

**MATRICULATION AND SECONDARY EDUCATION CERTIFICATE EXAMINATIONS BOARD
UNIVERSITY OF MALTA, MSIDA**

**MATRICULATION EXAMINATION
INTERMEDIATE LEVEL
SEPTEMBER 2017**

SUBJECT:	BIOLOGY
DATE:	31st August 2017
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	11	Total
Score												
Maximum	6	10	8	12	9	5	25	25	25	25	25	100

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SECTION A: Answer ALL questions in this section.

1. This question is about membranes.

State whether the statements below are **TRUE** or **FALSE**. If your answer is **FALSE**, explain why it is so.

a. The plasma membrane consists only of a phospholipid bilayer.

True/False:

Reason if False:

(2)

b. The outer surface of the cell membrane and the inner surface, in contact with the cytoplasm, are structurally identical.

True/False:

Reason if False:

(2)

c. Phospholipids have both hydrophobic and hydrophilic properties.

True/False:

Reason if False:

(2)

(Total: 6 marks)

2. This question is about biological evolution.

a. What is biological evolution?

(2)

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b. Name the process that causes organisms to develop adaptations.

_____ (1)

c. Explain how the process mentioned in part (b) operates.

_____ (3)

d. Giraffes feed on the leaves of trees and other plants in areas of Africa. They are adapted, through evolution, to survive in their environment. Fossil records show that giraffes had short necks about 7.5 million years ago. The modern giraffe has evolved a long neck.



Figure 1: Giraffe

Photo taken from: <https://www.pinterest.com>

e. Use your knowledge of the theory of evolution as proposed by Charles Darwin, to explain how evolution gave rise to long necks in the giraffe.

_____ (4)

(Total: 10 marks)

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3. This question is about DNA replication.

a. Complete the following table by marking **ALL** boxes with a tick (✓) if the event takes place during DNA replication or a cross (X) if it does not take place.

Nucleotides align along an exposed DNA strand	
Uracil pairs with Adenine	
A tRNA pairs with a complementary codon	
Hydrogen bonds between the two DNA strands are broken by helicase	

(4)

b. In which part of the cell cycle does DNA replication take place?

_____ (1)

c. If the base sequence of the DNA on the template strand reads **AACTAACGGGACCGA**, what is the base sequence on the leading strand?

_____ (2)

d. DNA replication is termed 'semi-conservative'. What does this imply about the process?

_____ (1)

(Total: 8 marks)

4. This question is about ecology.

Organisms in an ecosystem are interconnected by a feeding relationship. Analyse the food web shown below and answer the questions that follow.

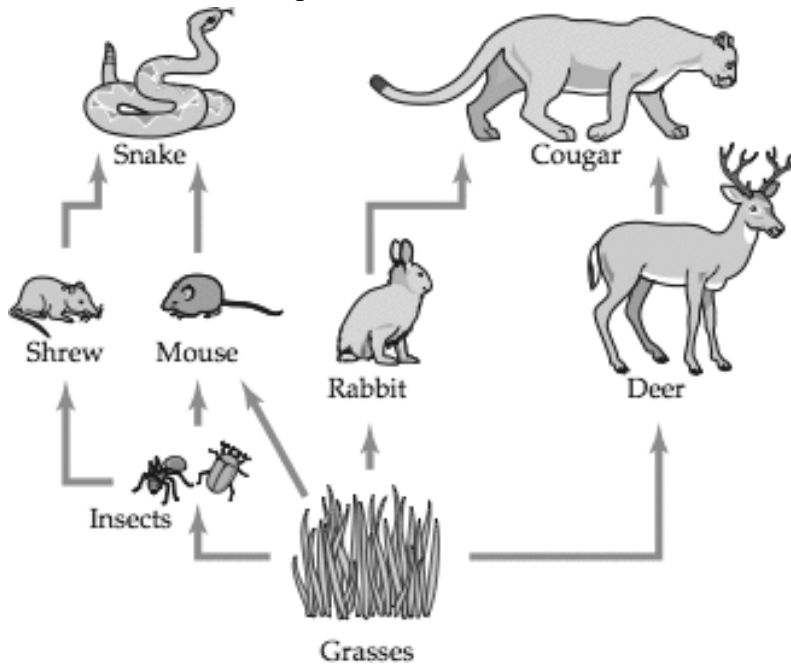


Figure 2: Food Web

Picture taken from: <https://www.triand.com>

a. Name the organism/s on the 4th trophic level.

