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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 15 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.

Question 1

Amylase is a type of enzyme involved in the breakdown of starches in the stomach. It would be reasonable to conclude that amylase is a:

- A. Storage protein
- B. Contractile protein
- C. Globular protein
- D. Hormonal protein

Question 2

Which one of the following combination of processes could have been involved in the production of mammalian urine?

- A. Endocytosis, diffusion and osmosis.
- B. Active transport, diffusion and exocytosis.
- C. Diffusion, active transport and osmosis.
- D. Osmosis, diffusion and secretion.

Question 3

The membrane bound organelle containing digestive enzymes for the destruction of substances no longer required by the cell is:

- A. endosome
- B. peroxisome
- C. melanosome
- D. lysosome

Question 4

Biological Engineering is:

- A. The design, manufacture and synthesis of 'designer drugs' which work due to molecular specificity to target a particular disease or disorder
- B. The design of drugs to fit the specific lock and key structures of induced fit enzymes
- C. The generation of energy through biological fuels
- D. The manufacture of 'designer drugs' which can target a wide range of diseases due to specific molecular arrangements.

Question 5

Compound Y is composed of carbon, phosphorous, nitrogen, oxygen and sulphur. Compound Y is a:

- A. Carbohydrate
- B. Lipid
- C. Amino Acid
- D. Nucleic acid

Question 6

Which of the following properties of water make it efficient in cooling organisms down?

- A. The cohesive nature of its molecules
- B. High specific heat capacity
- C. High polarity due to large differences in electronegativities of oxygen and hydrogen molecules
- D. Its ability to neutralise heat

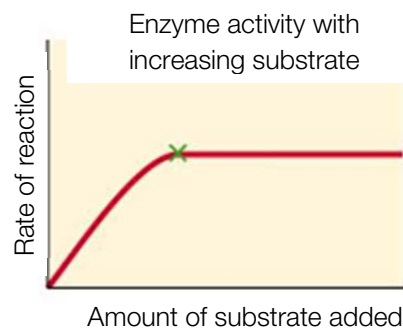
Question 7

Which of the following is **not** a measure that needs to be taken in experimental set ups to ensure conclusive results?

- A. Large sample size
- B. Repetition of experiment
- C. Inclusion of a control
- D. Safe laboratory techniques

Question 8

The graph depicted below shows the rate of enzyme activity (lactase) as substrate (lactose) is increased. The graph levels off at point X because:



- A. All enzyme active sites are temporarily occupied
- B. No more substrate is being added
- C. The amount of product produced has reached a constant level
- D. The enzyme has been denatured

Question 9

The study of the proteome is important to biologists because

- A. It encompasses all the genetic material in the cell and the way in which genes are linked.
- B. It means that a detailed database is kept of every protein found in humans, and this information can be used to create drugs and treat certain diseases.
- C. It details the complete array of proteins found in a cell and their interactions
- D. It encompasses all proteins and genes involved in infection and disease.

Question 10

The percentage of the nitrogenous base thymine in human DNA is 31.5 percent. This means that:

- A. The percentage of Uracil in DNA is 31.5 percent
- B. The percentage of Guanine in RNA is 31.5 percent
- C. The percentage of Cytosine in DNA is 18.5 percent
- D. The percentage of Adenine in RNA is 18.5 percent

Question 11

Steroid hormones have specific receptor sites only found on certain target cells. These receptors would be found

- A. In the plasma membrane
- B. On glycoproteins in the plasma membrane
- C. Protein Channels in the plasma membrane
- D. In the cytosol of target cells

Question 12:

Which of the following temperature regulation systems does NOT assist cooling in plants?

