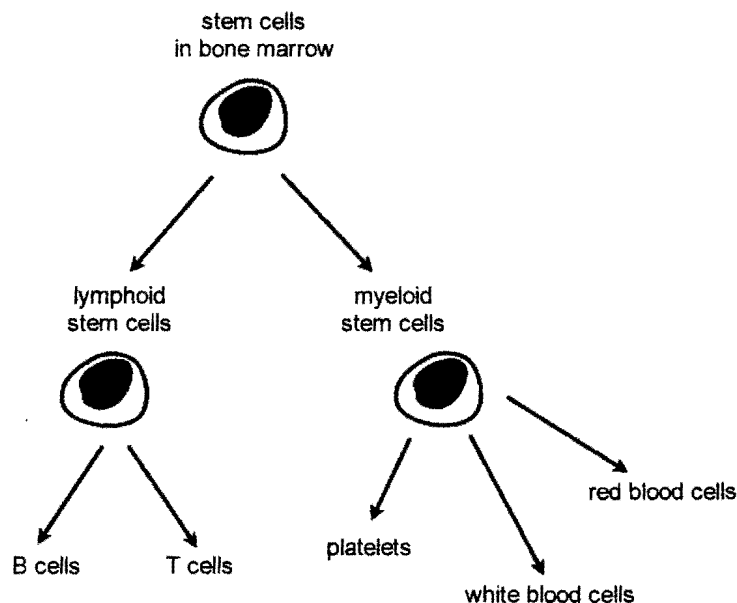
Transmissible spongiform encephalopathies (TSEs) have been documented since the 18th century. TSEs are caused by infectious proteins known as prions and are difficult to treat. Prions occur in two forms, PrP^c (normal) and PrP^{sc} (disease causing).

Prions

- A. possess genetic material in the form of DNA and sometimes RNA.
- B. are resistant to high temperatures, some enzymes and ultraviolet radiation.
- C. cause degenerative diseases including BSE, CJD and SARS.
- D. only infect humans and cattle.

Question 21

Human blood cells develop from stem cells in the bone marrow. Stem cells reproduce by mitosis and then differentiate into B-cells and T-cells, white blood cells, red blood cells and platelets.



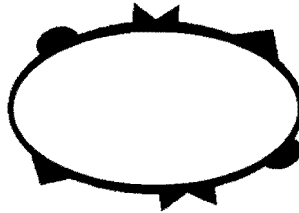
White blood cells are known as leucocytes and

- A. include monocytes, lymphocytes and erythrocytes.
- B. are associated specifically with the first line of defence.
- C. are found only in the lymphatic system.
- D. some are capable of producing antibodies.

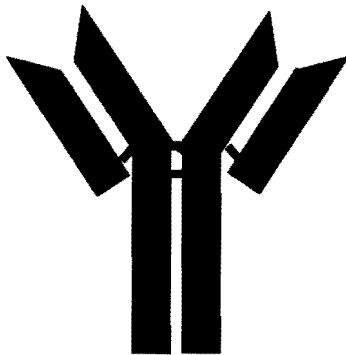
Question 22

The pathogen below entered an organism. After 48 hours, which one of the following might be found circulating through the body of the organism in much higher numbers?

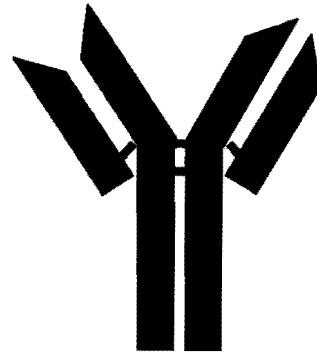
Pathogen W



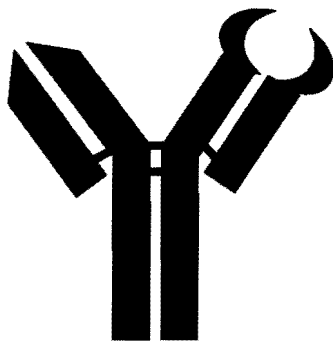
A.



B.



C.

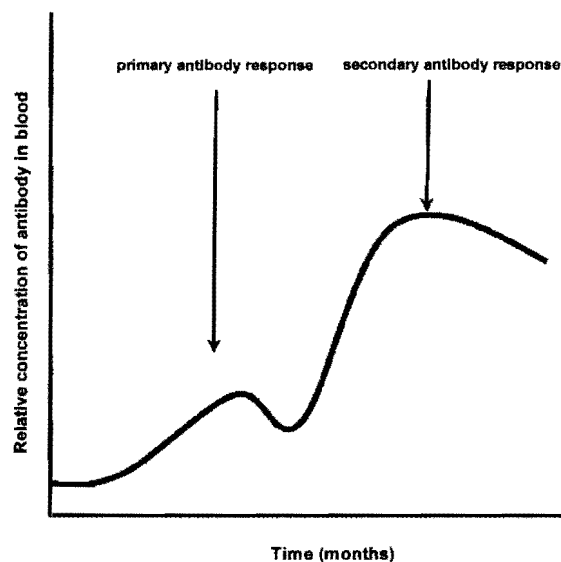


D.



