



L-Università  
ta' Malta

MATRICULATION AND SECONDARY EDUCATION CERTIFICATE  
EXAMINATIONS BOARD

**INTERMEDIATE MATRICULATION LEVEL  
2023 FIRST SESSION**

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SUBJECT: **Biology**  
DATE: 9<sup>th</sup> May 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	8	11	10	10	11	25	25	25	25	25	100

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

1. This question concerns biodiversity.

a. Define the term biodiversity.

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

b. Fill in the blanks with the appropriate term.

Kingdom \_\_\_\_\_ is the only kingdom whereby the cells do not have membrane-bound organelles. All the other kingdoms have their genetic material organised in a nucleus and the cells are therefore \_\_\_\_\_ cells. Organisms belonging to the Kingdom \_\_\_\_\_ can be either unicellular or multicellular. The latter organisms lack complex \_\_\_\_\_ systems. Kingdom \_\_\_\_\_ is characterised by the presence of hyphae and a \_\_\_\_\_ mode of nutrition. Angiosperms belong to the Kingdom \_\_\_\_\_. The cells of these organisms are characterised by the presence of a \_\_\_\_\_. Angiosperms have an \_\_\_\_\_ mode of nutrition. Kingdom \_\_\_\_\_ can be subdivided into two major groups known as invertebrates and vertebrates. Most of the organisms belonging to this Kingdom have a well-developed \_\_\_\_\_ system and hence they respond \_\_\_\_\_ to stimuli.

(½ mark each)

**(Total: 8 marks)**

2. This question concerns ecology.

Figure 1 shows a simple food web from a grassland ecosystem.

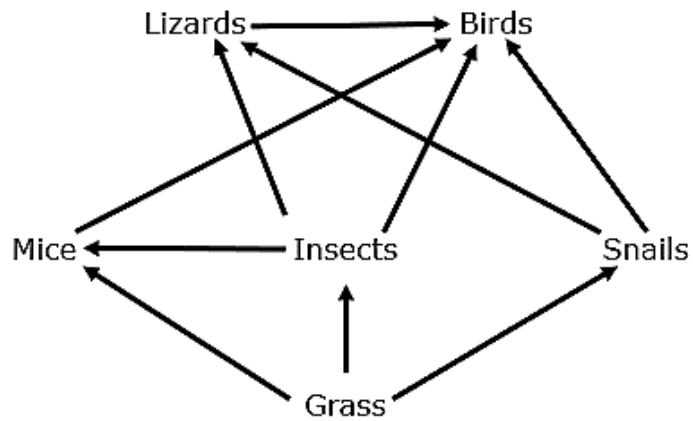


Figure 1: A simple food web.

a. Using the food web given in Figure 1, draw a food chain with three linkages.

(2)

b. Explain why most food chains consist of only three to five linkages.

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(2)

c. Identify the producers in Figure 1.

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(1)

d. What role do these producers have in the carbon cycle?

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(3)

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e. From Figure 1, identify **ONE** organism which is at the second trophic level.

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

f. What role do the organisms found at the second trophic level have in the carbon cycle?

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

**(Total: 11 marks)**

3. This question is about DNA.

Figure 2, below shows the structure of a DNA molecule.

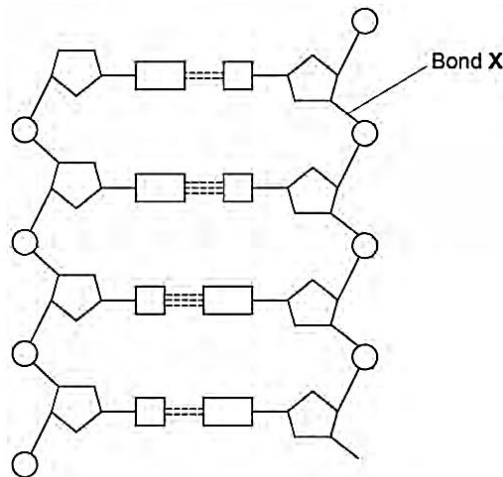


Figure 2: Diagram showing the structure of DNA

a. How many nucleotides are shown in Figure 2?

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

b. Name the type of bond labelled X in Figure 2.

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

c. The enzymes DNA helicase and DNA polymerase are involved in DNA replication. Describe the function of each of these enzymes.

DNA helicase: \_\_\_\_\_ (1)

DNA polymerase: \_\_\_\_\_ (1)

d. Adenosine triphosphate (ATP) has a similar structure to a nucleotide. Fill in the table below by giving **TWO** differences in the structures of ATP and a nucleotide found in DNA.

ATP	DNA Nucleotide

(4)

e. Distinguish between a chromosome and a gene.