- A. Leaves with a large surface area
- B. Positioning of stomata towards the ground
- C. Evaporation of water from plants
- D. Closing of stomata in the hottest part of the day

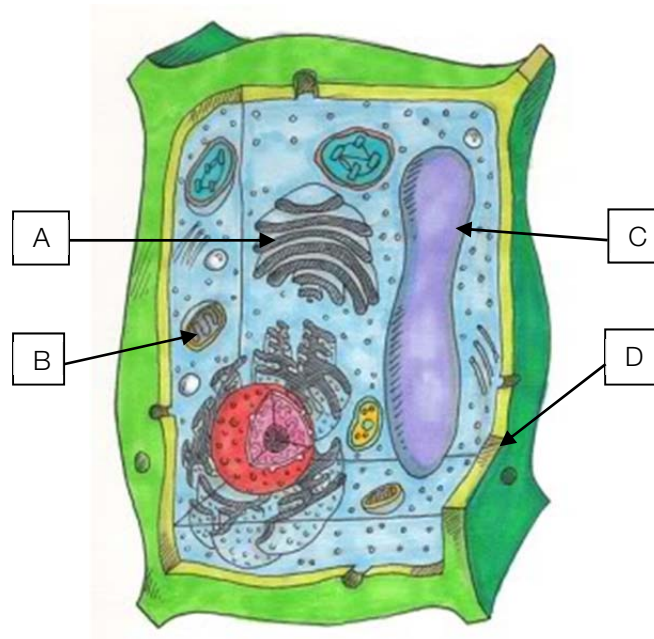
Question 13

The function of nephrons is to:

- A. Remove urine from the blood
- B. Filter waste products from the blood
- C. Filter waste products from the urine
- D. Remove glucose, amino acids and other ions from the blood.

Question 14

The following diagram depicts a plant cell.



It would be reasonable to conclude that the vacuole is:

- A. Structure A
- B. Structure B
- C. Structure C
- D. Structure D

Question 15

The organelles involved in the secretion of products from the cell are:

- A. vesicles and endoplasmic reticulum
- B. golgi apparatus and ribosomes
- C. golgi apparatus and vesicles
- D. endoplasmic reticulum and golgi apparatus

Question 16

A shoot tip bending towards light is due to

- A. Positive phototropism
- B. Negative phototropism
- C. Positive geotropism
- D. Negative geotropism

Question 17

Apical dominance in flowering plants is due to:

- A. Auxin produced in the lateral buds
- B. Auxin produced in the meristem
- C. Gibberellins found throughout the entire plant
- D. Absciscic acid found in the lateral buds

Question 18

The section of a chloroplast in which the light independent phase of photosynthesis occurs is called the:

- A. Granum
- B. Thylakoid membrane
- C. Stroma
- D. Chlorophyll

Question 19

The protein involved in the coagulation of plasma cells in blood clotting is called

- A. Fibrin and it is a secondary protein
- B. Collagen and it is a secondary protein
- C. Fibrin and it is a tertiary protein
- D. Collagen and it is a tertiary protein

Question 20

The breaking down of 6-carbon glucose molecules to 3-carbon pyruvate molecules in glycolysis is:

- A. An anabolic, hydrolysis reaction
- B. A catabolic, hydrolysis reaction
- C. An anabolic, dehydration reaction
- D. A catabolic, dehydration reaction

Question 21

An enzyme is denatured when:

- A. Irreversible damage is done to the protein structure of its active site due to changes in temperature and pH.
- B. Irreversible damage is done to the protein structure of the entire enzyme due to changes in temperature and pH.
- C. Irreversible damage is done to the protein structure of its active site due to changes in temperature and pH outside the enzyme's optimal range.
- D. Irreversible damage is done to the protein structure of the entire enzyme due to changes in temperature and pH outside the enzyme's optimal range.

Question 22

The final acceptor molecule in the electron transport chain is:

- A. Carbon dioxide
- B. NADH⁺
- C. FADH₂
- D. Oxygen

Question 23

Which of the following reaction models most accurately represents the action of an enzyme?

