



L-Università  
ta' Malta

MATRICULATION AND SECONDARY EDUCATION CERTIFICATE  
EXAMINATIONS BOARD

**INTERMEDIATE MATRICULATION LEVEL  
2021 FIRST SESSION**

SUBJECT: **Biology**  
DATE: 4<sup>th</sup> June 2021  
TIME: 4:00 p.m. to 7:05 p.m.

### 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.

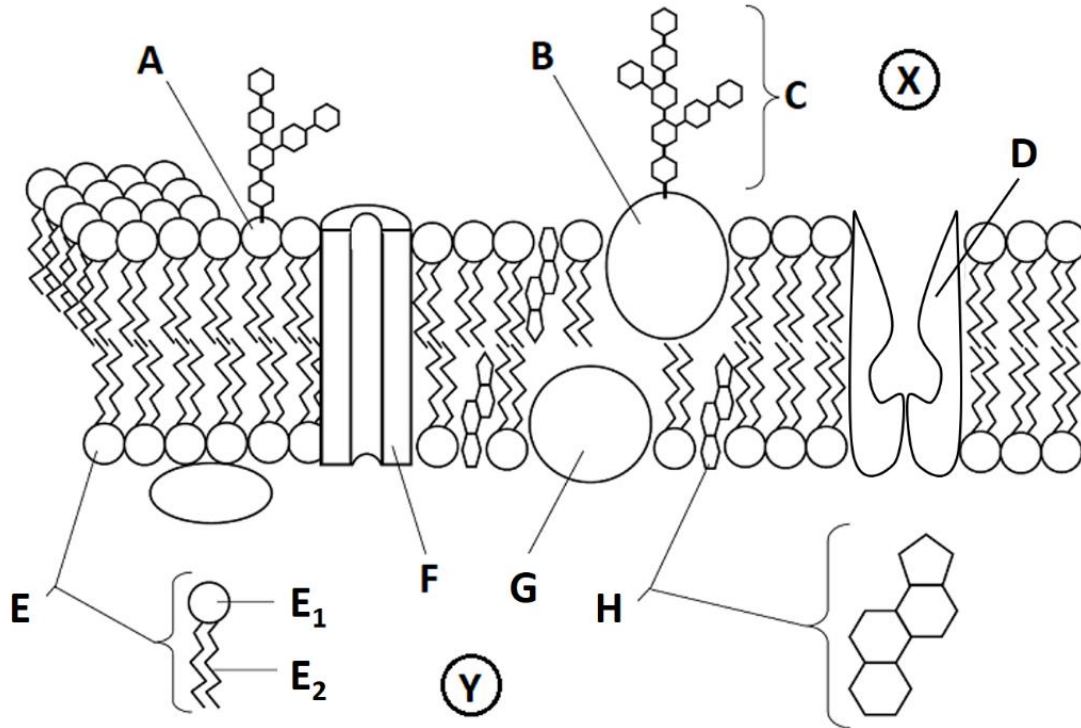
### For examiners' use only:

Question	1	2	3	4	5	6	7	8	9	10	Total
Score											
Maximum	7	8	13	11	11	25	25	25	25	25	100

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

1. This question is about biological membranes.

Figure 1 shows a section through the cell membrane of a eukaryotic organism.



Adapted from: <https://cronodon.com/BioTech/Membranes.html>

Figure 1

a. Name the following structures:

Label on Figure 1	Name of structure
C	
E	
F	
H	

(2)

- b. The table below refers to three transport mechanisms (osmosis, facilitated diffusion and active transport) that happen across the cell membrane. For **each** of the statements in the table, tick (✓) the transport mechanism/s to which it applies:

Statement	Osmosis	Diffusion	Active Transport
Transport makes use of ATP			
Molecules move along their concentration gradient			
Transport may make use of structure F (on Figure 1)			
Transport may make use of structure D (on Figure 1)			
Movement of water from side X to side Y			

(5)

**(Total: 7 marks)**

2. This question is about cellular division.

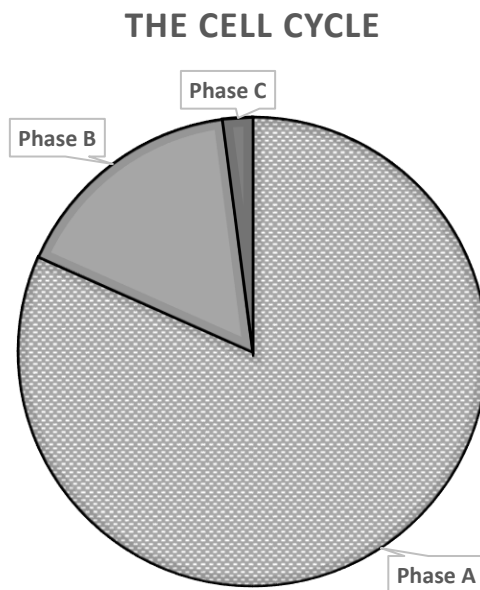


Figure 2: A pie chart showing the relative times of the three phases of the cell cycle.

