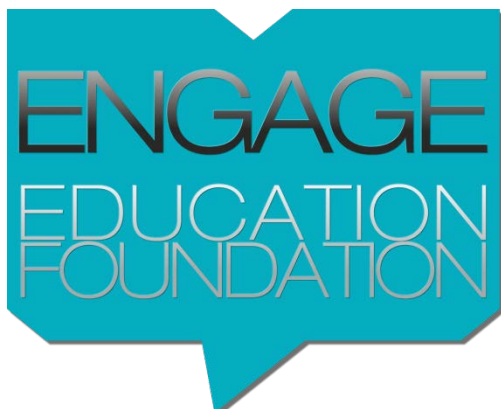




A **non-profit** organisation **supporting** students to **achieve** their best.

Unit 3 Biology

Practice Exam Question and Answer Booklet

Duration: 15 minutes reading time, 90 minutes writing time

Structure of book:

Section	Number of questions	Number of questions to be answered	Number of marks
A	25	25	25
B	7	7	50
Total			75

- Students are permitted to bring into the examination room: pens, pencils, highlighters, erasers 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:

- This question and answer booklet of 19 pages.

Instructions:

- You must complete all questions of the examination.
- Write all your answers in the spaces provided in this booklet.

Section A – Multiple-choice questions

Instructions

Answer all questions by circling your choice.

Choose the response that is correct or that best answers 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.

Questions

Question 1

A red blood cell was left in concentrated salt solution for 24 hours. The cell would:

- A. Become turgid
- B. Lyse
- C. Crenate
- D. Plasmolise

Question 2

An onion skin cell was left in distilled water for 24 hours. The cell would:

- A. Become turgid
- B. Lyse
- C. Crenate
- D. Plasmolise

Question 3

Pepsin is an enzyme that breaks down proteins in the stomach. It would be reasonable to assume that Pepsin is a:

- A. Fibrous protein
- B. Nucleic acid
- C. Nitrogenous base
- D. Globular protein

Question 4

The percentage of adenine in a sample of DNA was found to be 27 percent. The percentage of guanine in the same sample would thus be:

- A. 27 percent
- B. 73 percent
- C. 23 percent
- D. 32 percent

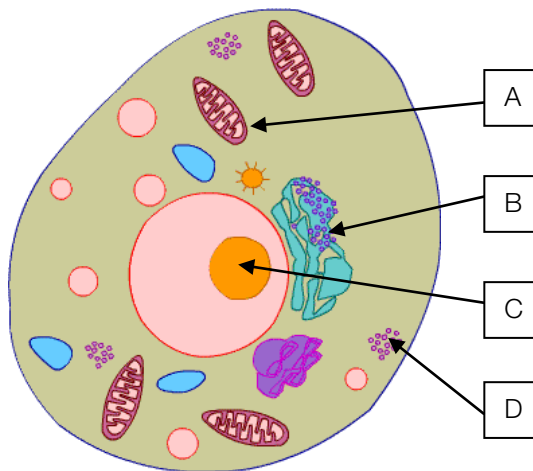
Question 5

Synthesis of the protein receptors on the cell membrane takes place on:

- A. Golgi Apparatus
- B. Rough Endoplasmic reticulum
- C. Lysosomes
- D. Nucleus

Question 6

The conversion of three carbon sugar molecules to ATP occurs in which organelle of the animal cell shown below?



- A. Organelle A
- B. Organelle B
- C. Organelle C
- D. Organelle D

Question 7

The final acceptor molecule of the electron transport chain in aerobic respiration is:

- A. Oxygen
- B. Carbon dioxide
- C. ATP
- D. NADP

Question 8

The outputs of the water splitting (light dependent) phase of photosynthesis are:

- A. 2 ATP, water, loaded acceptor molecules
- B. Water, oxygen, 2 ATP
- C. Loaded acceptor molecules, water, oxygen
- D. Oxygen, 2 ATP, Loaded acceptor molecules.