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(2)

**(Total: 10 marks)**

4. This question concerns gaseous exchange in humans.

The human respiratory system has a number of properties which increase the efficiency of gaseous exchange.

a. Explain how the following characteristics make the alveoli efficient gas exchange surfaces:

(i) millions of alveoli in the lungs:

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(1)

(ii) alveoli surrounded by many blood capillaries:

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(2)

(iii) thin walls of alveoli:

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(1)

***Please turn the page.***

- b. Insert the missing labels in Figure 3 below of the structure of the human gaseous exchange system. (3)

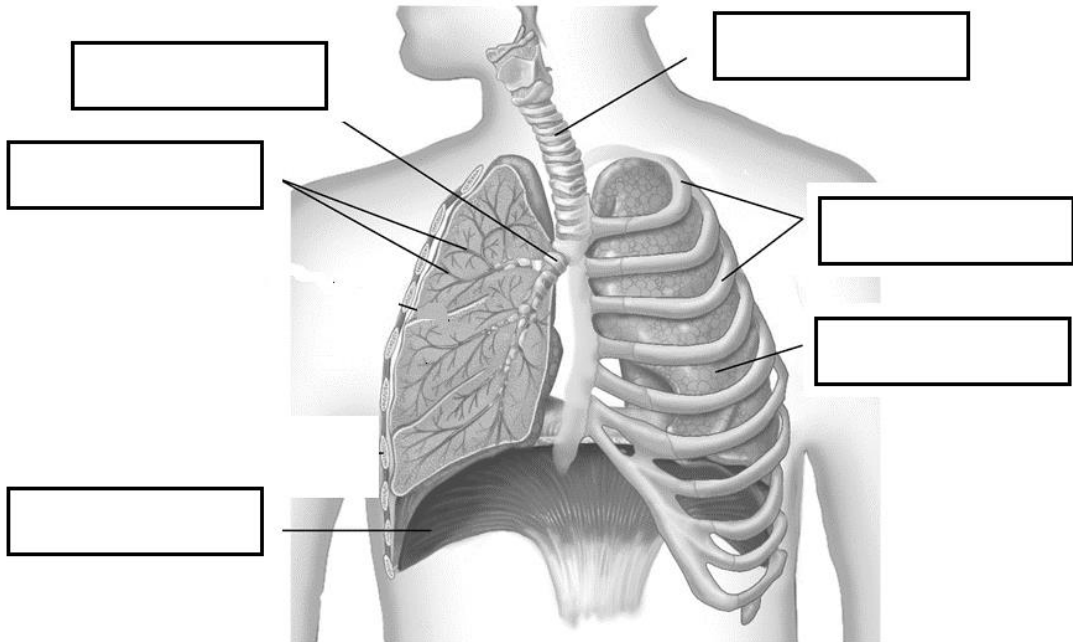


Figure 3: Structure of the gaseous exchange system in humans.  
(Source: [www.brittanica.com](http://www.brittanica.com))

- c. Is breathing and respiration the same biological process? Give a reason for your answer.

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(3)

**(Total: 10 marks)**

5. This question is about reproduction in humans.

a. Figure 4 shows the male reproductive system.

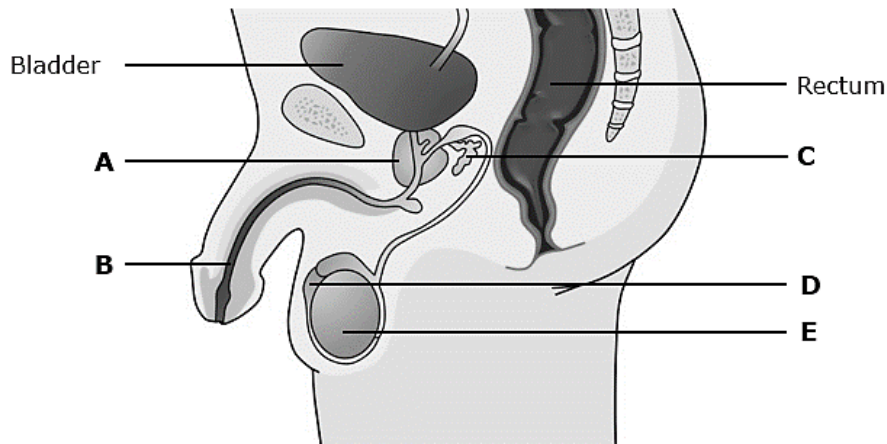


Figure 4: The male reproductive system  
 (Source: <https://ib.bioninja.com.au/>)

Name the following structures:

Label on Figure 4	Structure
A	
B	
C	
D	
E	

(5)

b. Hormones play an important role in both male and female reproductive systems.

i. Which organ produces testosterone in males?

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

ii. Give **TWO** major effects of testosterone in males.

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

iii. Which hormone is responsible for the development of female secondary sexual characteristics?

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

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iv. Give **TWO** roles of Luteinising Hormone (LH) in the menstrual cycle.

