insight

exam revision series

BIOLOGY

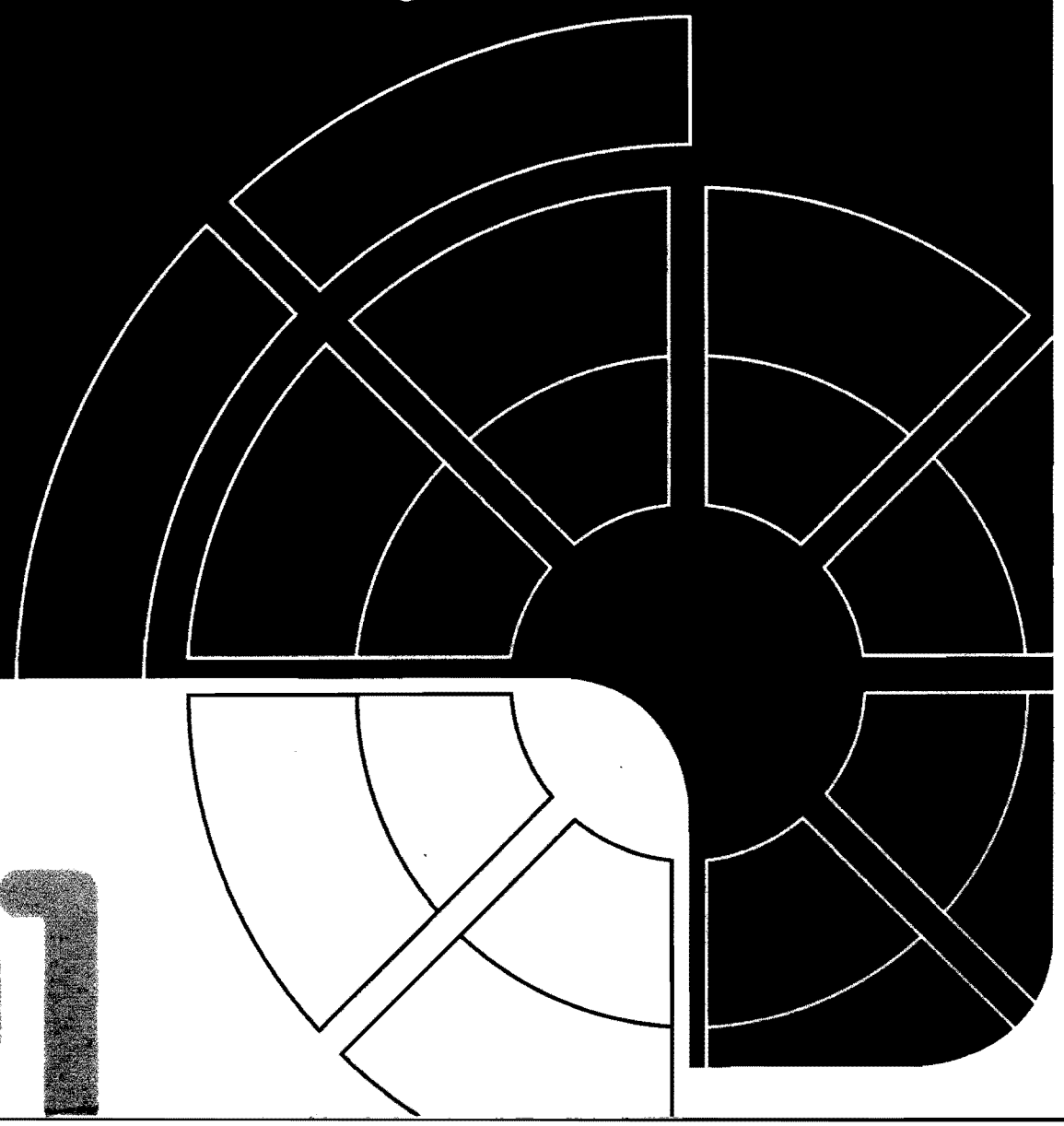
EXAM 1

Complete revision resource for VCE Year 12 students

Full range of questions on each section of exam

Detailed worked answers/solutions

Excellent tips, mark allocations and Assessor annotations throughout



EXAM 1

CONTENTS

This is more than a book of sample exams!

What makes this series the most useful revision resource for students and teachers?

It's a practice tool: To be successful in the actual exam, you really need to have a thorough knowledge of your subject and be able to understand and deal with any type of question that comes your way. That's why you should practise tackling as many questions as possible.

This book contains 3-4 complete sample exams papers set out in a similar format to official exams and covering all aspects of the course. You can fill in answers directly on the page, then go to the back of the book to check your answers against those supplied in the Answer/Solutions section.

It's a learning and revision tool: You also need to know which areas of the subject you might need to focus your revision on more or anything you don't yet understand. That's why we asked our exam writers to provide more than answers or solutions to each question or problem. We asked them to provide **detailed workings** for Accounting, Maths and the Sciences, **in-depth explanations** on the topic of the question, as well as **exam tips** – how to approach this type of question, things to look out for and the mark allocation for each part of the answer/solution.

PRACTICE EXAM 1

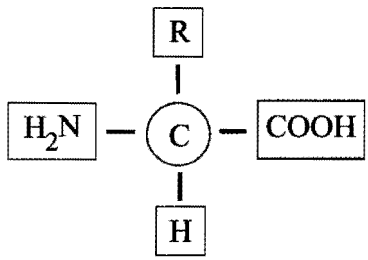
SECTION A / MULTIPLE-CHOICE QUESTIONS

INSTRUCTIONS FOR SECTION A

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 required for Questions 1 and 2.
There are over 100 amino acids found in living cells however there are only 20 which commonly occur in proteins. The behaviour of each amino acid is determined by its chemical structure.

Question 1
The general structure of an amino acid can be represented by the following diagram.



Each amino acid has different chemical properties due to the presence of the

A. carboxyl group (COOH).
B. amine group (NH_2).
C. hydrogen atom (H).
D. side chain (R).

Question 2
The formation of polypeptide chains can begin when two amino acids are joined together by a peptide bond. This process is best described as

A. amino acid + amino acid → dipeptide + water (condensation).
B. amino acid + amino acid → dipeptide + hydrogen (condensation).
C. amino acid + amino acid ← dipeptide + water (hydrolysis).
D. amino acid + amino acid ← dipeptide + hydrogen (hydrolysis).

