



L-Università  
ta' Malta

MATRICULATION AND SECONDARY EDUCATION CERTIFICATE  
EXAMINATIONS BOARD

**INTERMEDIATE MATRICULATION LEVEL  
2023 SECOND SESSION**

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SUBJECT: **Biology**  
DATE: 5<sup>th</sup> September 2023  
TIME: 4:00 p.m. to 7:05 p.m.

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### Directions to Candidates

- Write your index number in the space at the top left-hand corner of this page.
- Answer **ALL** questions in Section A and **TWO** questions from Section B.
- Write all your answers to questions from Section A in the spaces provided in this booklet. Candidates are advised that under no circumstances should answers to Section A be submitted in the separate answer booklet provided.
- Write all your answers to questions from Section B in the separate answer booklet provided.
- If more than two questions from Section B are attempted, only the first two answers shall be taken into consideration.
- The mark allocation is indicated at the end of each question. Marks allocated to parts of questions are also indicated.
- You are reminded of the necessity for good English and orderly presentation in your answers.
- In calculations you are advised to show all the steps in your working, giving your answer at each stage.
- The use of electronic calculators is permitted.

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### For examiners' use only:

Question	1	2	3	4	5	6	7	8	9	10	Total
Score											
Maximum	10	10	10	10	10	25	25	25	25	25	100

**SECTION A: Answer ALL questions in this section.**

1. This question is about cell membranes.

The figure below shows part of the structure of the cell membrane of a eukaryotic cell.

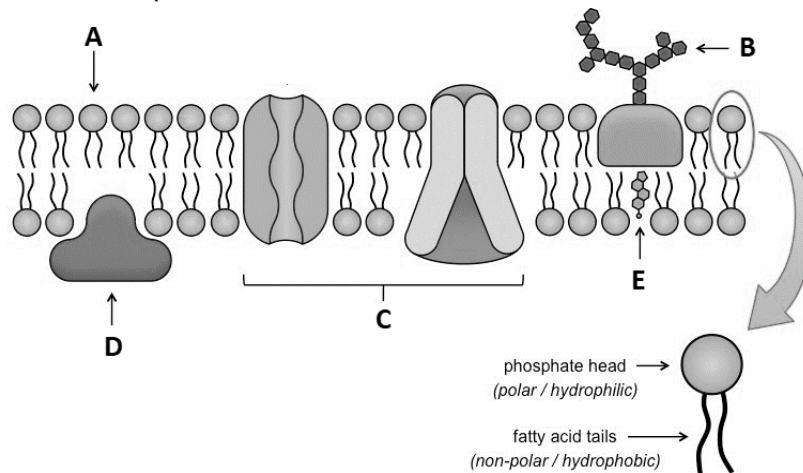


Figure 1: Eukaryotic cell membrane  
(Adapted from: <https://ib.bioninja.com.au>)

a. Name the molecules A to E shown in Figure 1.

A: \_\_\_\_\_

B: \_\_\_\_\_

C: \_\_\_\_\_

D: \_\_\_\_\_

E: \_\_\_\_\_

(5)

b. Explain how the structure of molecule A is essential in forming the basic structure of the membrane as shown in Figure 1.

\_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_

(3)

c. (i) On the diagram write the word 'OUTSIDE' to indicate where the outside of the cell would be. (1)

(ii) Explain your choice to part (i) above.

\_\_\_\_\_  
 \_\_\_\_\_

(1)

**(Total: 10 marks)**

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2. This question is about gene technology.

In gene technology, the DNA of organisms is manipulated forming GMOs that produce products that may be beneficial to humans.

a. What does the abbreviation 'GMO' stand for?

\_\_\_\_\_ (1)

b. The bacteria which are able to produce human insulin are one example of a GMO.

(i) What is the name of the type of enzyme which is used to cut out the human insulin gene from the donor DNA?

\_\_\_\_\_ (1)

(ii) What name is given to the region on the DNA that the enzyme you named in part (i) cuts?

\_\_\_\_\_ (1)

(iii) What are the ends created as a result of this cutting referred to and why are they given such name?

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_ (2)

(iv) Explain the importance of the ends mentioned in part (iii) for inserting the human insulin gene into the bacteria.

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_ (2)

(v) Name another important enzyme used in this process and explain its role.

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_ (2)

c. In the example mentioned in part (b), plasmids are used as vectors to transfer DNA into host cells. Name **ONE** other commonly used vector in gene technology.

\_\_\_\_\_ (1)

**(Total: 10 marks)**

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3. This question is about homeostasis.

a. Define the term 'homeostasis'.

\_\_\_\_\_ (1)

b. Fill in the blanks in the passage below:

Blood glucose is regulated mainly by two hormones which are produced and secreted by the \_\_\_\_\_. The hormone \_\_\_\_\_ is secreted when blood glucose rises above the optimum level. The effect of this hormone is to lower the level of blood glucose by for example, bringing about the conversion of \_\_\_\_\_ into \_\_\_\_\_ and fats. This hormone also lowers blood glucose by inducing cellular \_\_\_\_\_ and increased absorption of glucose by muscle cells.

The hormone \_\_\_\_\_ is secreted when blood glucose falls below the optimum level. This hormone stimulates the liver to convert \_\_\_\_\_ and \_\_\_\_\_ into glucose. (8)

c. Blood glucose regulation is under negative feedback control. Define the term 'negative feedback'.