Question 9

The light dependent phase of photosynthesis occurs in the

- A. Grana
- B. Stroma
- C. Christae
- D. Matrix

Use the following information to answer questions 10 and 11:

The specific biological pathway for the synthesis of enzyme X is as follows:

Enzyme A catalyses the production of protein C, which binds onto the allosteric enzyme Y, which changes it's active site to provide a platform for substrates B and D to join to form enzyme X.

Question 10

If substrate D is unavailable within the cell, a build-up of which molecules would be observed?

- A. Substrate D and Enzyme Y
- B. Substrate B and Enzyme X
- C. Substrate B and Enzyme Y
- D. Substrate D and Enzyme X

Question 11

Enzyme Y is allosteric. An allosteric enzyme:

- A. is an enzyme which requires another enzyme/protein to bind to its active site, which changes the shape of its allosteric site in order to fit the substrate.
- B. is an enzyme which requires another enzyme/protein to bind to its allosteric site, which changes the shape of its active site in order to fit the substrate.
- C. is an enzyme which requires another enzyme/protein to bind to its active site, which changes the shape of its active site in order to fit the substrate.
- D. is an enzyme which requires another carbohydrate to bind to its allosteric site, which changes the shape of its active site in order to fit the substrate.

Question 12

An example of passive immunity is:

- A. Becoming ill with chicken pox only once in your life
- B. Obtaining a common cold and recovering from it without the use of antibiotics
- C. Pest flies on a food crop being resistant to a particular pesticide
- D. Receiving the anti-venom from a horse's blood for a snakebite

Question 13

A desert mouse would have:

- A. An shortened loop of Henle and dilute urine
- B. A lengthened loop of Henle and concentrated urine
- C. A shortened loop of Henle and concentrated urine
- D. A lengthened loop of Henle and dilute urine

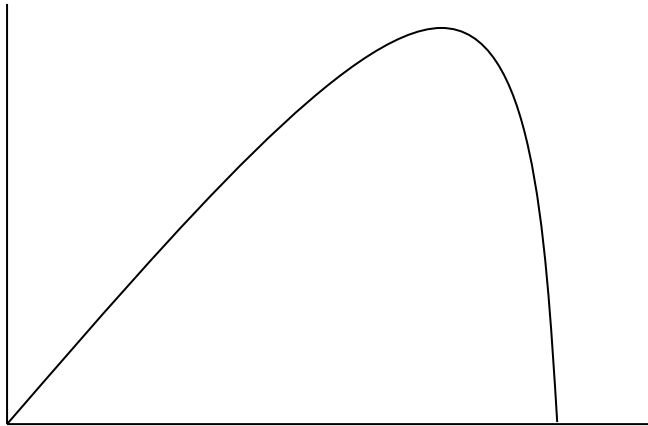
Question 14

Fish kept in fish bowls without proper filtration inevitably die. This is because:

- A. The concentration of ammonia in the fish bowl becomes too concentrated
- B. The concentration of urea in the fish bowl becomes too concentrated
- C. The concentration of uric acid in the fish bowl becomes too concentrated
- D. All of the above

Question 15

The following graph could represent:



- A. Enzyme activity versus substrate concentration
- B. Rate of reaction versus enzyme concentration, with limited substrate concentration
- C. Rate of reaction versus substrate concentration, with limited enzyme concentration
- D. Enzyme activity versus rate of reaction

Question 16

Fibrin is a:

- A. Secondary protein involved in the formation of muscle
- B. Tertiary protein involved in the synthesis of skin cells
- C. Secondary protein involved in the clotting of blood
- D. Steroid hormone involved in male reproduction

Question 17

The smooth endoplasmic reticulum is responsible for the

- A. Synthesis of proteins
- B. Packaging of proteins for export from the cell
- C. Synthesis of lipids
- D. Packaging of lipids for export from the cell

Question 18

The electron transport chain produces how many electrons?