- a. The above chart shows the cell cycle divided into three phases: Phase A, B and C. Identify and name the three phases.

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

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

Phase C: \_\_\_\_\_ (3)

**Question continues on next page**

b. Describe what happens in Phase A.

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(2)

c. Describe what happens in Phase B.

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(3)

**(Total: 8 marks)**

3. This question is about DNA and its processes.

Look at the following diagram and then answer the questions that follow.

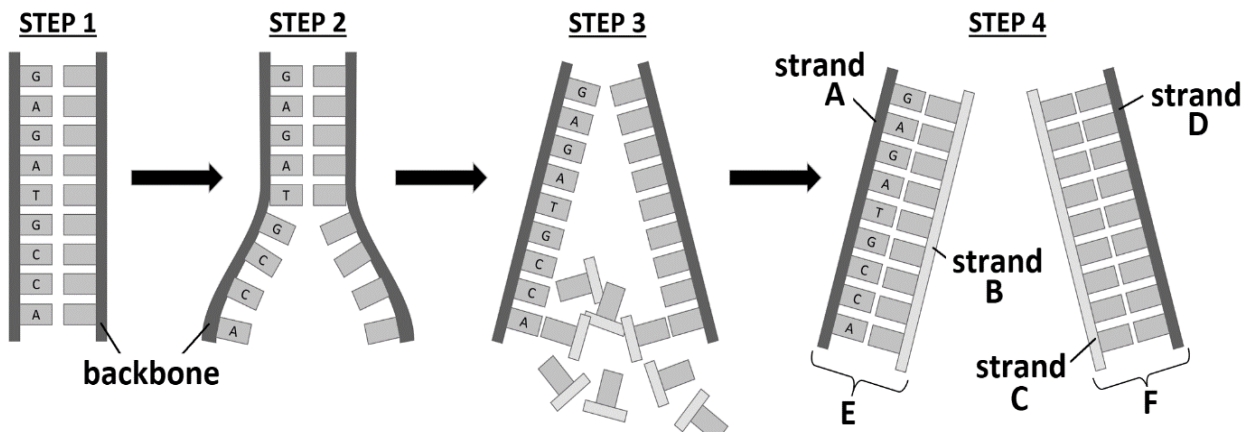


Figure 3: A small section of DNA and an associated process.

a. Name **FOUR** elements that you would expect to find in the structure labelled "backbone" in Figure 3.

Element 1: \_\_\_\_\_

Element 2: \_\_\_\_\_

Element 3: \_\_\_\_\_

Element 4: \_\_\_\_\_

(2)

b. Complete the following table by inserting the appropriate term/s:

Statement	Term/s defining the given statement
The process that is being shown in Figure 3	
The enzyme which is responsible for step 3	

(2)

c. Explain what is happening in step 2 in Figure 3.

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

(3)

d. The base sequence on strand A reads "GAGATGCCA" and is part of the gene that codes for brown eye colour. The following statements are incorrect. Give a reason/s why they are incorrect and give the correct answer.

i. Incorrect statement: The base sequence on strand B would read "CUCUACGGU".

Reason: \_\_\_\_\_

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

Correct Answer: \_\_\_\_\_

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

**Question continues on next page**

ii. Incorrect statement: Strands E and F are homologous chromosomes.

Reason: \_\_\_\_\_  
\_\_\_\_\_ (1)

Correct Answer: \_\_\_\_\_  
\_\_\_\_\_ (1)

iii. Incorrect Statement: The base sequence on strand C shown in figure 3, is part of a gene that also codes for eye colour but it may code for a different eye colour, since it is coming from a different parent.