Question 3
Polypeptide chains can undergo precise folding to form fibrous or globular proteins. Globular proteins fold into a spherical shape, have a tertiary structure and are water soluble. They are most likely to exhibit

A. α-helix coils, β-pleated sheets and have a structural role in cells.
B. α-helix coils, β-pleated sheets and have a contractile role in cells.
C. α-helix coils, β-pleated sheets, disulfide bridges and have a transport role in cells.
D. α-helix coils, β-pleated sheets, disulfide bridges and have a structural role in cells.

The following information is required for Questions 4 and 5.
Some organisms have organelles possessing membranes, which are the site of energy transfer.

Question 4
In organisms that photosynthesise, the organelle responsible for converting radiant energy to chemical energy is the

A. chlorophyll.
B. chloroplast.
C. thylakoid membrane.
D. granum.

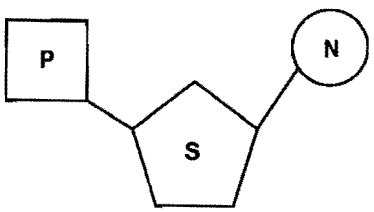
Question 5
The stroma is the liquid interior of the organelle in which the light independent phase of photosynthesis occurs. Molecules that are produced directly from the light independent phase could include

A. PGAL.
B. NADPH.
C. ATP.
D. CO_2.

Question 6
The carbohydrates α-glucose and β-glucose have the same chemical formula and are known as structural isomers because their atoms are arranged differently. Fructose and glucose are also structural isomers and are examples of monosaccharides, unlike

A. deoxyribose which is an example of a polysaccharide.
B. sucrose which is an example of a polysaccharide.
C. cellulose which is an example of a polysaccharide.
D. maltose which is an example of a polysaccharide.

Question 7
Nucleic acids are the biomacromolecules which pass on inherited information from generation to generation. The diagram shows a nucleotide, the basic unit of a nucleic acid which is comprised of three subunits.



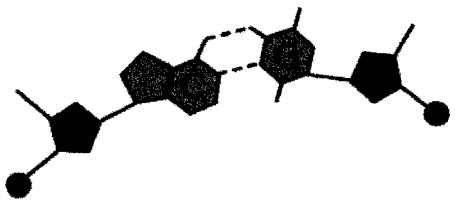
Nucleotides would **NOT** be found in

A. adenosine triphosphate (ATP).
B. ribonucleic acid (RNA).
C. flavine adenine dinucleotide (FAD).
D. acetyl co-enzyme A (acetyl CoA).

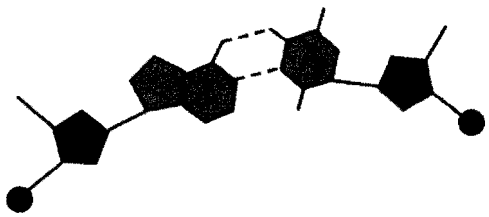
Question 8

Deoxyribonucleic acid (DNA) is comprised of a double strand of nucleotide bases linked together in a specific bonding pattern. The nucleotide bases are attracted to each other and form hydrogen bonds. In the diagrams below, which representation shows the correct structural arrangement of complementary nucleotide base pairs?

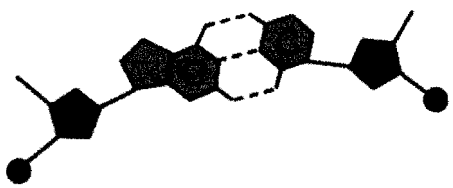
A.



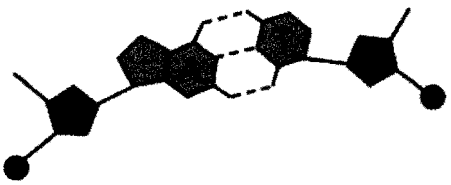
B.



C.



D.



Question 9

Enzymes are molecules which act as organic catalysts in biochemical processes. An enzyme will

A. lower the activation energy needed to catalyse a metabolic reaction.

B. increase the activation energy required to catalyse a metabolic reaction.

C. only ever bind one substrate molecule in its active site.

D. undergo a permanent change in its tertiary structure only after participating in a metabolic reaction.

Question 10

Metabolic reactions can occur simultaneously within organisms. Some of these reactions release energy while others require energy to proceed. A student was asked to construct a table summarising the relationship between metabolic reactions, identifying the energy requirements and reaction type for each. Which of the following is the only correct statement?

	Reaction		
A.	cellular respiration	endergonic	catabolic
B.	chemical digestion (hydrolysis)	exergonic	catabolic
C.	photosynthesis	exergonic	anabolic
D.	protein synthesis	exergonic	anabolic

Question 11

Cells are involved in the production of many different biomacromolecules, many of which must be packaged and transported out of the cell. Polypeptides that require such transport are synthesised by

A. the smooth endoplasmic reticulum.

B. the Golgi apparatus.

C. free ribosomes found in the cytosol.

D. membrane-bound ribosomes.

The following information is required for Questions 12 and 13.
Proteomics is the study of proteins and their structure and function. The term proteome is a hybridisation of the words protein and genome. The proteome is the entire collection of proteins produced by an organism during its lifetime, whilst the genome is the full complement of genes.

Question 12
Proteomics is considered more complex than genomics because

A. the genome of an organism is relatively constant unless the environment changes.
B. proteins are smaller molecules than genes.
C. the proteome of an organism varies due to its biochemical interactions with the genome and the environment.
D. everything about the human genome has been discovered.

Question 13
Proteomics relies on the use of many technologies in order to increase understanding of the proteome. One such technology is the use of gel electrophoresis which can be used to identify the

A. relative mass of a protein.
B. relative length of a protein.
C. three dimensional structure of a protein.
D. relative amounts of the different amino acids in protein.

Question 14
In the past, drugs were often discovered and developed through a haphazard process of trial and error. In contrast, rational drug design uses knowledge of the specific chemical responses of an organism, to develop an appropriate and effective treatment. Examples of rational drug design would NOT involve

A. determining the activity of a drug at its binding site.
B. the use of three-dimensional information about biomacromolecules.
C. testing chemical substances on organisms and correlating the effects with treatments.
D. preventing the function of a key molecule, thereby interrupting a metabolic pathway.

Question 15
Adenosine diphosphate (ADP) has the potential to become the principle energy carrier for a cell. With the addition of a phosphate, ADP is converted to adenosine triphosphate (ATP). An energy releasing molecule that would NOT be involved in the conversion of ADP to ATP would be

A. glucagon.
B. glycerol.
C. glycogen.
D. glucose.

Question 16
Follicle stimulating hormone (FSH) is a peptide hormone which is released from the pituitary gland into the bloodstream. It is transported through the circulatory system until reaching target cell receptors in the ovaries. Receptors for peptide hormones are found

A. in the cytosol of target cells.
B. on the plasma membrane of target cells.
C. in the nuclear membrane of target cells.
D. within the nucleus of target cells.

