

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

**MATRICULATION CERTIFICATE EXAMINATION
INTERMEDIATE LEVEL
SEPTEMBER 2012**

SUBJECT:	BIOLOGY
DATE:	10th September 2012
TIME:	9.00 a.m. to 12.00 noon

Directions to Candidates

- 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	11	Total
Score												
Maximum	8	10	8	9	6	9	25	25	25	25	25	100

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

1. Indicate whether each of the following statements concerning photosynthesis is TRUE or FALSE. Give a reason for each answer.

1.1 Chlorophyll *a* is a strong absorber of green light;

TRUE/FALSE:

REASON:

[two marks]

1.2 Chlorophyll *a* is the most abundant photosynthetic pigment in plants;

TRUE/FALSE:

REASON:

[two marks]

1.3 Glucose is synthesised during the light-dependent reaction of photosynthesis;

TRUE/FALSE:

REASON:

[two marks]

1.4 The light-dependent reaction of photosynthesis provides ATP and reducing power to drive the light-independent reaction.

TRUE/FALSE:

REASON:

[two marks]

[Total: eight marks]

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2. Explain each of the following statements concerning water:

2.1 The water molecule is polar;

[two marks]

2.2 The polarity of the water molecule promotes the formation of hydrogen bonds between water molecules;

[two marks]

2.3 Hydrogen bonding of water molecules gives water a high specific heat capacity;

[three marks]

2.4 The high specific heat capacity of water generates a relatively unchanging thermal environment for aquatic organisms.

[three marks]

[Total: ten marks]

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3. The diagram in Figure 1 represents the different phases of the cell cycle of a eukaryotic cell.

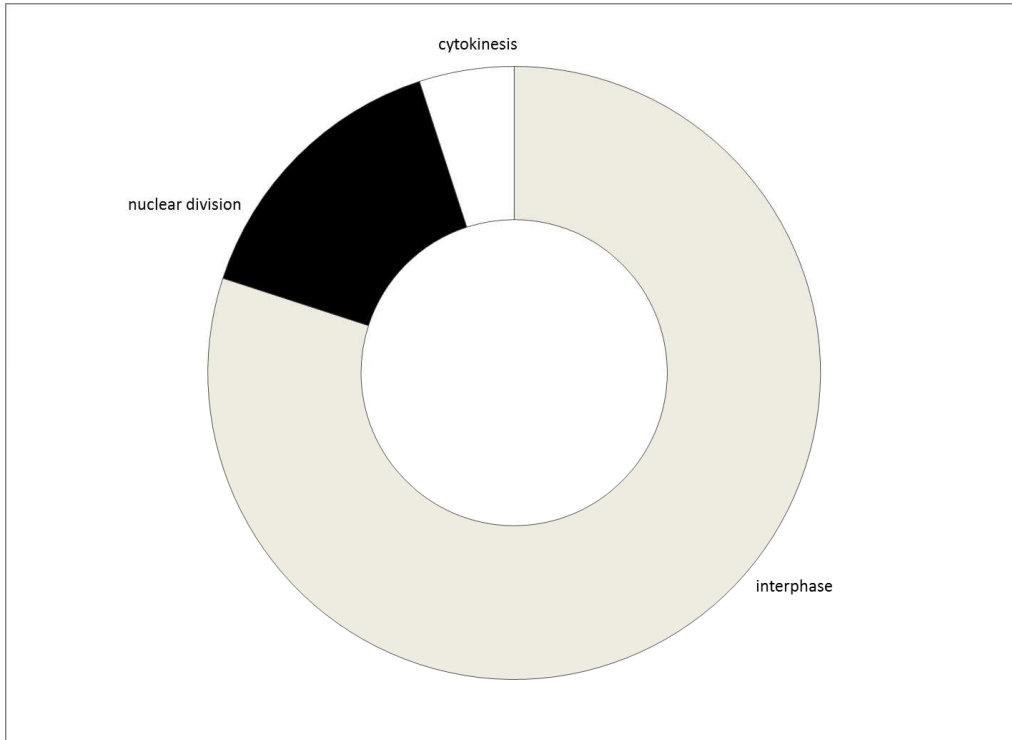


Figure 1: Diagrammatic representation of the cell cycle of a eukaryotic cell

3.1 What is the *cell cycle*?

[two marks]

3.2 Briefly describe the processes that occur during each of these phases of the cell cycle:

Interphase:

Nuclear division:

Cytokinesis:

[three marks]

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3.3 Name a type of cell division that produces haploid daughter cells from diploid parent cells.

[one mark]

3.4 Briefly describe how the type of cell division given in your answer to question 3.3 can generate genetic diversity.

[two marks]

[Total: eight marks]

4. The string of letters below represents the sequence of nucleotide bases in a DNA strand:

TACGACGATGCCAGTCATAAA

4.1 Give the sequence of nucleotide bases in the complementary DNA strand;

[one mark]

4.2 List the sequence of triplet codons that would be produced when the DNA strand is transcribed to produce a messenger RNA (mRNA) molecule;

[one mark]

4.3 List THREE characteristics of the genetic code;

[three marks]

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4.4 Briefly describe how the triplet codons produced during transcription of the mRNA strand would be translated into a polypeptide chain.