_____ (1)

b. Name **ONE** producer and **ONE** consumer shown in Figure 2.

Producer:

Consumer:

_____ (2)

c. Draw **ONE** complete food chain, from the food web shown in Figure 2, with at least **THREE** links.

(3)

This question continues on the next page.

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d. The mice population decreased due to disease. As a result a decrease in the shrew population was also noted. Give **ONE** reason why there was a decrease in the shrew population.

(2)

e. When energy is transferred across trophic levels, approximately 90% of it is lost. Why?

(2)

f. What role would decomposers have in the food web shown in Figure 2?

(2)

(Total: 12 marks)

5. This question is about homeostasis.

Homeostasis refers to the tendency of maintaining an organism's internal conditions within a narrow range that permits the continuation of life. Homeostasis is based on feedback mechanisms and can involve the endocrine system or the nervous system.

a. Give **ONE** difference between the two systems mentioned above.

(2)

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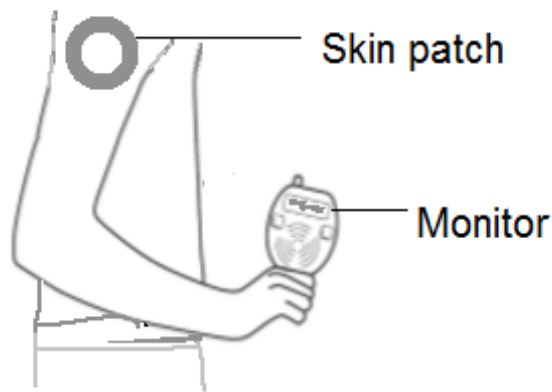


Figure 3: Skin patch used to test blood glucose levels.

- b. Blood glucose levels are usually monitored and kept at 90 mg of glucose/ 100 ml of blood. A skin patch can be used to monitor Type 1 diabetes patients when their homeostatic mechanism fails to function. This skin patch measures the blood glucose levels every minute. The monitor sounds the alarm if the blood glucose level is too high. Explain how the monitor will help the patient.

(4)

Another homeostatic mechanism in the human body is thermoregulation.

- c. In which part of the brain is the thermoregulatory centre located?
-
- (1)
- d. Name the receptors that detect information about temperature in the human body and indicate their location.

(2)

(Total: 9 marks)

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6. This question is about gaseous exchange in the human body.

An athlete was placed on a treadmill and an investigation was run to observe how she responds to the need of air with exercise. The graph in Figure 4 illustrates the results of ventilation rate of the athlete at different treadmill speeds.