Question 17

Sensory receptors act as biological signal transducers when they detect stimuli and respond with the generation of an electrochemical signal which will always demonstrate particular properties. Which one of the following statements is NOT a true property of the receptor cell response?

A. The frequency of impulses in a receptor cell is directly proportional to the strength of the stimulus.

B. Action potentials are generated from within the cell body of an axon.

C. Sensory cells demonstrate sensory adaptation and will eventually stop responding to a stimulus.

D. The receptor cell response has the capacity to change energy from one form to another.

Question 18

In mammals, pheromones are used as a means of communication with other organisms. Rabbits are known to release a mammary pheromone which initiates feeding behaviour in the young. A pheromone is a chemical

A. produced by an organism and travels in the bloodstream to its target tissue.

B. which acts interspecifically.

C. which is large, inert and insoluble in water.

D. produced by an organism and is released into the external environment.

Question 19

Like animals, plants also possess biochemical and structural defence mechanisms. These defence mechanisms can be classified into two different groups. Passive defences are barriers of a structural or chemical nature whereas active defences are triggered in direct response to physical attack or infection by a pathogen. An example of active defence in plants is

A. sealing off infected areas with the production of cork cells.

B. bad tasting chemicals that deter insects.

C. a thick waxy cuticle to act as a barrier against pathogenic enzymes.

D. hairs on the stomata to prevent entry by pathogens.

Question 20

The immune system relies entirely on the coordination of the humoral and cell-mediated responses. The humoral immune response is associated with the serum and involves the action of antibodies. The humoral response effectively protects the body against

A. parasitic protozoans, fungi and worms.

B. viruses and bacteria found within cells.

C. circulating viruses and bacterial toxins.

D. the development of tumours that cause cancer.

The following information is required for Questions 21 and 22.
In humans, normal body temperature can range from 36.2°C – 37.8°C. When a pathogen infects an organism, one observable response is an increase in body temperature (fever) which is caused by a change in the body's thermostat. An increase in body temperature can be beneficial as it facilitates defence responses.

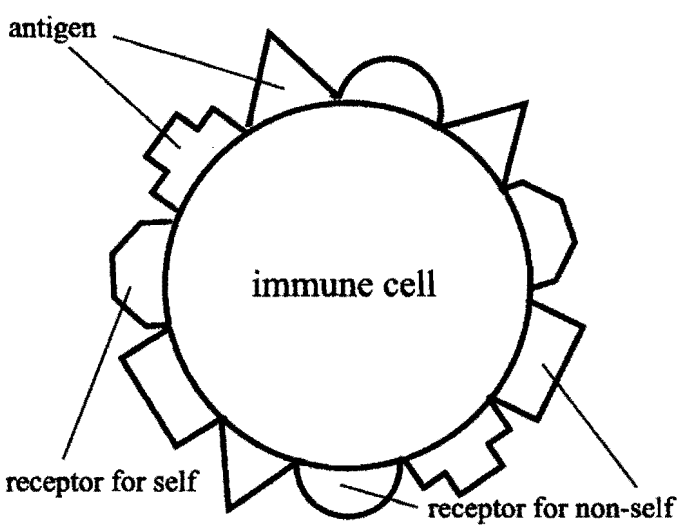
Question 21
Fever would NOT

A. speed up metabolism to assist in the repair of body tissues.
B. increase heart rate to enable more efficient supply of white blood cells to sites of infection.
C. be due to the release of pyrogens which set the body's thermostat at a higher temperature.
D. be associated with vasoconstriction which causes shivering.

Question 22
The raising of the body's thermostat to a slightly higher temperature is an example of positive feedback. Positive feedback mechanisms

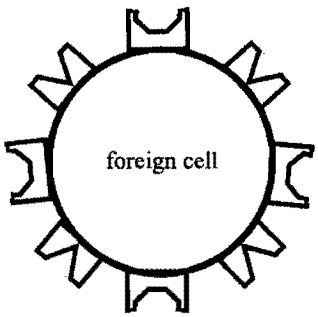
A. trigger a response that counteracts the original stimulus.
B. are always harmful to living organisms.
C. trigger a response that amplifies the original stimulus.
D. are never harmful to living organisms.

Question 23
Immune cells carry many different kinds of receptors on their plasma membrane. Immune cells are capable of recognising the nature of the threat posed by non-self cells. The more non-self antigens detected by an immune cell, the greater the response will be when it comes into contact with a foreign cell. The diagram shows an example of an immune cell.

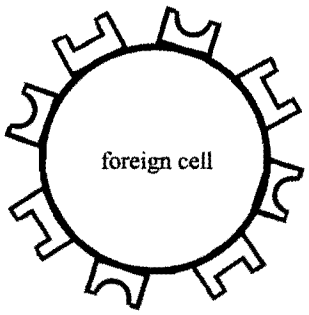


Which of the following foreign cells (below) is likely to induce the greatest response from the immune cell shown above?

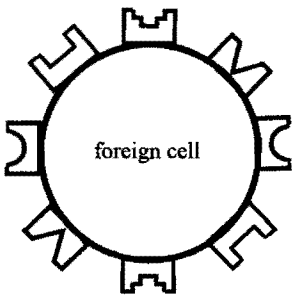
A.



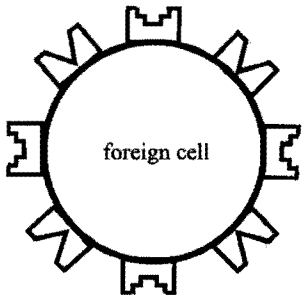
B.



C.



D.



The following information is required for Questions 24 and 25.

Triple Antigen is a multivalent vaccine made from a mixture of toxoids from organisms causing diphtheria and tetanus, in addition to killed organisms from strains of *Bordetella pertussis*. The vaccine is administered by deep intramuscular injection to infants at the age of 2 months, 4 months and 6 months.

Question 24

Following intramuscular administration, Triple Antigen stimulates production of antibodies which protect against the diseases caused by each of the three infective organisms. This response should provide the immunised infant with

A. natural passive immunity.
B. natural active immunity.
C. induced passive immunity.
D. induced active immunity.

Question 25

Effective protection requires the administration of three consecutive injections of Triple Antigen, preferably at 4 to 8 week intervals. It is necessary to schedule three injections because

A. at this early stage of life, the toxoids are naturally absorbed from the infant bloodstream.
B. immunity is usually not acquired until the third administration.
C. the immature immune system cannot produce any antibodies until the third administration of toxoids.
D. the antibodies provided in the vaccination have a short lifespan.