[four marks]

[Total: nine marks]

5. Explain each of the following observations in terms of evolution through natural selection:

5.1 The Peppered Moth (*Biston betularia*) occurs in two forms: a light-coloured form and a darker melanic form. The start of the Industrial Revolution (and, therefore, of large-scale air pollution) coincided with an increase in numbers of the melanic form and a corresponding decrease in the abundance of the lighter form.

[three marks]

5.2 Overuse of particular antibiotics will eventually produce bacteria that are immune to those antibiotics.

[three marks]

[Total: six marks]

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6. Figure 2 shows a diagrammatic representation of the human respiratory system.

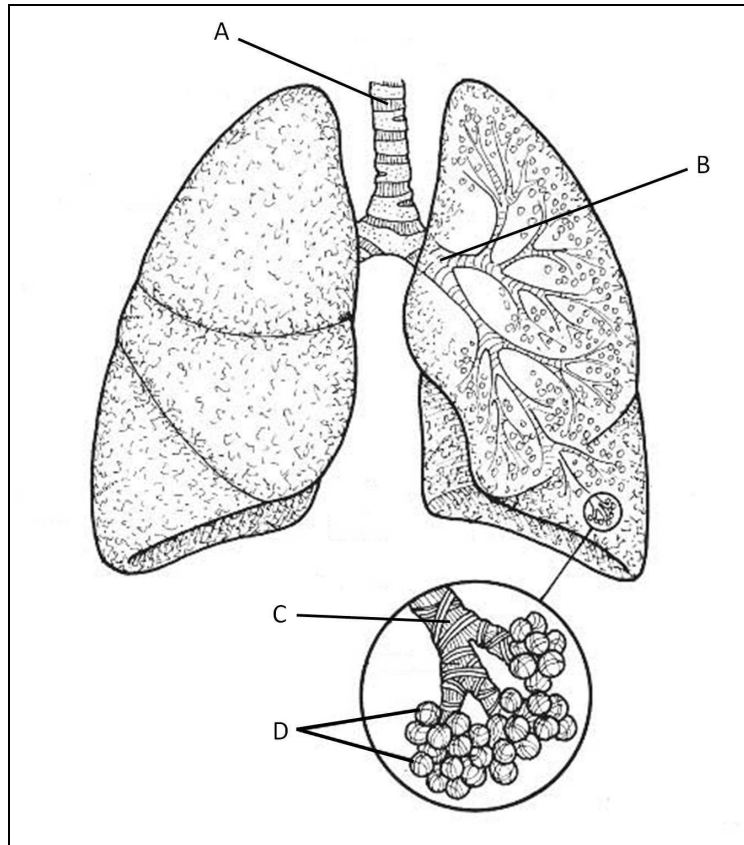


Figure 2: Human respiratory system

6.1 Identify the structures labelled A through D in Figure 2.

A:

B:

C:

D:

[four marks]

6.2 List four features, characteristic of structure D, which facilitate efficient gaseous exchange.

[four marks]

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6.3 Name ONE health problem associated with gaseous exchange.

[one mark]

[Total: nine marks]

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. Recombinant DNA may be used in the production of proteins following its introduction into a suitable host cell through a vector.

7.1 What is *recombinant DNA*?

[three marks]

7.2 Name TWO vectors that may be used to introduce recombinant DNA into host cells.

[two marks]

7.3 Describe how recombinant DNA may be used in the production of human insulin.

[twenty marks]

[Total: twenty-five marks]

8. Rapid growth of the human population has led to overexploitation of land and has been responsible for the generation of large volumes of waste products and pollutants.

8.1 Describe the environmental impact of:

- (a) Large volumes of waste products;
- (b) Atmospheric pollution;
- (c) Overexploitation of land.

[fifteen marks]

8.2 Briefly describe how effective environmental management may halt or reverse these trends.

[ten marks]

[Total: twenty-five marks]

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9. This question is concerned with the immune system of the human body.

9.1 What is the *immune system*?

[five marks]

9.2 Describe the role of each of the following in the immune system:

- (a) Antigens;
- (b) Antibodies;
- (c) B-lymphocytes (B-cells).

[fifteen marks]

9.3 How may a vaccine be used to boost the immune system?

[five marks]

[Total: twenty-five marks]

10. This question concerns digestion of food in the human body.

10.1 Why does food need to be digested?

[two marks]

10.2 Briefly describe the structure of the digestive system of the human body (a diagram is not required).

[five marks]

10.3 Describe the processes undergone by a protein molecule from the point of its ingestion into the body up to the point where its constituent parts are assimilated into body tissues.

[fifteen marks]

10.4 Why is the removal of faeces through the anus not considered as excretion?

[three marks]

[Total: twenty-five marks]

11. Unicellular organisms are composed of a single cell and are generally microscopic, whilst multicellular organisms are composed of several cells and may be very large in size.

11.1 What is a *cell*?

[five marks]

11.2 Why can multicellular organisms generally attain larger sizes than unicellular organisms?

[five marks]

11.3 Compare and contrast the structure of a prokaryotic cell and a eukaryotic cell.

[fifteen marks]

[Total: twenty-five marks]

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