

MATRICULATION AND SECONDARY EDUCATION CERTIFICATE EXAMINATIONS BOARD
UNIVERSITY OF MALTA, MSIDA
MATRICULATION EXAMINATION
INTERMEDIATE LEVEL
MAY 2015

SUBJECT: BIOLOGY
DATE: 7th May 2015
TIME: 9.00 a.m. to 12.00 noon

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	12	6	14	6	6	25	25	25	25	25	100

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

1. Briefly explain the following statements related to cell membranes.

1.1. The structure of membranes can be described as being a fluid mosaic.

[two marks]

1.2. The extracellular side of the cell membrane is different from the intracellular side of the cell membrane.

[two marks]

1.3. Passive and active transport are two different processes through which particles can move across membranes.

[two marks]

[Total: six marks]

2. The following question concerns water and biomolecules.

2.1. List **TWO** properties of water and briefly explain the biological importance of each property.

Property 1: _____

Biological importance: _____

Property 2: _____

Biological importance: _____

[three marks]

2.2. Large biomolecules, also known as polymers, are vital for organisms. Complete the table below, indicating the monomers and mention ONE function of the polymer in living organisms. The first one has been filled as an example.

Polymer	Monomer	One function of the polymer
Glycogen	Glucose	Used in cellular respiration to produce ATP
Cellulose		
Triglyceride		
Keratin		
Collagen		
Haemoglobin		
DNA		

[half a mark per monomer, 1 mark for function]

[Total: twelve marks]

Please turn the page.

3. Give ONE characteristic of the following Kingdoms and name ONE representative organism from each Kingdom.

3.1. Prokaryota: characteristic - _____

representative organism - _____

3.2. Protoctista: characteristic - _____

representative organism - _____

3.3. Fungi: characteristic - _____

representative organism - _____

3.4. Animalia: characteristic - _____

representative organism - _____

[six marks]

[Total: six marks]

4. Figure 1 shows a mesophytic leaf in cross-section.

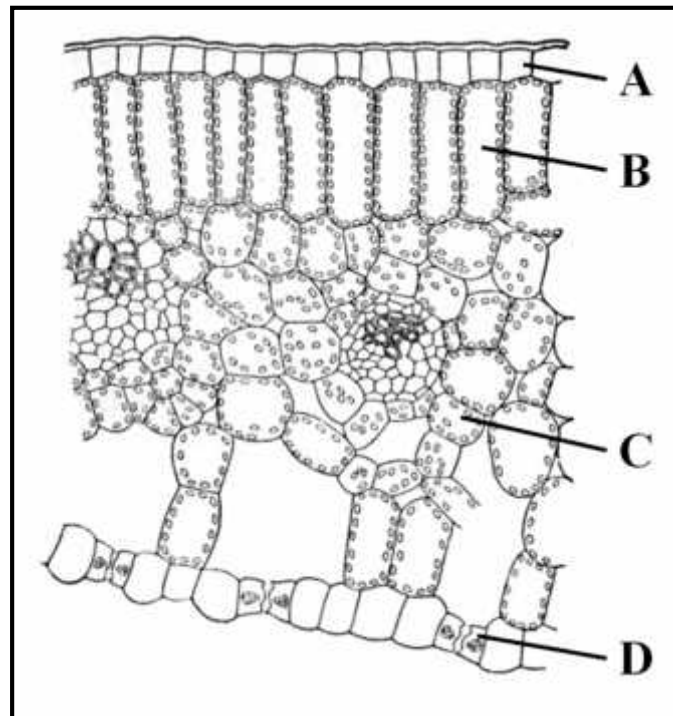


Figure 1: A diagrammatic representation from a leaf cross-section
(adapted from <http://www.gutenberg.org>)

4.1. Fill in the table below by identifying the various cell types and list ONE function for each cell type.

Label	Cell type	Function
A		
B		
C		
D		

[half a mark for each cell type, 1 mark per function]

4.2 The rate of photosynthesis in this plant was measured at: a) different light intensities; and b) different temperatures and the results were plotted as shown in Figures 2 and 3.