Key: E-Enzyme, S₁-Substrate 1, S₂-Substrate 2, P₁-Product 1, P₂-Product 2

- A. $E + S_1 \rightarrow P_1 + P_2$
- B. $E + P_1 + P_2 \rightarrow S_1 + E$
- C. $S_1 + E \rightarrow E + P_1 + P_2$
- D. $S_1 + S_2 \rightarrow E + P_1$

Question 24

The Krebs cycle occurs in the:

- A. Mitochondrial matrix
- B. Mitochondrial cristae
- C. Mitochondrial cytosol
- D. Mitochondrial membrane

Question 25

Pain is caused by:

- A. An overstimulation of mechanoreceptors in the skin
- B. Damage to the ends of mechanoreceptors in the skin
- C. Inflammation from the non specific immune response
- D. Inflammation from the specific immune response

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.

- i. What is the name for the hormone involved in the dropping of leaves in deciduous trees?

1 mark

- ii. Briefly compare the modes of transport of hormones in plants compared to animals.

1 mark

- b. A hormone was produced in a human endocrine gland and travelled to its target cell, which was located adjacent to another type of cell. The hormone came in contact with this other cell, but the cell did not respond to it. Explain the reason for this.

2 marks

c.

- i. Consider a human hormone you have studied this year. Name the hormone and the endocrine gland it is produced in.

1 mark

- ii. Explain how this hormone has its effect, making reference to signal transduction.

2 marks

- iii. Draw a negative feedback loop involving this hormone.

2 marks

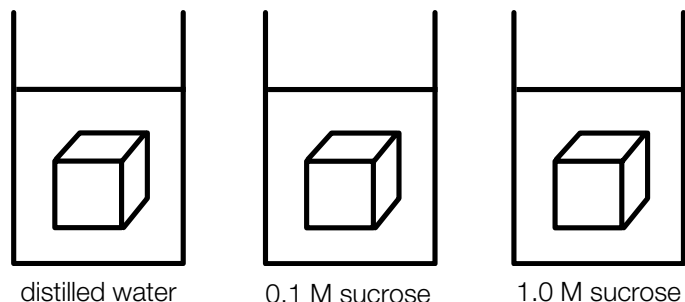
Total 9 marks

Question 2

- a. Outline the function of the phospholipid bilayer of a cell membrane through use of a labelled diagram showing all major structures and macromolecules.

3 marks

- b. An experiment was set up as shown below with 1 cm x 1 cm x 1 cm potato cubes. The concentration of sucrose in each of the potato cubes is 0.1 M. A potato cube was placed in a beaker containing 50 mL distilled water, another potato cube was placed in a beaker containing 50 mL 0.1 M sucrose solution and a third potato cube was placed in a beaker containing 50 mL 1.0 M sucrose solution, as shown below:



Fill in the following table of expected experimental results:

Beaker	Potato cube appearance	Type of solution (isotonic/hypertonic/hypotonic) that the potato was placed in	Biological term describing the cells of the potato cube
1			
2			
3			

3 marks

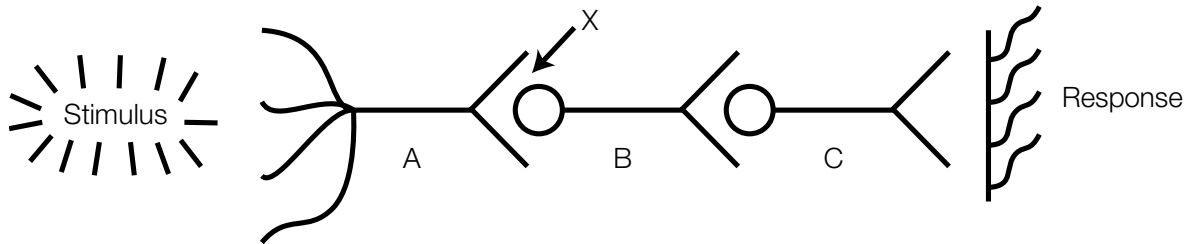
- c. Explain how altering the pH of a solution can alter the function of a plasma membrane.

2 marks

Total 8 marks

Question 3

The diagram below shows a nervous response with three neurons, A, B and C being involved in detecting a stimulus, sending a nervous impulse and generating a response.



- a. What is the term to describe an action potential strong enough to generate a nervous response?

1 mark

- b. When this action potential has been generated, electrical changes occur in the molecule. Briefly describe these changes, referring to specific ions.