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_ (1)

**(Total: 10 marks)**

4. This question is on cellular respiration.

a. Aerobic respiration involves three major stages which occur in different sites. Complete Table 1 to indicate the name of the stages and the corresponding location.

Table 1: Name of Respiration stage and location.

Name of Stage of Respiration	Location where the stage occurs

(6)

b. One of the stages mentioned as part of your answer to part (a) is common to both aerobic and anaerobic respiration.

(i) Name this stage.

\_\_\_\_\_ (1)

(ii) Briefly describe what happens during this stage.

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_ (3)

**(Total: 10 marks)**

***Please turn the page.***

5. This question is about water and biomolecules.

a. Which property of water contributes to its effectiveness as a solvent?

\_\_\_\_\_ (1)

b. Describe the thermal property of water that leads to a cooling effect when sweating.

\_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_ (3)

c. Complete Table 2 by giving the name of the corresponding monomer and the type of bond formed between the monomers in the synthesis of these polymers.

Table 2: Table on Biomolecules

<b>Polymer</b>	<b>Monomer</b>	<b>Bond formed between monomers</b>
Starch		
Haemoglobin		

(4)

d. Explain why lipids, rather than carbohydrates and proteins, are used as a long-term energy store.

\_\_\_\_\_  
 \_\_\_\_\_ (2)

**(Total: 10 marks)**

**SECTION B:**

**Answer any TWO questions from this section; each question carries 25 marks. If more than two questions are attempted, only the first two answers shall be taken into consideration.**

**Write all your answers to questions from this section in the separate answer booklet provided.**

6. This question is about the nervous system.

a. The neuron is the specialized cell which makes up the bulk of the nervous system.

- (i) Give a detailed description of the general structure of the neuron, indicating the importance of each part of the cell. A well labelled diagram with annotations is also accepted. (8)
- (ii) There are three main types of neurons. Name the **THREE** types of neurons indicating the function of each and include **ONE** structural feature unique for each. Present your answer in the form of a table. (9)

b. Impulses travel along neurons by means of action potentials.

- (i) Briefly describe how an action potential is generated in a neuron. (4)
- (ii) Briefly describe how an action potential is propagated down the neuron. (4)

**(Total: 25 marks)**

7. This question is about gas exchange in humans.

The figure below shows an alveolus and an associated blood capillary.

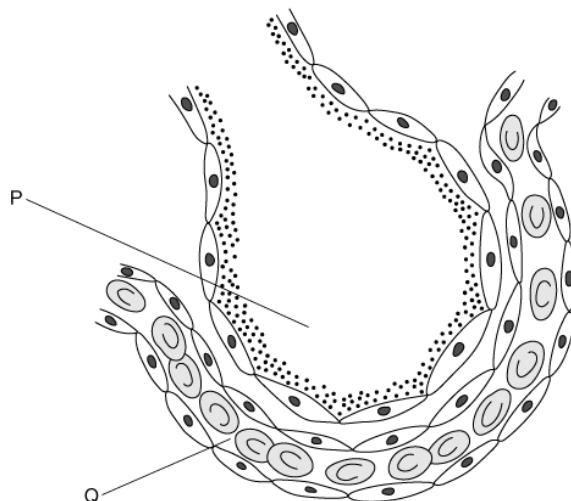


Figure 2: Human alveolus and associated blood capillary.  
(Adapted from: <https://www.savemyexams.co.uk>)

***Please turn the page.***

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- a. Making reference to features visible in Figure 2, explain **FOUR** features of alveoli which enable them to carry out gas exchange efficiently. (7)
  - b. Draw a simple diagram to represent the structure of the gas exchange system. In your diagram include the following labels: trachea, bronchi, bronchioles and lungs. (5)
  - c. Explain how the contraction and relaxation of the diaphragm and intercostal muscles enable ventilation of the lungs to take place. Highlight the changes in volume and pressure of the lungs during this process. (10)
  - d. Briefly explain the difference between breathing and cellular respiration. (3)

**(Total: 25 marks)**

8. This question is about defence against infectious disease.

- a. Describe the function of the immune system. (4)
- b. Explain in detail how skin and mucous membranes act as borders against microbes. (7)
- c. Different types of blood cells have specific roles in defending the body against pathogens. Identify **THREE** types of blood cells that defend the body against pathogens and describe in detail the role played by each type of cell. (9)
- d. Outline the mode of action of vaccines and their role in the immune system. (5)

**(Total: 25 marks)**

9. This question is about DNA.

- a. Draw a simplified labelled diagram of a monomer of a generalised nucleic acid. (5)
- b. Describe in detail the structure of DNA. (9)
- c. Explain why DNA replication is described as semi-conservative. (2)
- d. DNA replication involves the use of enzymes. Identify **TWO** enzymes that are used during DNA replication and explain their role in this process. Explain in detail the role that the **TWO** named enzymes play in DNA replication. (9)

**(Total: 25 marks)**

10. This question is on human impact on the environment.

- a. Explain in detail **THREE** distinct ways by which agriculture negatively impacts the environment. (9)
- b. Describe how human activities have contributed to the greenhouse effect. (9)
- c. List **THREE** potential long-term effects of the increased greenhouse effect. (3)
- d. Conservation protects the environment through the responsible use of natural resources. Describe **TWO** conservation techniques that can be applicable to the Maltese Islands. (4)

**(Total: 25 marks)**