a)

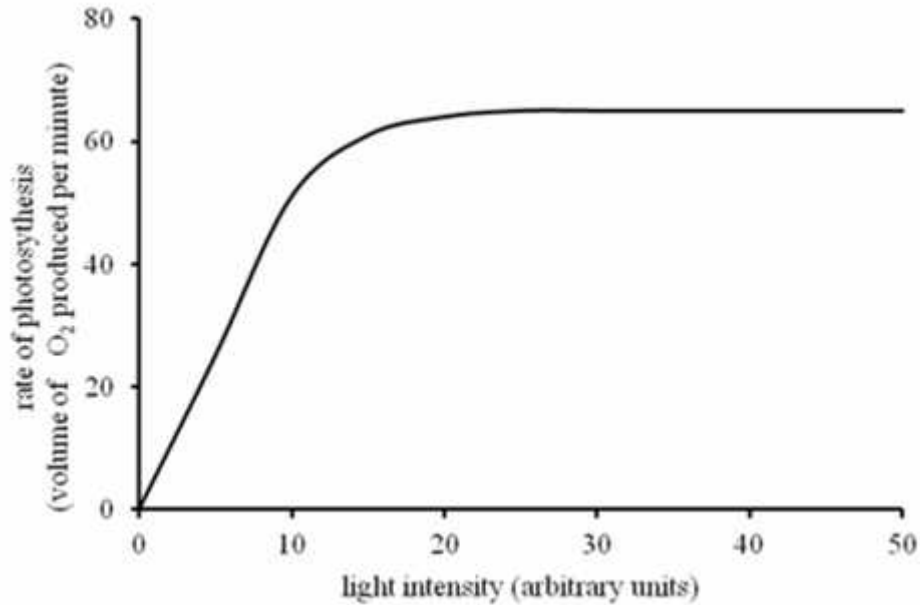


Figure 2: Rate of photosynthesis at different light intensities.

b)

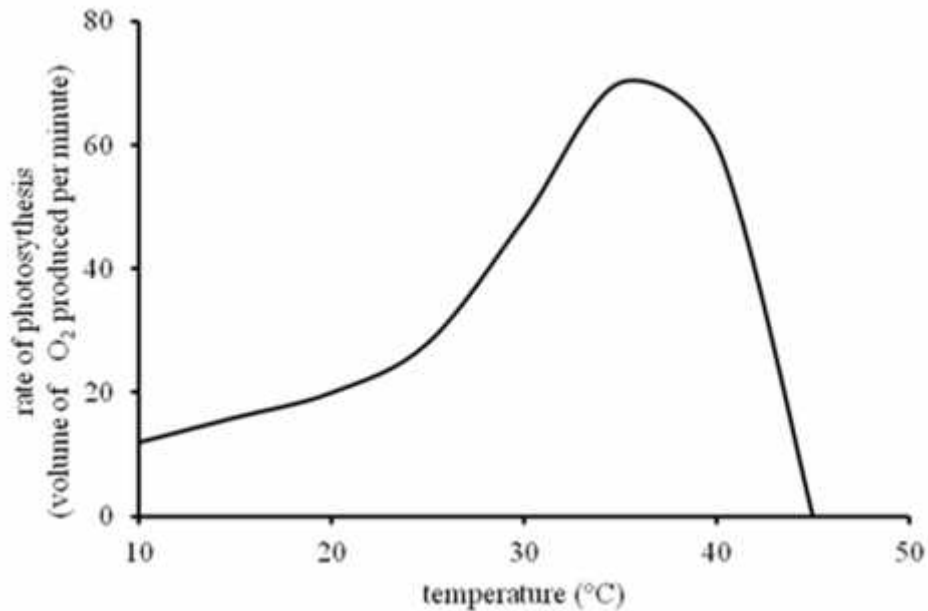


Figure 3: Rate of photosynthesis at different temperatures.

Using the data in Figures 2 and 3, explain why the rate of photosynthesis varies with

Light intensity: _____

Temperature: _____

[four marks]

4.3. The process of photosynthesis can be split into the light-dependent reaction and the light-independent reaction. Briefly explain the importance of each of these two steps during photosynthesis.