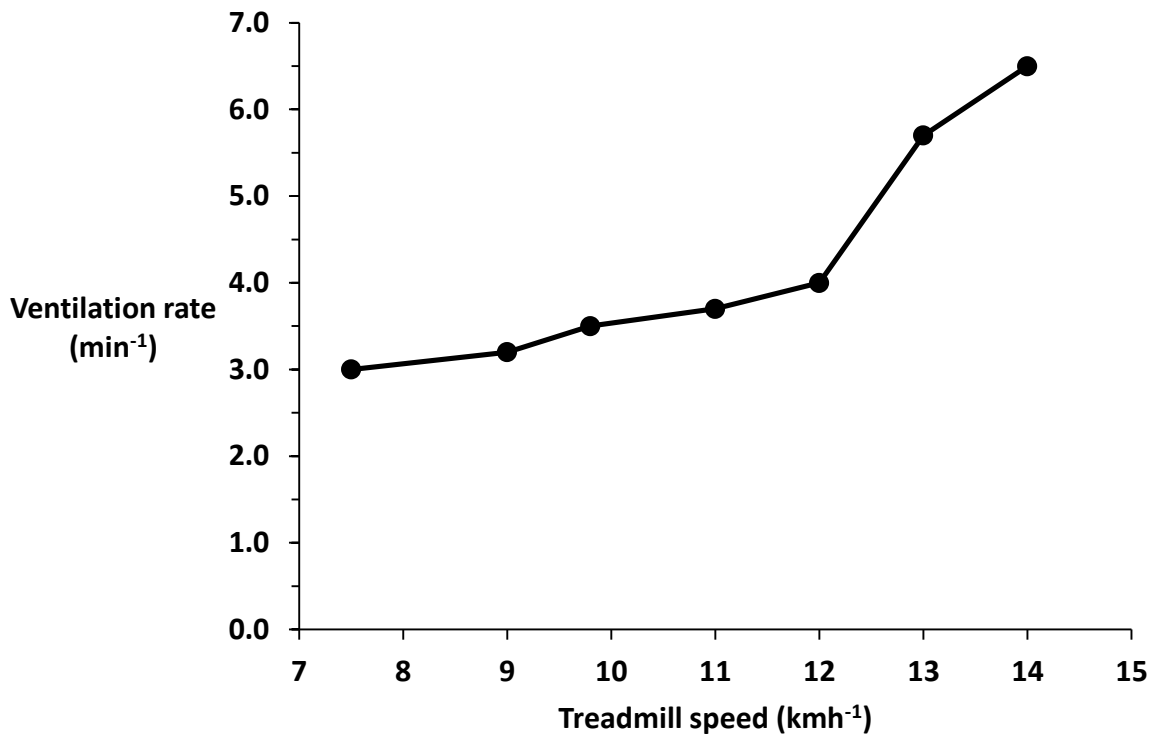


Figure 4: Ventilation rate (min⁻¹) against treadmill speed (kmh⁻¹)

a. Explain the relationship between the treadmill speed and the ventilation rate.

(2)

b. Emphysema is a disease that affects the alveoli of the lungs. State why the graph of a person with emphysema would show a faster ventilation rate than that of an athlete.

(3)

(Total: 5 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.

7. This question concerns proteins and enzymes.

Proteins come in a variety of shapes. The structure and function of a protein is determined by the sequence of its monomers.

- a. What are proteins? (2)
- b. Give a brief explanation of the following processes involved in protein synthesis:
i. transcription; (6)
ii. translation. (3)
- c. Give **TWO** differences between transcription and DNA replication. (4)
- d. Cells regulate chemical reactions through the use of proteins called enzymes. Discuss how enzymes function and how temperature and pH affect the activity of enzymes. (10)

(Total: 25 marks)

8. This question concerns human reproduction.

Give biological explanations for each of the following:

- a. Sexual reproduction increases genetic variation. (5)
- b. The structure of the male gamete is related to its reproductive function. (5)
- c. The testes have a dual function in the reproductive system. (5)
- d. Oestrogen and progesterone levels vary during the menstrual cycle. (5)
- e. The amniotic sac is an essential membrane during pregnancy. (5)

(Total: 25 marks)

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9. This question deals with the human digestive system and nutrition.
- a. Explain why digestion of large food molecules is essential. (4)
 - b. Explain why enzymes are needed in digestion. (4)
 - c. List **EIGHT** organs found in the human body that are part of the digestive system. (4)
 - d. Explain how the structure of the villus is related to its function in absorption and transport of digested products. (7)
 - e. A balanced diet is important to maintain good health. It should include lipids, carbohydrates, proteins, minerals, vitamins and water in correct amounts. Not following a balanced diet can lead to malnutrition, overnutrition or undernutrition.
Explain the terms: malnutrition, overnutrition and undernutrition. (6)

(Total: 25 marks)

10. This question concerns photosynthesis and cellular respiration, in eukaryotic cells.
- a. Name the **TWO** organelles used for photosynthesis and cellular respiration. (2)
 - b. List **TWO** similarities in the two organelles mentioned in part (a). (4)
 - c. List **FOUR** differences between the two organelles mentioned in part (a). (8)
 - d. Both photosynthesis and cellular respiration produce chemical energy in the form of ATP. Discuss. (11)

(Total: 25 marks)

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11. This question is about the diversity of life on earth.
- a. Organisms are organised into groups. The largest taxonomic group they are organised in is known as a kingdom. Organisms in a common kingdom share a number of important features.
- i. List the **FIVE** kingdoms and give a named example of an organism found in each listed kingdom. (5)
- ii. Give **TWO** characteristics for each listed kingdom. (10)
- b. Distinguish between an invertebrate and a vertebrate animal. Give an example of each. (5)
- c. Distinguish between a prokaryotic and a eukaryotic organism. (3)
- d. Give the name of **ONE** kingdom that includes prokaryotic organisms and the name of **ONE** kingdom that includes eukaryotic organisms. (2)

(Total: 25 marks)

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