SECTION B / SHORT-ANSWER QUESTIONS

INSTRUCTIONS FOR SECTION B

Answer this section in pen.
Answer all questions in the spaces provided.

Question 1

Carbonic anhydrase is found in red blood cells where it catalyses a reaction to form carbonic acid from carbon dioxide and water. The carbonic acid then readily dissociates into a hydrogen ion and bicarbonate ions. This enables the transport of carbon dioxide (produced during cellular respiration in cells) from the tissues of the body to the lungs.

$$CO_2 + H_2O \xleftarrow{\text{carbonic anhydrase}} H_2CO_3 \longleftrightarrow H^+ + HCO_3^-$$

1a. Name the class of biomacromolecules that carbonic anhydrase is a member of.

1 MARK

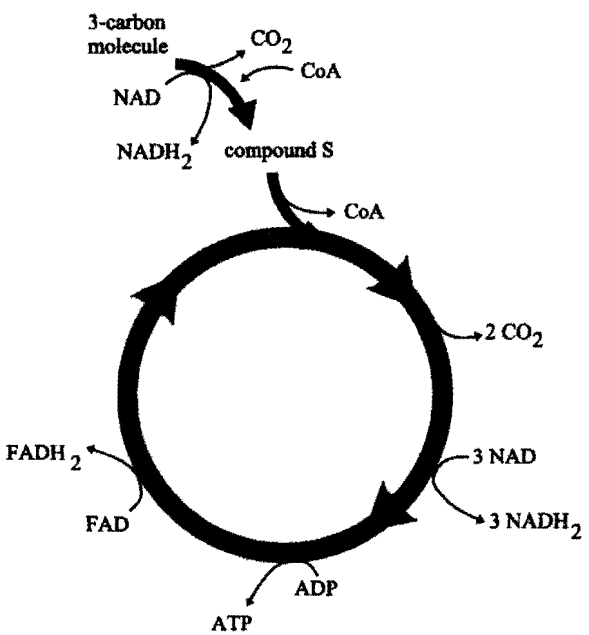
1b i. What is a transmembrane channel?

1 MARK

1b ii. Why must bicarbonate ions use transmembrane channels to leave a cell?

1 MARK

Cellular respiration is a process essential to all living cells. The following diagram summarises the Krebs cycle.



1c i. Where exactly does the Krebs cycle occur?

1 MARK

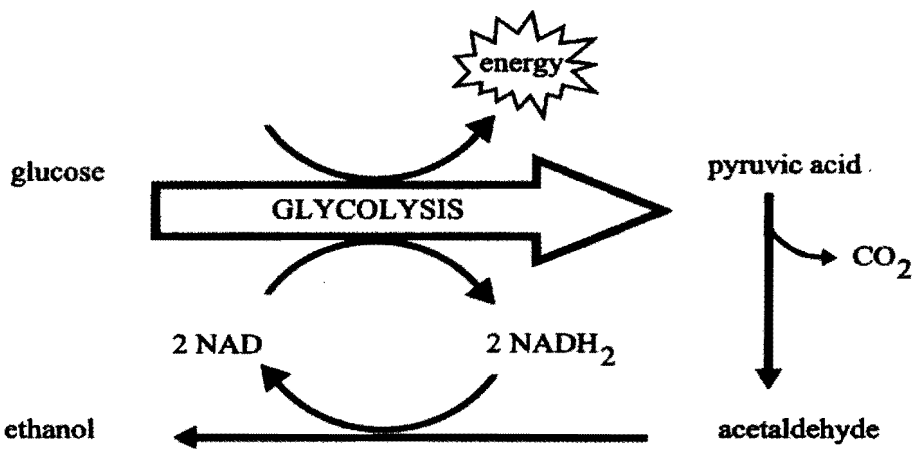
1c ii. What is the name of the 3-carbon molecule that is the source of compound S?

1 MARK

1c iii. During the Krebs cycle, what chemical process results in the formation of 'loaded' acceptor molecules?

1 MARK

Saccharomyces cerevisiae is a species of yeast that has been used in baking and the production of alcoholic beverages for many centuries. In the presence of oxygen, yeast are capable of performing cellular respiration. In the absence of oxygen, glycolysis still occurs in the cytosol, however if there are no molecules available to accept the electrons produced by the glycolytic pathway, the process stops. This is represented in the following diagram.



1d. What is the name of this process?

1 MARK

1e. Explain why this process cannot continue indefinitely.

1 MARK

1f. What conclusion can be made about the efficiency of this process? Explain your answer.

1 MARK

TOTAL 9 MARKS

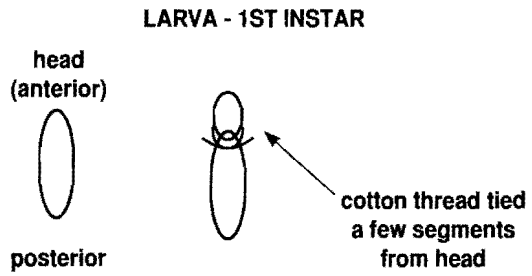
Question 2

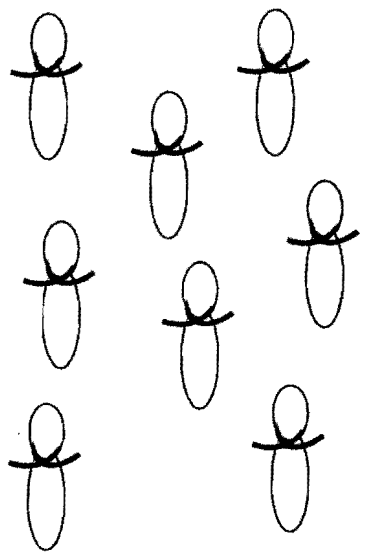
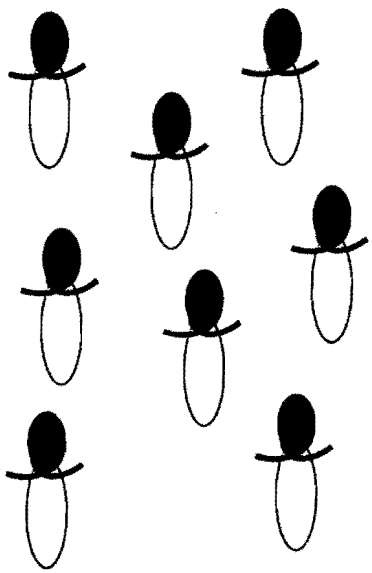
The blowfly, *Chrysomya rufifacies*, is capable of picking up faint traces of the odour of decay and can fly up to 20 km in search of a suitable corpse in which to lay eggs. After hatching, the larvae of the blowfly will grow and moult, three times. At the end of the third growth stage (3rd instar), the larva leaves the corpse and burrows into the ground where it develops into a pupa. After around 14 days of reorganisation, the pupa emerges as an adult fly. The life cycle of *Chrysomya rufifacies* is described in the following diagram.

egg → larva (1st instar) → larva (2nd instar) → larva (3rd instar) → pupa → adult

When a larva develops into a pupa, the larval case darkens in colour, becoming thin and forming a rigid case inside which the adult blowfly will develop.