Reason: \_\_\_\_\_  
\_\_\_\_\_ (1)

Correct Answer: \_\_\_\_\_  
\_\_\_\_\_ (1)

**(Total: 13 marks)**

4. This question is about ecosystems.

The following diagram represents a marine food web:

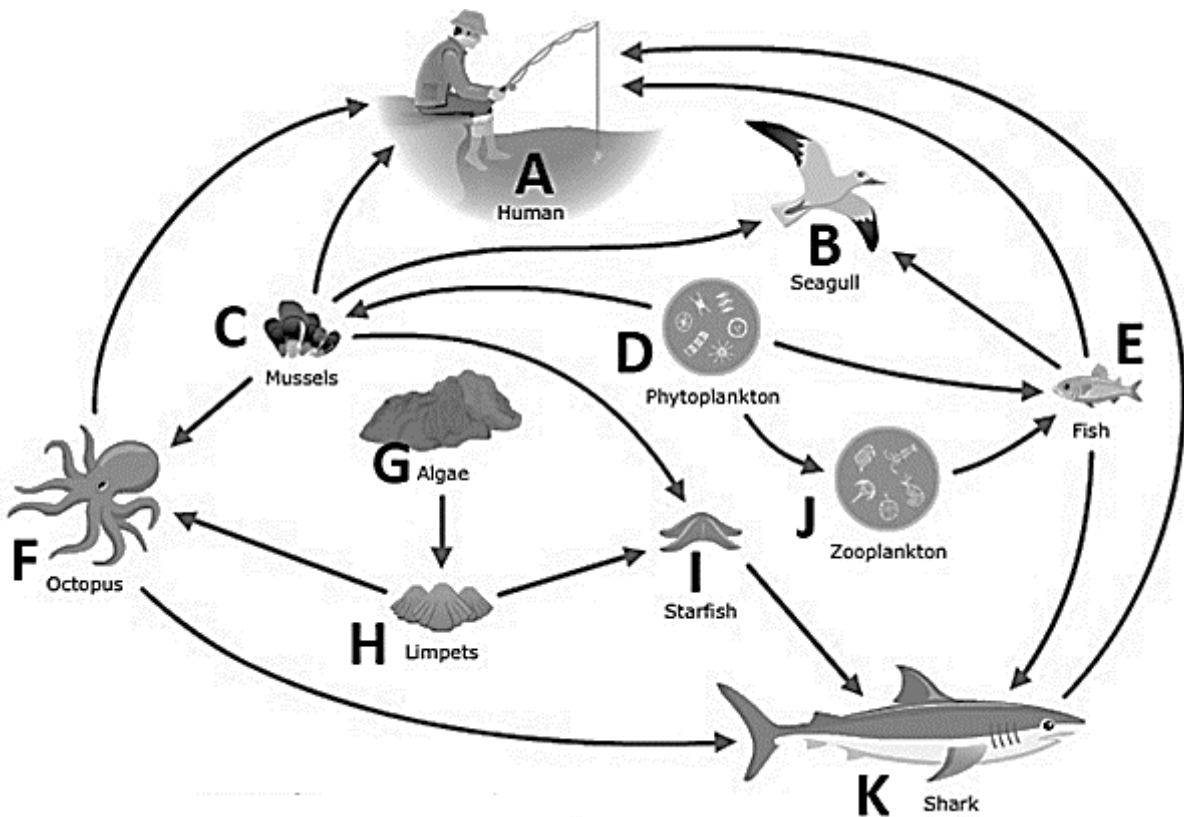


Figure 4: A Marine Food Web

(Adapted from: <https://www.sciencelearn.org.nz/resources/367-toxins-and-food-webs>)

a. Define the following terms:

i. ecosystem;

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(1)

ii. food web;

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(1)

- b. Figure 5 is a pyramid of energy showing the quantity of energy transferred between organisms on different Trophic Levels. The letters represent the organisms in the food web in Figure 4.

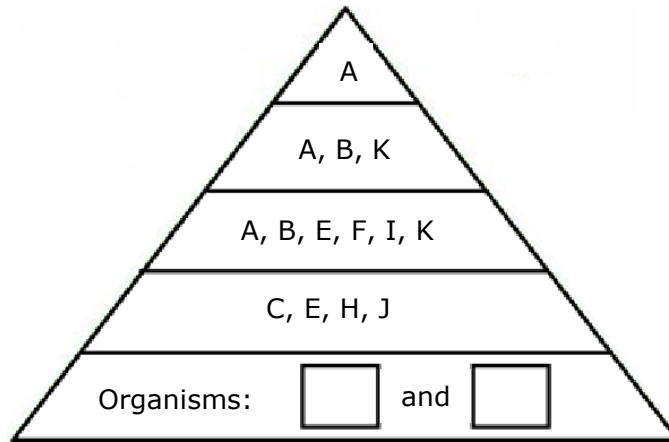


Figure 5: Pyramid of Energy

- i. Fill in the **TWO** empty boxes in Figure 5 with the letters representing the two organisms that fit in that trophic level. (1)
- ii. Draw **TWO** food chains to explain why certain organisms are written more than once in Figure 5 and explain your answer.