Question 23

The graph shows the relative concentration of antibodies in the blood following an initial infection by a pathogen.



The secondary response occurs more rapidly and is greater in magnitude because

- A. antibodies produced to fight the initial infection still remain.
- B. there is a low concentration of B-plasma cells.
- C. there is a high concentration of B-plasma cells.
- D. B-memory cells are present in lymph nodes.

Question 24

Vaccines, which contain dead or attenuated disease-causing micro-organisms, activate the immune system to produce antibodies and prevent development of the disease.

This form of immunity is known as

- A. acquired active immunity.
- B. acquired passive immunity.
- C. natural active immunity.
- D. natural passive immunity.

Question 25

An allergic response is an exaggerated immune response to normally harmless substances found on the surfaces of foods, animals, drugs or cosmetics.

The cells most directly associated with an allergic response are

- A. mast cells.
- B. mast cells and basophils.
- C. basophils.
- D. lysosomes.

SECTION B / SHORT-ANSWER QUESTIONS

INSTRUCTIONS FOR SECTION B

Answer this section in pen.

Answer all questions in the spaces provided.

Question 1

As part of a research project, four samples of organic material were scientifically analysed to determine the percentage composition of different elements. The results of the analysis are shown in the table.

Percentage	Sample A	Sample B	Sample C	Sample D
Carbon	32	22	20	23
Hydrogen	45	46	35	48
Oxygen	21	20	21	26
Nitrogen	15	12	31	0
Sulphur	2	0	0	0
Phosphorus	0	0	14	0

- a. State which elements are found in proteins.

1 MARK

- b. i. State which one of the samples is most likely to be a nucleic acid.

- ii. Explain the reason for your choice.

1 + 1 = 2 MARKS

Nucleic acids serve as a blueprint in the production of proteins. There are two types of nucleic acids: DNA and RNA.

- c. Explain the fundamental difference between the chemical structures of DNA and RNA.

1 MARK

Chitin, a structural polysaccharide, is a major component of the arthropod exoskeleton. It is similar to cellulose except for the addition of nitrogen in the glucose monomer.

d. i. Define the term monomer.

ii. What is the name given to the process where monomers join to become macromolecules?

iii. Which sample is most likely to contain chitin?

1 + 1 + 1 = 3 MARKS

TOTAL 7 MARKS

Question 2

Living organisms are comprised of one or more cells. All cells have distinctive structures and these structures are directly related to the specific function of the cell.

The table below shows information about cells found in a typical eukaryotic organism.

a. Complete the table below.

Cell type	Cellular structure	Function of structure
epithelial cell	microtubule	
muscle cell		site of ATP production
	flagellum	produces motion to allow transport
liver cell	endoplasmic reticulum	

4 MARKS

In addition to their complex internal structure, body cells of some eukaryotes are supported by connective tissue such as bone and cartilage.

b. i. What is the name of the network that surrounds cells in body tissues?

ii. What cells produce and secrete the macromolecules that contribute to this network?

1 + 1 = 2 MARKS

TOTAL 6 MARKS

Question 3

Vicia faba is a species of broad bean commonly used in investigations of plant growth. Like all plants, the broad bean is reliant on the biochemical processes of photosynthesis and cellular respiration for survival. Photosynthesis occurs in structures known as chloroplasts.

There are two phases in photosynthesis – a light-dependent phase and a light-independent phase.

- a. Where in the chloroplast does the light-dependent phase occur?

1 MARK

- b. What is produced as a result of the light-independent phase?

1 MARK

Plants are dependent on photosynthesis because it produces essential materials for the process of cellular respiration.

Cellular respiration proceeds over three stages – glycolysis, Krebs cycle and electron transport.

- c. i. Where in a plant cell does glycolysis occur?