It is known that pupation is under the control of a hormone. A researcher carried out an experiment to investigate this idea.



Larvae (0 hours)	Larvae (96 hours)
	

2a. State the hypothesis being tested by the researcher.

1 MARK

2b. Do the experimental results support the researcher's hypothesis? Explain the reason for your choice.

2 MARKS

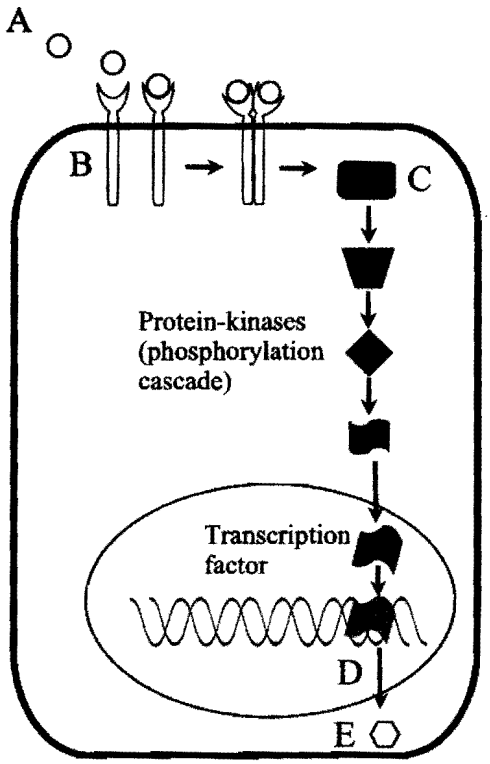
2c. Design an experiment that would enable you to determine the time at which the hormone controlling pupation becomes active.

3 MARKS

TOTAL 6 MARKS

Question 3

Cell growth can be controlled by the action of a regulatory signalling pathway. The cell cycle is stimulated due to the action of an intracellular molecule known as *Ras*. The diagram illustrates the signalling pathway that regulates cell growth.



3a i. What is substance A?

1 MARK

3a ii. Explain what is happening to substance A at structure B. Why is this process essential in the signalling pathway?

2 MARKS

3b i. The molecule represented at C is known as *Ras*. By what other name could it be known?

1 MARK

3b ii. What is the name of the process which occurs during the phosphorylation cascade?

1 MARK

3c i. What will occur at D?

1 MARK

3c ii. Explain the likely function of substance E?

1 MARK

TOTAL 7 MARKS

Question 4

Maple-syrup urine disease (MSUD) is an autosomal recessive disorder in which the body is unable to properly process certain amino acids and is characterised by progressive neurological dysfunction and a sweet, burnt-sugar or maple-syrup smell in the urine. Generally, newborns appear normal at birth however within 4 – 7 days symptoms, including vomiting, lethargy, failure to thrive, seizures and coma, begin to appear. MSUD can be life-threatening if untreated and affects an estimated 1 in 225,000 infants worldwide.

Affected individuals carry high levels of the amino acids leucine, isoleucine and valine which are present in many kinds of food, especially protein-rich foods such as milk, meat, and eggs. One type of mutation occurs in the E1α gene in which there is an A → T substitution at position 438.

The DNA triplet sequences found at position 438 in the normal and mutated gene are shown below.

Normal E1α Exon 9 sequence **↓438**

Nucleotide sequence ACCTACGGGGAGCACAACCCACTGGATCACTTC

Mutated E1α Exon 9 sequence **↓438**

Nucleotide sequence ACCTACGGGGAGCACTACCCACTGGATCACTTC

4a i. How many amino acids does the normal E1α Exon 9 sequence code for?

_____

1 MARK

4a ii. In the table below, write the base sequences for the mutant triplet in the complementary strand of DNA.

Normal	Mutant
AAC	TAC
TTG	

1 MARK

4b i. What does the **A** in AAC stand for?

_____

1 MARK

4b ii. Explain why a substitution in the E1α gene of A ® G at position 438 does not change the expression of the gene.

_____

_____

1 MARK

4c. What is one advantage of early newborn diagnosis?

_____

1 MARK

Two methods are available to test for MSUD in individuals. A comparison of the two methods is shown in the table below.

	PCR-RFLP Assay	Taqman Assay
Samples tested	127	126
Samples requiring repeat testing	48	10
% repeat samples	38%	8%
% agreement	100%	100%
Relative sensitivity	20 µl	1 – 5 µl
Newborn screening time	11 – 14 hours minimum	4 – 5 hours

4d. Explain which method is likely to lend itself more to commercial application.

1+1=2 MARKS

TOTAL 7 MARKS

Question 5

All living organisms encounter predators and parasites during their lifecycle. Observations of the interactions between hosts and their parasites provide a clear example of evolutionary adaptation. As the host evolves strategies that give it greater protection from a parasite, the parasite evolves counterstrategies. There are many ways by which parasites can evade host defence strategies.

5a. Identify one pathway by which parasites can enter a host.

1 MARK

5b. Describe the likely immune response of the host to the presence of the resident flatworm.

2 MARKS

5c. What is the advantage of the host's response if the resident flatworm is not killed?

1 MARK

5d i. Explain what is meant by the term 'self'.

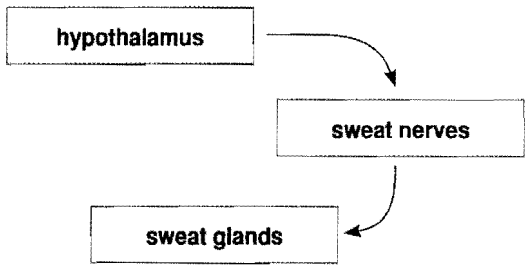
1 MARK

5d ii. Suggest how the flatworms could present as 'self'.