Food chain 1:

Food chain 2:

Explanation: \_\_\_\_\_

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

- c. As seen in Figure 5, energy is lost along the food chain so it has to be continuously supplied. On the other hand, nutrients such as carbon are constantly recycled and reused.
  - i. Which process is used to introduce energy and carbon into a food web?

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

- ii. List **TWO** ways by which organism E (the fish) affects the Carbon cycle.

1: \_\_\_\_\_

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



iii. Human impacts have an effect on the carbon cycle. Explain this statement by mentioning **TWO** examples.

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(2)

**(Total: 11 marks)**

5. This question is about gaseous exchange and cellular respiration.

For energy production in animals, both **gaseous exchange** and **respiration** are crucial processes.

a. Distinguish between the terms in bold.

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(2)

b. Name the molecule that is considered to be the "energy currency of the cell" and briefly describe its role.

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(2)

c. Increasing the surface area is an important adaptation for both processes. Describe how surface area is increased in **both** cases and how this affects the respective process.

Gaseous exchange: \_\_\_\_\_  
\_\_\_\_\_ (2)

Respiration: \_\_\_\_\_  
\_\_\_\_\_ (2)

**Question continues on the next page**

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d. Give an explanation for **each** of the following observations:

i. The trachea is lined with cilia that beat continuously.

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(1)

ii. During exercise, the breathing rate increases, and muscle cells may undergo anaerobic respiration.

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(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 is about homeostasis.

a. Living organisms need to maintain homeostasis constantly in order to survive. Discuss. (5)

b. Negative feedback is an important process in homeostasis. Explain the meaning of this statement. (5)

c. After eating some donuts, Austin's blood glucose level begins to rise. Apply the concept of negative feedback to this situation to illustrate how his body reacts to this change. (12)

d. Austin's sister also ate some donuts but she is diabetic. Diabetes is a disorder in which not enough hormone is secreted to control the blood glucose level. Explain how your answer to part (c) changes. (3)

**(Total: 25 marks)**

7. This question is about the human nervous system.

The nervous system is a complex collection of nerves that transmit signals between different parts of the body. Messages are continuously passing through specialised cells to and from the Central Nervous System (CNS).

- a. Name the 'specialised cells' that transmit signals towards the CNS and draw a generalised diagram of **ONE** of these cells to show its different components. (4)
- b. Explain the functions of the different structures found within the CNS. (13)
- c. Cells within the Peripheral Nervous System (PNS) connect the CNS to the effectors. Briefly describe the **TWO** branches into which the PNS is divided. (8)

**(Total: 25 marks)**

8. This question is about nutrition and digestion.

Heterotrophic (holozoic) nutrition can be divided into five steps: ingestion, digestion, absorption, assimilation and egestion.

- a. Name the organs (or locations) within the digestive system where digestion happens. For **each** explain what is digested and how. (15)
- b. By means of a suitable diagram, explain where and how absorption takes place. (6)
- c. Assimilation refers to the utilisation of the absorbed molecules for various metabolic processes. Briefly describe **TWO** ways in which the different products of digestion may be assimilated. (4)

**(Total: 25 marks)**

9. This question is about cell structure.

- a. Why are many organisms composed of large numbers of relatively small cells rather than a single large cell? Explain. (5)
- b. By using diagrams, compare and contrast the structure of eukaryotic cells and prokaryotic cells. (20)

**(Total: 25 marks)**

***Please turn the page***

10. This question is about biomolecules.

Modern agricultural production worldwide is responding to different demands. One of these demands is that of having healthier foods, especially in developed countries. In turn this creates a demand for different kinds of crops to be grown to supply these nutritional benefits. For example, much of the carbohydrate in our food is in the form of sucrose and starch. These carbohydrates are readily digested by enzymes in our gut, and it is easy to eat too much so that we become overweight. But some plants produce carbohydrates that can make us feel full without piling on calories. Inulin is one such carbohydrate. Some plants such as the Jerusalem artichoke, accumulate a series of polymers of fructose called inulin in their underground tubers. Each chain ends in a glucose molecule and consists of anything from 2 to 60 fructose units. Inulin has become a valuable crop product for the food industry.

*(Adapted from: Biological Sciences April 2008)*

- a. 'Sucrose' and 'starch' are two carbohydrates mentioned in the text above. Distinguish between these **TWO** carbohydrates in terms of structure and function. (8)
- b. Explain the following statement: 'polymers of fructose called inulin'. (2)
- c. In inulin 'each chain ends in a glucose molecule and consists of anything from 2 to 60 fructose units.' Draw the ring structure of glucose. (4)
- d. Mention **TWO** other polymers **not** mentioned in the text above and briefly describe their structure and function. (6)
- e. Another way of producing such foods is by gene technology. Explain this statement. (5)

**(Total: 25 marks)**