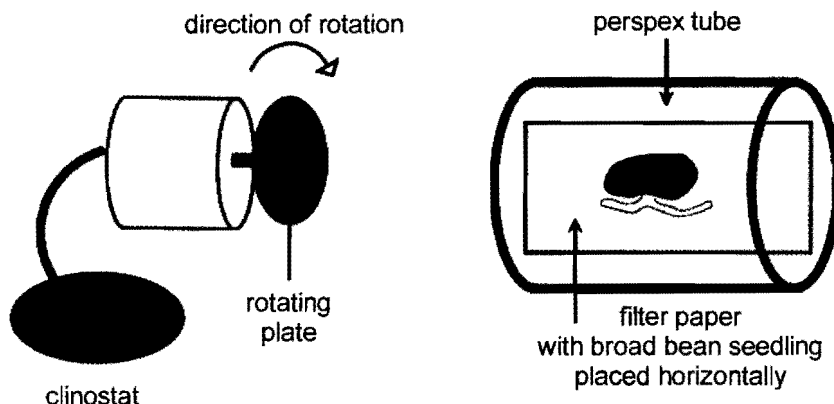
- ii. Where in a plant cell does electron transport occur?

1 + 1 = 2 MARKS

TOTAL 4 MARKS

Question 4

An experiment was carried out to investigate the control of growth of roots and shoots in the broad bean *Vicia faba*. Young broad bean seedlings (approximately 2 cm) were placed securely against water soaked filter paper in clear perspex tubes that also contained a hydrating gel. The tubes were uncapped during the day, capped loosely at night and experienced the same light conditions. A clinostat (a device consisting of a rotating plate which can revolve at various speeds) was used in the experiment.



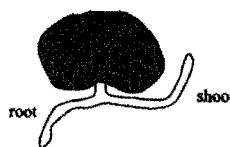
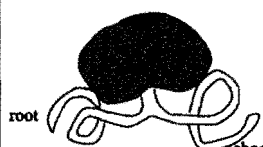
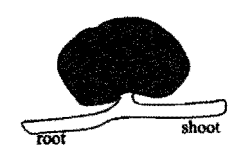
Group 1: seedling placed horizontally and grown in the light (no clinostat)

Group 2: seedling placed horizontally on a clinostat (not switched on)

Group 3: seedling placed horizontally on a clinostat (switched on slow)

Group 4: seedling placed horizontally on a clinostat (switched on fast)

The results are shown in the following table.

Group 1	Group 2	Group 3	Group 4
seedling placed horizontally	seedling placed horizontally on a clinostat	seedling placed horizontally on a clinostat	seedling placed horizontally on a clinostat
seedling not placed on clinostat	clinostat not switched on	clinostat switched on (slow rotation)	clinostat switched on (fast rotation)
			

a. What is the name given to the plant response investigated in this experiment?

1 MARK

b. Why was a clinostat used in this experiment?

1 MARK

c. Using the information from the experiments, what conclusion can you make about the growth of roots and shoots? Explain how you reached your conclusion.

Conclusion

Explanation

1 + 2 = 3 MARKS

Roots and shoots of broad beans have cells which contain starch grains known as starch statoliths. It has been hypothesised that the position of statoliths has a direct impact on the distribution of the plant hormone associated with growth in the root and shoot.

- d. What is the name of the plant hormone associated with growth in the root and shoot?

1 MARK

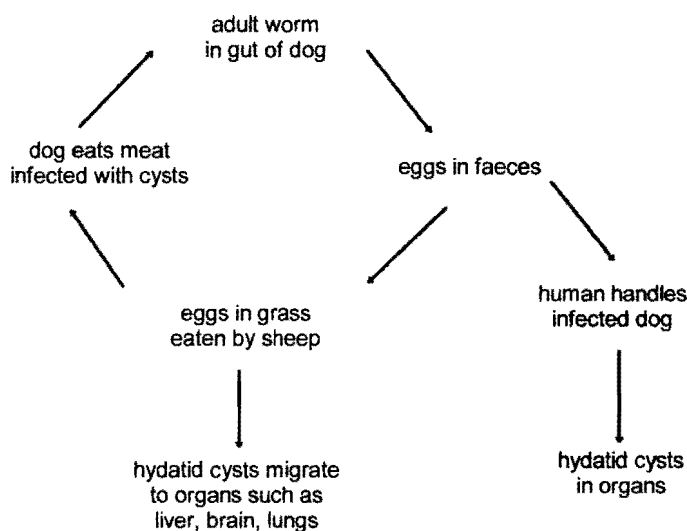
- e. Using the information from the experiments and your knowledge of plant hormones, explain the directional growth of roots and shoots in broad beans.

2 MARKS

TOTAL 8 MARKS

Question 5

The hydatid tapeworm *Echinococcus granulosus* normally inhabits the intestines of dogs. The mature adult produces eggs that are passed in the dog faeces. The eggs contaminate grass and, in rural areas, are ingested by livestock, usually sheep. In the sheep, the eggs develop into hydatid cysts that contain many tapeworm heads. Individual cysts can generate more cysts that are suspended in the fluid of the mother cyst. Hydatid cysts move into the bloodstream and migrate to body tissue, in particular, the liver, brain and lungs. Dogs can ingest the hydatid cysts if they eat raw tissue from infected dead livestock.