Light-dependent reaction: _____

Light-independent reaction: _____

[four marks]

[Total: fourteen marks]

5. This question is about homeostasis.

5.1. What is meant by the term *homeostasis*?

[one mark]

5.2. The human body has a number of specialized neurons, called thermoreceptors. Where are these thermoreceptors found, and what is their function?

[two marks]

5.3. Describe THREE involuntary mechanisms through which the human body lowers its temperature.

[three marks]

[Total: six marks]

6. Sexual reproduction is a process that promotes genetic variation.

6.1. List THREE ways how sexual reproduction increases genetic variation in a species.

[three marks]

6.2. Hormones play a very important role in reproduction. Describe ONE role for each of the following hormones in the human body:

Luteinizing hormone: _____

Progesterone: _____

Testosterone: _____

[three marks]

[Total: six marks]

Please turn the page.

SECTION B:

Answer any **TWO** questions from this section; each question carries twenty-five 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 is about the human digestive system.

7.1. What is meant by *digestion*?

[three marks]

7.2. Explain how large molecules such as starch, proteins and lipids are broken down into smaller molecules by the digestive enzymes. (The answer should include the source, substrates, products and optimum pH conditions for the mentioned digestive enzymes).

[fourteen marks]

7.3. Explain how the structure of the small intestine ensures efficient absorption of the digested molecules.

[four marks]

7.4. Briefly outline the fate of glucose after it is absorbed from the small intestine.

[four marks]

[Total: twenty-five marks]

8. This question is about populations.

8.1. What is a *population*?

[three marks]

8.2. Sketch a sigmoid population growth curve and label the different growth phases noted in this graph.

[six marks]

8.3. Give biological explanations for each of the phases that make up this growth curve.

[nine marks]

8.4. What is meant by the term *carrying capacity*?

[two marks]

8.5. Use the sigmoid population curve sketched in your answer to Question 8.2, to indicate the carrying capacity of a population.

[two marks]

8.6. Describe **THREE** factors that influence population expansion.

[three marks]

[Total: twenty-five marks]

9. This question is about gaseous exchange.
- 9.1 Distinguish between ventilation, gaseous exchange and cellular respiration. **[six marks]**
- 9.2 Why does the body need a ventilation system? **[five marks]**
- 9.3 Draw a labelled diagram to show the structure of the human gaseous exchange system. **[six marks]**
- 9.4 Alveoli enable efficient gas exchange to be carried out due to a number of features they possess. Give a brief outline of these features. **[four marks]**
- 9.5 Briefly discuss ONE health problem involving gas exchange. **[four marks]**

[Total: twenty-five marks]

10. Explain each of the following statements related to DNA replication and protein synthesis.
- 10.1 The cell cycle is composed of three distinct phases. **[five marks]**
- 10.2 The process of DNA replication is semi-conservative. **[five marks]**
- 10.3 DNA replication requires the use of enzymes. **[five marks]**
- 10.4 Both DNA and RNA molecules are nucleic acids but they have different structures. **[five marks]**
- 10.5 During protein synthesis, copies of particular genes are allowed to leave the nucleus. **[five marks]**

[Total: twenty-five marks]

Please turn the page.

11. Advances in biotechnology have led to further use of recombinant DNA molecules to produce proteins of interest.

11.1. What is meant by the term *recombinant DNA*?

[three marks]

11.2. Explain how the gene coding for the required protein can be isolated and inserted into a vector.

[six marks]

11.3. Name TWO types of vectors which are commonly used in biotechnology.

[two marks]

11.4. The vectors are then introduced to host cells, such as bacteria. Explain why bacteria are commonly used as host cells in this process.

[five marks]

11.5. Using a suitable example, explain what is meant by *gene therapy*.

[six marks]

11.6. Biotechnology is also being applied to produce *genetically modified crops*. Describe ONE agricultural advantage for the use of *genetically modified crops*.

[three marks]

[Total: twenty-five marks]