2 marks

- c. In a reflex arc response, one of these neurons would be missing. Explain which neuron (A, B or C) this would be.

2 marks

- d. Name a stimulus and the type of receptors that detect it that cause the nervous response of shivering.

2 marks

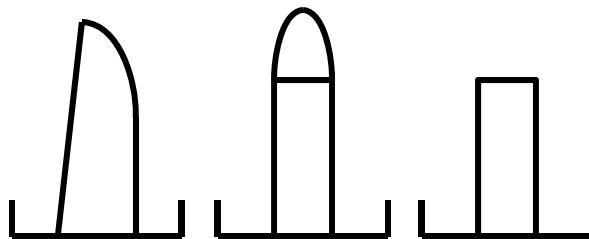
- e. Explain how the stimulus detected in question d. is transmitted at point X in the diagram, which represents an interneural synapse.

1 mark

Total 8 marks

Question 4

An experiment was set up to analyse the effects of the plant hormone auxin. 3 shoots were grown in identical conditions with one plant left intact, one with its coleoptile removed and then replaced and one with its coleoptile tip removed and not replaced. All were subjected to equal light, H₂O, CO₂ and nutrients. The following diagram represents the experimental set up.



- a. Name the independent and dependent variables.

1 mark

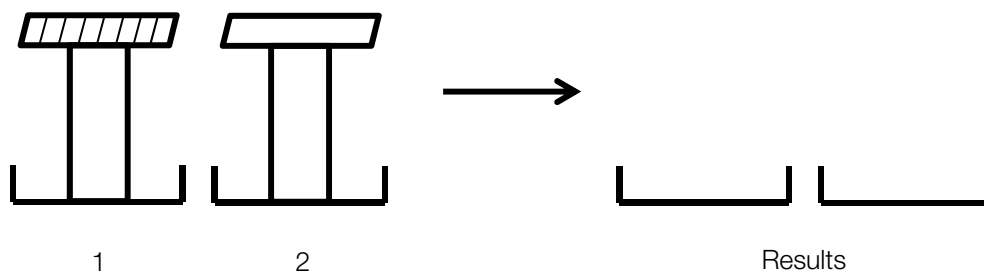
- b. What is the purpose of the shoot left intact?

1 mark

- c. Draw the expected results of the experiment.

1 mark

- d. In the second part of the experiment, two more plant shoots were added with their tips cut off, one with an agar block soaked in juices (plant 1) from ground up coleoptiles tips and one with a plain agar block on it. The diagram below represents the experimental set up of these two new plants. Draw the expected results in the spaces on the right, and briefly explain the results for plant 1.