1 MARK

TOTAL 6 MARKS

Question 6



In humans, sweating is a normal process which the body uses to control temperature and hydrate the skin. Primary hyperhidrosis is an inherited condition which affects around 2 – 3 % of the population. It is characterised by an abnormally increased level of sweating (mostly from the hands, feet and underarms), in excess of that required for control of body temperature. The actual cause of primary hyperhidrosis is unknown, one theory suggests that the brain overstimulates the glands that are responsible for sweating. Normally, the hypothalamus sends sensory signals to the sweat nerves. These nerves, part of the sympathetic nervous system, are located in the chest cavity and send signals to the sweat glands causing the production of sweat. This pathway is shown in the diagram above.

6a. Is the overstimulation of sweat glands in primary hyperhidrosis likely to be due to the action of the autonomic or somatic nervous system? Explain.

1 MARK

6b i. Name a hormone that might be involved in this pathway.

1 MARK

6b ii. Explain the role of this particular hormone in this pathway.

1 MARK

It is possible to treat hyperhidrosis using a surgical procedure known as endoscopic thoracic sympathectomy (ETS). ETS involves the cutting or clamping of the sympathetic nerve node and has been shown to reduce excessive sweating.

6c. Explain how cutting segments of the sympathetic nerve node can control excessive sweating.

1 MARK

TOTAL 4 MARKS

Question 7

Multiple sclerosis (MS), affecting 1 in 1000 people of northern European origin, is a disease of the central nervous system in which oligodendrocytes, cells which make up the myelin in the brain and spinal cord, are destroyed.

7a. What is the function of myelin?

1 MARK

MS is also known as an autoimmune disorder and typically begins early in adult life and includes symptoms such as numbness, tingling, muscle weakness and eventually paralysis.

7b i. What is an autoimmune disorder?

1 MARK

7b ii. What cells are most likely to be involved in this response?

1 MARK

The exact cause of MS is unknown however is it thought to occur when individuals who have a genetic predisposition to the disorder are exposed to viruses, triggering a process known as molecular mimicry.

7c. Clearly outline how and why molecular mimicry is likely to occur.

2 MARKS

TOTAL 5 MARKS

Question 8

Recently, in order to prevent the transmission of illnesses, hospitals have emphasised the need for strict hand hygiene in their staff. In an assessment of 124 staff at a particular hospital, it was found that 47 were wearing lanyards around their necks, 10 of which carried *Staphylococcus aureus*. In addition, plastic badges attached to lanyards were also found to be carrying the bacteria S. *aureus* and *Enterococcus* spp.

Staphylococcus aureus and *Enterococcus* spp are both bacterial pathogens.

8a i. What is a pathogen?

1 MARK

8a ii. What are two characteristics these bacterial species would have in common?

Characteristic 1:

Characteristic 2:

1+1=2 MARKS

Staphylococcus aureus is normally a harmless strain of bacteria, however it has become a superbug known as methicillin-resistant *Staphylococcus aureus* (MRSA). In Australian hospitals, MRSA infects 2000 patients (killing 33% of infected individuals) annually.

8b. What is meant by the term methicillin-resistant?

1 MARK

8c i. Suggest one reason why MRSAs have persisted as a problem in hospitals.

1 MARK

8c ii. Identify one method which could be employed to control the spread of MRSAs in hospitals.

1 MARK

TOTAL 6 MARKS

END OF PRACTICE EXAM 1

SECTION A – MULTIPLE-CHOICE QUESTIONS

INSTRUCTIONS FOR SECTION A

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

Fats, oils and waxes are macromolecules also known as lipids. They are known for their lack of affinity with water. Triglycerides are a form of fat and are

A. the only lipids which form a solid at room temperature.
B. always composed of carbon, hydrogen, oxygen and nitrogen.
C. made of a single fatty acid molecule to which three glycerides are attached.
D. made of a single glycerol molecule to which three fatty acids are attached.

Question 2

The formula that represents a polysaccharide is compound

A. $C_{312}H_{520}O_{260}$
B. $C_{736}H_{1161}N_{184}O_{208}S_3$
C. $C_6H_{12}O_6$
D. $C_{51}H_{98}O_6$

Question 3

Myoglobin is an oxygen-binding protein found in the muscle tissue of vertebrates. Myoglobin does not have a quaternary structure because it

A. exhibits no β-pleated sheets.
B. only contains 153 amino acids in its chain.
C. is a single-chain globular protein.
D. demonstrates no peptide bonds in its structure.

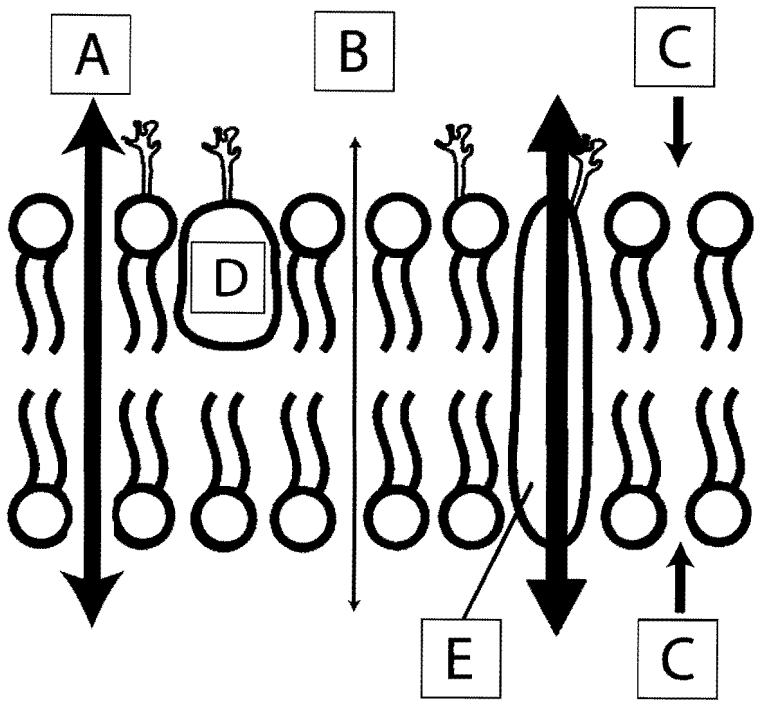
Question 4

Apoptosis and necrosis are both processes that result in cell death. Necrosis occurs as a result of significant chemical or mechanical damage to the plasma membrane of a cell. Apoptosis

A. only occurs in cells of damaged tissue.
B. occurs in response to signals via the mitochondrial pathway.
C. occurs in response to signals via the ribosomal pathway.
D. only occurs in embryos.

The following information is required for Questions 5 to 7.

Cells are capable of exchanging many substances across the plasma membrane. The plasma membrane can selectively control the movement of molecules entering and leaving the cell.