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

**(Total: 11 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 concerns photosynthesis.

- a. What is photosynthesis? (2)
- b. Draw a labelled diagram of a cross-section through a leaf. You are expected to include at least **FIVE** labels. (9)
- c. Describe how **THREE** structures labelled as part of your answer to part (b) are adapted to carry out photosynthesis. (6)
- d. Photosynthesis is a complex process made up of **TWO** different stages. Identify these stages. (2)
- e. Briefly describe how the following factors affect the rate of photosynthesis:
  - i. light intensity; (2)
  - ii. carbon dioxide concentration; (2)
  - iii. temperature. (2)

**(Total: 25 marks)**

7. This question is about biomolecules.

- a. Distinguish between condensation reactions and hydrolysis reactions. (4)
- b. Give a brief comparison of the energy content of carbohydrates, lipids and protein. (3)
- c. Fibrous proteins can be broadly classified as structural proteins whilst globular proteins can be classified as functional proteins. Discuss this statement using **TWO** named examples from **each** class. (10)
- d. Explain, using named examples, how the relative solubility of different carbohydrates varies with molecular size. (8)

**(Total: 25 marks)**



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8. This question is about cells.

- a. Draw and label a generalised diagram of a prokaryotic cell. **SIX** labels are required. (5)
- b. Mention **ONE** function each for **FIVE** of the structures you labelled in part (a). (5)
- c. Draw a generalised diagram of a plant cell. In your drawing, label the following features: Rough endoplasmic reticulum, Golgi apparatus, vacuole, mitochondrion and chloroplast. (5)
- d. Mention **ONE** function each for **FIVE** of the structures you labelled in part (c). (5)
- e. Describe **TWO** similarities and **THREE** differences between prokaryotic and eukaryotic cells. Present your answer in table format. (5)

**(Total: 25 marks)**

9. Scientists investigated the hydrolysis of biomolecules by enzymes in the digestive tract.

- a. Define the term 'enzyme' and explain the importance of enzymes in digestion. (4)
- b. Using a flow diagram, describe the 'lock-and-key' model of enzyme action. (5)
- c. Draw up a table giving the source, substrate, products and optimum pH conditions for one amylase, one protease and one lipase involved in digestion. (6)
- d. In part (c) above, you indicated the optimum pH for **THREE** digestive enzymes. Draw a graph showing how the rate of reaction of **ONE** of these enzymes varies with pH and explain the shape of the graph you have drawn. (5)
- e. Draw a diagram of a villus and explain the importance of the microvilli, lacteal and blood capillaries in absorption of digested food. (5)

**(Total: 25 marks)**

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10. This question is about gene technology.

- What is recombinant DNA? Explain the importance of recombinant gene technology. Support your answer using the production of insulin as an example. (5)
- Restriction endonuclease and DNA ligase are two important enzymes used in gene technology. Explain the importance of these **TWO** enzymes in the process of making recombinant DNA. (6)
- The following schematic diagram, Figure 5, shows the steps involved in the recombinant DNA procedure used for making human insulin. Use the diagram to explain what is happening in steps 1-5. (5)

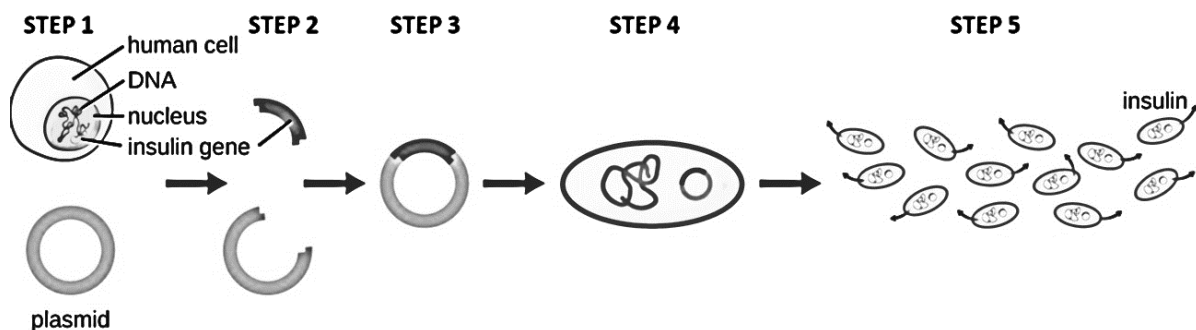


Figure 5: Schematic diagram showing steps involved in recombinant DNA procedure used to make human insulin.  
(Source: [www.lumenlearning.com](http://www.lumenlearning.com))

- In Figure 5, plasmids are used as vectors. Name **ONE** other commonly used vector for transferring DNA into host cells and explain how this vector may be used as an alternative to plasmids. (5)
- Define the term GMO and describe **ONE** example in which GMOs have been beneficial to humans. (4)

**(Total: 25 marks)**

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