- A. 32 or 34
- B. 36
- C. 36 or 38
- D. 32-34

Question 19

What are the products of anaerobic fermentation in plant cells?

- A. Ethanol and lactic acid
- B. Lactic acid and carbon dioxide
- C. Carbon dioxide and ethanol
- D. Ethanol

Question 20

What is the name of the molecule that enters the mitochondrion to initiate cellular respiration?

- A. Glucose
- B. Pyruvate
- C. Pyruvic fluid
- D. Glycogen

Question 21

What is an embolism in plants?

- A. A blockage of the phloem due to a build-up of sucrose, or low amounts of sucrose
- B. A rupture in the xylem
- C. A blockage in the xylem due to air bubbles, frozen water or low water
- D. A rupture in the phloem

Question 22

Plants adapted to live in hot dry conditions are:

- A. Xerophytes
- B. Halophytes
- C. Aridophytes
- D. Hydrophytes

Question 23

If depolarisation along neurons is large enough, what is generated?

- A. Neurotransmitters
- B. An action potential
- C. Generation of an impulse
- D. A synapse

Question 24

Schwann cells can be found on the:

- A. Axon
- B. Dendrite
- C. Neurotransmitters
- D. Axon terminal

Question 25

B cells mature in the:

- A. Thymus
- B. Liver
- C. Bone marrow
- D. Blood stream

Section B – Short-answer questions

Instructions

Answer all questions in the spaces provided.

Unless otherwise indicated, the diagrams in this book are not drawn to scale.

Questions

Question 1

- a. Explain, with the use of diagrams, the difference between saturated, monounsaturated and polyunsaturated fats, and why we are so regularly encouraged by health food experts to opt for the latter two in our diet.

2 marks

- b. Though one is a plant and the other is an animal, discuss the functional similarities of a potato and a liver.

2 marks

- c. Name one type of RNA and briefly give a description of its function.

2 marks

- d. Using a diagram, illustrate how the Adenine Triphosphate (ATP), molecule provides energy for cellular processes.

2 marks

Total: 8 marks

Question 2

- a. What is an enzyme?

2 marks

A class of biology students sought to test the effect of very high and low pHs on the enzyme mythase. Mythase is involved in the reaction between substrate X and Y to form product Z (a gaseous product), which is a central reaction in the digestive system.

- b. Design an experiment to test the effect of pH upon mythase.

3 marks

- c. Through the experiment, the students discovered that the enzyme functioned much better at a very low pH, compared to a neutral or high pH. From this information, where in the digestive system might mythase be?

1 mark

- d. With reference to the structure of myxase, explain why it may function well at a low pH, but not at all at a high pH.

2 marks

- e. With the help of a diagram, explain how two amino acids join to form a peptide bond.

2 marks

Total: 10 marks

Question 3

- a. Explain why a yellow banana, when placed in a paper lunch bag with an overripe orange, will become brown within a day.

2 marks

- b. Briefly complete the following table:

Plant tropism or hormone response	Positive/Negative/Not applicable	Hormone(s) responsible	Brief function of this/these hormones
Phototropism towards sun light of plant tip			
Geotropism up out of the ground			
Growth of lateral buds			
Flowering			

4 marks

Total: 6 marks

Question 4

The fight-or-flight response is a natural bodily response to potentially dangerous situations where stress hormones (Adrenaline, for example) are released from the adrenal glands to prepare an animal for either a fight or a flight response to danger. The response is characterised but not limited by actions such as shaking, tunnel vision, acceleration of heart/lung activity, increase in blood sugar levels and pupil dilation.

- a. Explain whether this is a nervous response, a hormonal response or both.

2 marks

The production of the hormone adrenaline is a biological pathway characterised by a series of enzyme enhanced biological reactions. The last step is a hormone called noradrenaline, which not only works with adrenaline, but also produces it. Suppose a person was producing too much adrenaline, and suffering the adverse side effects such as increased blood pressure, constantly raised metabolic rate, and feelings of anxiousness.