Question 5

The movement of substances across the plasma membrane, represented by arrows **A**, **B** and **C**, is best described as

A. bulk transport.
B. endocytosis.
C. exocytosis.
D. diffusion.

Question 6

Crossing the plasma membrane occurs via many processes including passive and active transport. Arrows represent the pathways of lipid-soluble molecules (**A**), small uncharged molecules (**B**) and most water-soluble molecules (**C**) across a plasma membrane. The substances crossing the plasma membrane at **A**, **B** and **C** are most likely to be

A. proteins (**A**), sugars (**B**), chloroform (**C**).
B. alcohol (**A**), urea (**B**) and proteins (**C**).
C. ions (**A**), water (**B**) and carbon dioxide (**C**).
D. sugars (**A**), alcohol (**B**) and amino acids (**C**).

Question 7

The plasma membrane is comprised of many structures, all of which contribute to its functioning. In order, the structures labelled **D** and **E** represent

A. cholesterol and protein channel.
B. phospholipid and glycoprotein.
C. protein channel and cholesterol.
D. glycoprotein and protein channel.

Question 8

Proteomics is the name given to the study of the proteome of an organism. A proteome is best described as all the

A. proteins produced by a single cell or organism in a particular environment.
B. genes produced by a single cell or organism in a particular environment.
C. polysaccharides produced by a single cell or organism in a particular environment.
D. glycoproteins produced by a single cell or organism in a particular environment.

Question 9

Scientists have moved away from studying components of the proteome in isolation because

A. there are too many components and research funding is not readily available.
B. proteomes are too complex in structure to study in isolation.
C. proteomes do not act in isolation from each other.
D. there are only a few components and it is more efficient to group them together.

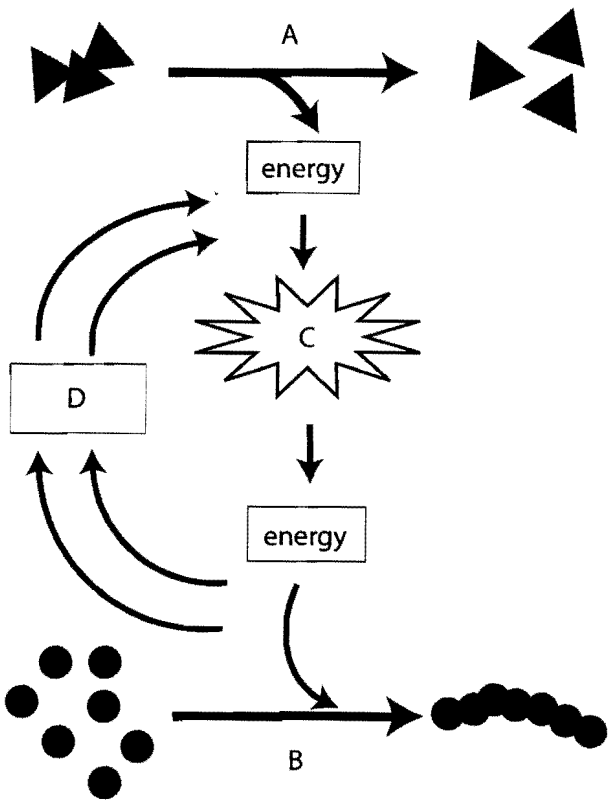
Question 10

In order to function, living cells link amino acids to make proteins. The organelles directly responsible for the assembly of proteins include

A. ribosomes, chloroplasts and Golgi apparatus.
B. ribosomes, chloroplasts and lysosomes.
C. ribosomes, mitochondria and chloroplasts.
D. ribosomes, mitochondria and the nucleus.

The following information is required for Questions 11 and 12.

Thousands of metabolic reactions occur simultaneously within living cells. Some of these reactions release energy while others require energy to proceed.



Question 11

In the diagram, **A** could be an example of

A. photosynthesis.
B. cellular respiration.
C. reduction.
D. anabolism.

Question 12

In the diagram, **C** and **D** respectively are examples of

A. ATP and ADP + P_i
B. ATP and ADP_i
C. ADP_i + P and ATP
D. ADP_i and ATP

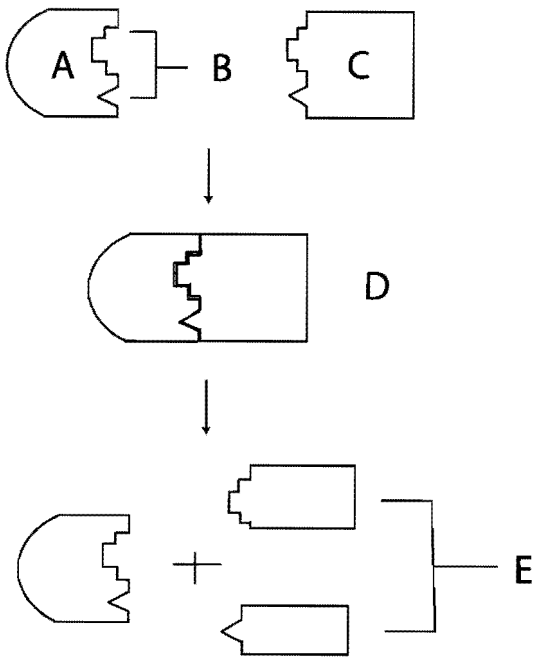
Question 13

Enzymes are biological catalysts which are highly specific in their action and reduce the amount of energy required to enable metabolism in living organisms. Which of the following statements is **not** correct?

A. There are two theories of enzyme action: 'lock-and-key' and 'induced-fit'.
B. Enzyme activity is affected by pH, temperature and concentration of enzyme and substrate.
C. Enzymes are made exclusively of protein.
D. Enzyme inhibition can occur if a compound binds competitively with the active site of enzymes.

Question 14

Compound **A** is a protein.



The correct names of the parts **B**, **C**, **D** and **E** in order are

A. substrate, active site, enzyme-substrate complex, products.
B. active site, substrate, products, enzyme-substrate complex.
C. active site, enzyme-substrate complex, substrate, products.
D. active site, substrate, enzyme-substrate complex, products.

Question 15

Photosynthesis is a metabolic process in which autotrophic organisms harness radiant energy to produce organic compounds from inorganic substances. The process occurs in two stages. Photosynthetic pigments, which include chlorophylls, carotenoids and phycobilins, are integral to the process of harnessing radiant energy. Radiant energy is converted to chemical energy. Trapping of radiant energy is known as the _____-_____ _____and occurs within the _____ of the _____ on the _____.