- a. What is the role of the sheep in the life cycle of *Echinococcus granulosus*?

1 MARK

- b. Identify one structural feature you would expect to find in the mature adult and explain how it helps it to survive in the dog.

2 MARKS

Humans can become infected by *Echinococcus granulosus* after handling infected dogs. In some circumstances, growing cysts can block blood vessels leading to vital organs. With care, the cysts can be removed surgically.

- c. Why is it necessary to ensure that cysts are removed intact from an infected person?

1 MARK

- d. What is one method that can be used to prevent domestic pets from being infected by this parasitic worm?

1 MARK

TOTAL 5 MARKS

Question 6

Bombyx mori is a silkworm moth. The female silkworm moths attract males by emitting chemical signals that diffuse through the air. A male hundreds of metres away is capable of detecting these molecules and will fly toward their source.

- a. What is the name given to the chemical used by the female silkworm moth?

1 MARK

In some circumstances, other organisms will release the same chemical signals used by certain species. This enables them to trap their prey more effectively.

- b. i. What term is used to describe the simulation of this chemical signal?

- ii. For what other purpose is an organism likely to copy a characteristic of another species?

1 + 1 = 2 MARKS

The male silkworm moth has large comb-like antennae which act as sensory organs for the chemicals the female emits. Each filament of an antenna possesses thousands of structures that detect the chemical signal.

- c. What is the general name given to the detecting structures found on the antennae?

1 MARK

TOTAL 4 MARKS

Question 7

Multiple sclerosis (MS) is the most common chronic disease of the central nervous system in developed countries. It affects one in 1000 people of northern European origin and is considered an autoimmune disease.

- a. What are the characteristics of an autoimmune disease?

1 MARK

In MS, there is a breakdown of the myelin sheath. Damage to the myelin sheath can interfere with communication between parts of the central and the peripheral nervous systems.

- b. i. What is the myelin sheath?

- ii. What is its function?

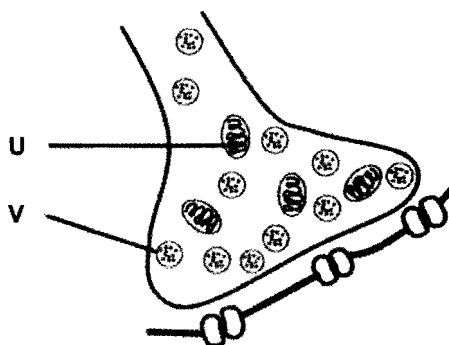
1 + 1 = 2 MARKS

For a person who does not have MS, communication signals between the central and the peripheral nervous systems are unimpaired.

- c. By what method are communication signals principally transmitted in the nervous system?

1 MARK

The diagram shows the junction between two neurons.



- d. i. Identify structure U.

What is its function?

- ii. Identify structure V.

What is its function?

1 + 1 = 2 MARKS

Between the two neurons there is a gap known as a synaptic cleft.

- e. How does the communication signal travel across this gap?

3 MARKS

TOTAL 9 MARKS

Question 8

The human body acts in many ways to guard against infection and disease. Sometimes these lines of defence are not always effective and a person may become infected with a pathogen. *Clostridium tetani* is a bacterial micro-organism that causes a disease called tetanus.

- a. What is the difference between an infection and a disease?

1 MARK

If the first line of defence fails and *Clostridium tetani* enters the body, a series of responses occurs. Cells known as phagocytes play a significant role in the second line of defence.

- b. How does a macrophage contribute to second-line defence?

1 MARK

Complement proteins are blood proteins that assist phagocytes in recognising pathogenic micro-organisms. There are around 20 known complement proteins.

- c. Outline one way that complement proteins can assist phagocytes in recognising pathogenic micro-organisms.

1 MARK

If *Clostridium tetani* has entered the body through the skin, there may be some inflammation at the site of entry.

- d. Explain what causes the inflammation in the area.

1 MARK

- e. What chemical is associated with the inflammatory response?

1 MARK

- f. State whether this response is an example of non-specific or specific immunity.

1 MARK

The current program against vaccine-preventable diseases in Australia recommends that infants, children and adults be immunised against tetanus at the age of 2 months, 4 months, 6 months, 4 years and around 15 years, with a booster every 5 years afterwards.

- g. Why is it necessary to have so many immunisations in the first 6 months of life?

1 MARK

TOTAL 7 MARKS