- b. Outline a potential drug that could be synthesised to overcome this.

3 marks

Total: 5 marks

Question 5

- a. Explain why, in cases of fever, human body temperature will be raised to around 40 degrees Celsius, but if it is raised much higher there is a real cause for concern. If possible, include a graph in your answer.

2 marks

- b. A person is bitten by a dog. Initially, blood flow to the wound appears unrestricted, but after a period of minutes it is obvious that the flow of blood is slowing. Describe briefly the process that is occurring, outlining whether it is a specific or non-specific immune response.

2 marks

Total: 4 marks

Question 6

Anticodons in Transfer RNA join to codons in messenger RNA in a process known as translation; that is, the synthesis of polypeptides. Various anticodons and the amino acids they are associated with are shown below:

AAA- Phe
AAG- Phe
UAC- Met
AUU- stop
AUC- stop
ACU- Thr
UGG- Gly
GCG- Gly
GGU- Pro
AGA- Ser

- a. Explain why there is more than one anticodon associated with the single amino acid Glycine (gly).

1 mark

- b. Write out the DNA sequence of bases that would code for the complete polypeptide below. While there may be more than one acceptable answer, only one is required.

Met – Phe – Gly – Thr - Ser

1 mark

- c. Describe the process in which the messenger RNA is synthesised in the nucleus.

2 marks

Total: 4 marks

Question 7

While she was cooking in the kitchen, boiling water spilt on the bench where Christina's hand was resting. Before she realised, her hand retracted from the bench.

- a. What is a reflex?

1 mark

- b. What is the benefit of a reflex over the usual stimulus-response model in circumstances such as Christina's?

1 mark

- c. Complete the table below:

	Part of the central nervous system, peripheral nervous system, or both?	Brief description of function
Thermoreceptors on the skin		
Hypothalamus		

2 marks

Total: 4 marks

Question 8

Cytochrome C is a molecule that exists within mitochondria and usually aids the electron transport chain during aerobic respiration. However, when injury occurs to cells, cytochrome C is released into the cytoplasm, which triggers the assembly of apoptosomes which, in turn, control the action of caspase proteases in cells. These proteases work in a process known as apoptosis by digesting key cellular proteins, so that the cell may die in order to be replaced by healthy cells.

Multiple Appendagal Aflomosis (MAA) is an autoimmune disease where the muscles one's arms and legs are slowly broken down. In this condition, the apoptotic process in muscle cells is stopped from occurring excessively through extrinsic factors such as molecules released by T cells.

- a. What is an autoimmune disease?

1 mark

The average concentration of cytochrome C in the cytoplasm of fresh muscle cells from people affected by MAA was compared with that in healthy cells before and after they were subjected to excessive UV radiation.

	5 minutes before irradiation	1 minute before irradiation	1 minute after irradiation	5 minutes after irradiation	20 minutes after irradiation
Cytoplasmic concentration of cytochrome c in muscle cells of healthy individuals ($\mu\text{ mL}^{-1}$)	0.7	0.6	0.9	6.3	0.1
Cytoplasmic concentration of cytochrome c in muscle cells of MAA individuals ($\mu\text{ mL}^{-1}$)	4.8	2.1	0.3	0.1	0.2

- b. Account for the differing concentrations between the MAA and healthy individual's cells 5 minutes after irradiation.

2 marks

- c. Why does the cytoplasmic concentration of cytochrome c decrease between 5 and 20 minutes after irradiation?

2 marks

Individuals may be genetically predisposed to developing MAA in later life; however it may also be triggered by infection of the MAA-inducing retrovirus.

- d. Outline the lifecycle of a typical virus.

2 marks

- e. What distinguishes retroviruses from normal viruses?

1 mark

- f. Viruses can be targeted to specific marker molecules on different cell types. With this knowledge, which type of cell in the body would the MAA-inducing retrovirus infect?

1 mark

Total: 9 marks

End of Booklet