A. light-dependent reaction, chloroplasts, thylakoid membranes, grana.

B. light-dependent reaction, grana, chloroplasts, thylakoid membranes.

C. light-independent reaction, thylakoid membranes, grana, chloroplasts.

D. light-independent reaction, grana, chloroplasts, thylakoid membranes.

Question 16

The second stage of photosynthesis is reliant on some of the outputs from the conversion of radiant energy to chemical energy. These outputs are

A. NADPH and ATP.

B. NADPH, ATP and CO_2.

C. $NADP^+$, ATP and CO_2.

D. $NADP^+$ and ADP + P_i.

Question 17

Homeostatic mechanisms regulate the internal environment of birds and mammals and can be described as stimulus-response mechanisms. In a stimulus-response model, a change (stimulus) in the external and internal environment is detected by receptors and a response is produced by effectors. There are two types of stimulus-response model: the negative feedback and the positive feedback systems. Which of the following is **not** true about negative feedback systems?

A. Negative feedback mechanisms act to restore the original homeostatic state of an organism.

B. Negative feedback mechanisms act to increase the effect of the original disturbance.

C. Most negative feedback systems operate as proportional control systems.

D. Some negative feedback systems operate as on-off control systems.

Question 18

Endocrine glands are ductless glands that produce hormones and release them directly into the bloodstream. Sometimes in mammals, endocrine glands may not function appropriately, resulting ultimately in detrimental effects. Which of the following accurately represents an endocrine defect with its likely effect?

	DEFECT	EFFECT
A.	overactive pituitary	decrease in metabolic rate
B.	underactive thyroid	overproduction of thyroxine
C.	overactive adrenal gland	prolonged fight-or-flight response
D.	overactive parathyroid gland	decrease in blood calcium levels

The following information is required for Questions 19 to 21.

Cells can communicate with each other through signalling molecules, which are chemicals that can act on nearby cells, travel to another location within the body or even interact with cells in another organism.

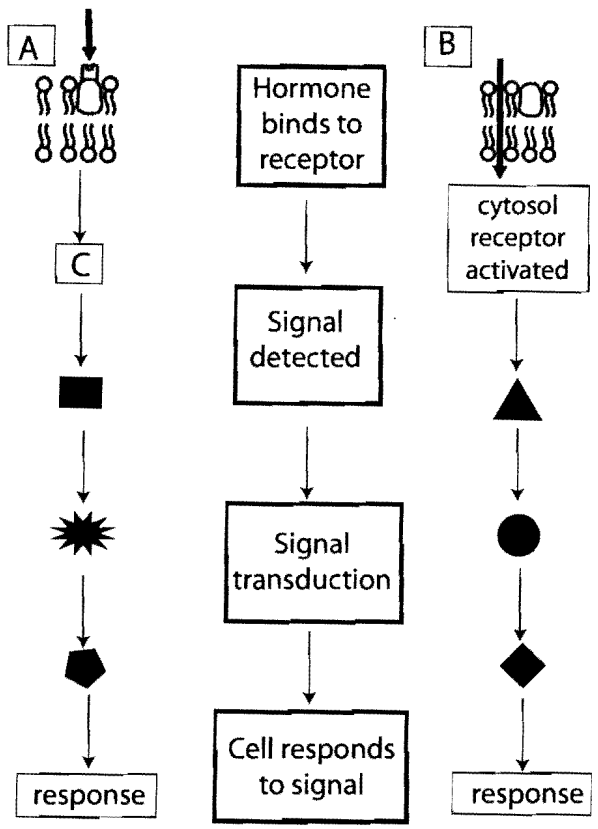
Question 19

Hormones are signalling molecules and, based on their chemical structures, are classified into three groups. Which of the following is correct about the synthesis and life span of the three groups of hormones?

	AMINO ACID DERIVATIVES	STEROID HORMONES	PEPTIDE HORMONES
A.	synthesised in advance, short life span	synthesised on demand, long life span	synthesised in advance, short life span
B.	synthesised on demand, long life span	synthesised in advance, short life span	synthesised on demand, long life span
C.	synthesised in advance, short life span	synthesised in advance, short life span	synthesised on demand, long life span
D.	synthesised on demand, long life span	synthesised on demand, long life span	synthesised on demand, long life span

Question 20

The chemical nature of hormones influences the manner in which they transmit signals to the inside of a cell. The diagram indicates the sequence of events that occurs in signalling pathways, depending on the chemical nature of the hormone. The pathway at **A** is taken by water-soluble hormones and the pathway at **B** is taken by lipid-soluble hormones.



Pathway B would be taken by

A. amino acid derived hormones.
B. protein hormones.
C. steroid hormones.
D. peptide hormones.

Question 21

Water-soluble hormones bind with receptors found on cell membranes. This activates a cascade of chemical reactions, also known as signal transduction, which is sustained by water-soluble molecules. At C, signal transduction could be initiated by a

A. relay molecule.
B. G protein.
C. transduction molecule.
D. primary messenger.

Question 22

An axon is an extension of a nerve cell along which nerve impulses are transmitted. Axons can range from a few millimetres to over a metre in length and can be linear or branching. The presence of a myelin sheath provides insulation which increases the rate at which an impulse is conducted along the axon. When a nerve impulse reaches an axon terminal, the next event is

A. transmitter substance binds to a receptor molecule on the muscle cell membrane.
B. transmitter substance is inactivated by an enzyme.
C. transmitter substance is secreted from a neuron.
D. the muscle cell contracts.

Question 23

Neuron transmission can be interrupted by adverse events. Substances such as venom contain toxins that can act on the nervous system to affect the neuromuscular synapses or to block the transmission of an impulse along an axon. Compounds known as antivenoms can be used to rapidly reverse the effects of venom. Antivenoms contain

A. antigens which bind with antibodies in the venom to form an antigen–antibody complex.
B. antibodies which bind with antigens in the venom to form an antigen–antibody complex.
C. toxoids which are capable of destroying the active site of the venom.
D. plasma cells which are capable of producing antibodies to act against the venom.

Question 24

A group of proteins that are important in immunity are interferons. Interferons are released by some cells when the cells have been infected with virus particles. Interferons act on uninfected cells by making them more resistant to the infecting virus. Other important proteins associated with non-specific immunity include

A. complement proteins and cytokines.
B. complement proteins and MHC markers.
C. cytokines and antibodies.
D. cytokines and immunoglobulins.

Question 25

A woman is exposed to chicken pox (*Varicella zoster* virus) in her second month of pregnancy. She has never been exposed to chicken pox or immunised against it. She consults her health practitioner who recommends treatment with varicella-zoster immunoglobulin (VZIG), a substance that triggers an immune response against the virus. This method of treatment will provide the woman with

A. natural passive immunity.
B. natural active immunity.
C. induced passive immunity.
D. induced active immunity.