2 marks

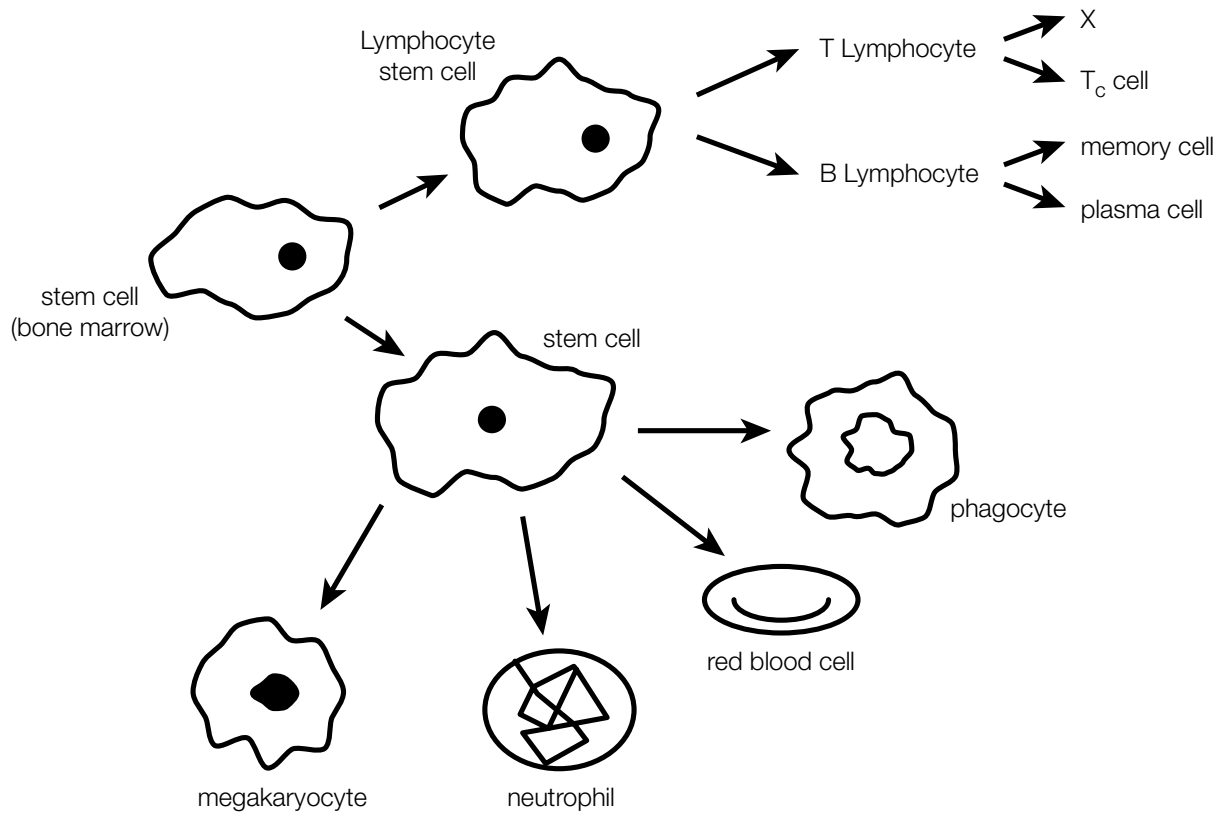
- e. What steps must be taken in experimental set ups such as this one to achieve conclusive results?

2 marks

Total 7 marks

Question 5

Stem cells from the bone marrow can differentiate into a number of specialised cells, some of which are involved in the immune response.



a.

- i. From the diagram above, select a cell involved in the **specific** immune response and outline its function.

2 marks

- ii. From the diagram above, select a cell involved in the **non specific** immune response and outline its function.

2 marks

- iii. Name another type of T cell, represented by X on the diagram above.

1 mark

- b. Recently, there has been much research into possible treatments of diseases caused by autoimmune attacks on cells.

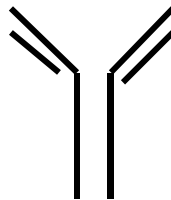
i. What is meant by the term autoimmune disease?

1 mark

ii. What chemicals are present in the blood of a person with an autoimmune disease and that of someone without the disease?

1 mark

iii. On the following diagram of an antigen, circle the binding sites.



1 mark

c.

i. Explain the key difference between active and passive immunity.

1 mark

ii. For each of the examples listed below, circle whether they are examples of active or passive immunity.

A person is given a dose of anti-venom found in the blood of a horse following a dangerous snake bite. Active / Passive

After contracting chicken pox, you never contract it again. Active / Passive

A baby is automatically resistant to German measles after drinking the breast milk of its mother, who has immunity. Active / Passive

3 marks

Total 12 marks

Question 6

The messenger RNA (mRNA) triplets shown below are called codons. They each contain the codes for specific amino acids, as indicated:

UUU- Phe
UUC- Phe
AUG- Met
UAA- stop
UAG- stop
UGA- Thr
ACC- Gly
GGC- Gly
CCA- Pro
UCU- Ser

- a. Phenylalanine (phe) is one amino acid. Why are there two different codons coding for it? (2 marks)

2 marks

- b. Write the template DNA sequence for a polypeptide: **met-phe-pro**. Note that there are multiple acceptable answers, you only need to give one.

2 marks

- c. Describe the process in which an mRNA molecule is synthesised in the nucleus, and name this process. (2 marks)

2 marks

Total 6 marks

End of Booklet