

## MATRICULATION AND SECONDARY EDUCATION CERTIFICATE EXAMINATIONS BOARD

UNIVERSITY OF MALTA, MSIDA

MATRICULATION EXAMINATION

INTERMEDIATE LEVEL

MAY 2014

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<b>SUBJECT:</b>	BIOLOGY
<b>DATE:</b>	15 <sup>th</sup> May 2014
<b>TIME:</b>	9.00 a.m. to 12.00 noon

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**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	12	8	10	7	7	6	25	25	25	25	25	100

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

1. This question concerns enzymes and enzyme action.

1.1 Define the term ‘enzyme’.

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[two marks]

1.2 Briefly explain how enzymes convert a substrate molecule into a product molecule.

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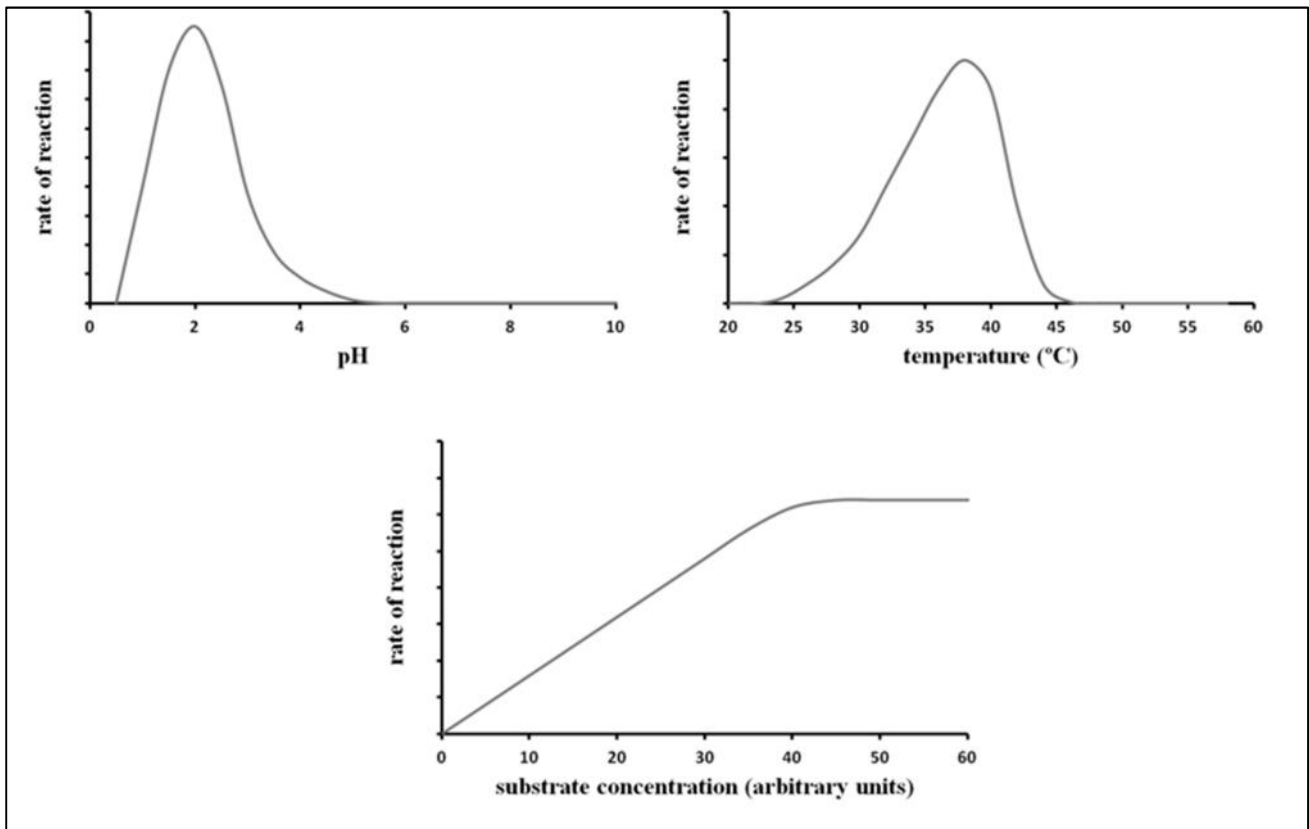
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[three marks]

The graphs below illustrate the rate of reaction of an enzyme under various conditions:



**Figure 1: Rate of reaction of an enzyme under various conditions.**

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1.3 Use the graphs in Figure 1 to determine the optimum *pH* and temperature at which this enzyme functions.

***pH*:**

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**Temperature:**

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**[two marks]**

1.4 Why does the enzyme activity reduce to zero in temperatures exceeding 45°C?

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**[one mark]**

1.5 How does substrate concentration affect the rate of enzyme activity?

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**[two marks]**

1.6 In which organ of the human body would you expect the enzyme represented in Figure 1 to be active?

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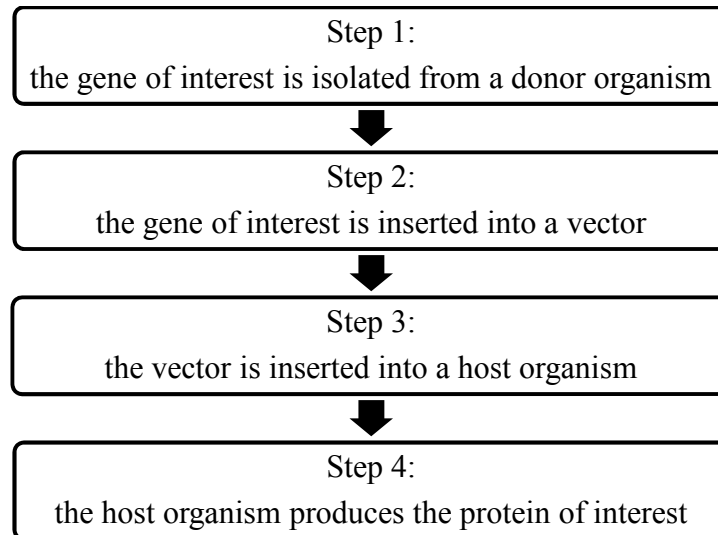
**[two marks]**

**[Total: twelve marks]**

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2. Recombinant DNA technology is being used to produce a number of biomolecules, such as human insulin. A simplified version of the procedures involved in such technology is outlined in Figure 2.



**Figure 2: Procedures involved in gene technology**

- 2.1 Define the term '*recombinant DNA*'.

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[one mark]

- 2.2 Name a donor organism used in the production of human insulin (Step 1).

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[one mark]

- 2.3 Name an enzyme that may be used during Step 1 and an enzyme that may be used during Step 2:

**Step 1:**

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**Step 2:**

---

[two marks]

- 2.4 Name ONE vector (Step 3), that is frequently used in gene technology.

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[one mark]

- 2.5 What host organism (Step 4) is involved in the production of human insulin?

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[one mark]

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2.6 Name TWO applications, other than the production of insulin, where recombinant DNA technology is used.

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**[two marks]**

**[Total: eight marks]**

3. Briefly explain the function of each of the following in relation to human reproduction:

3.1 Oviduct (Fallopian tube):

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**[two marks]**

3.2 Uterus:

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**[two marks]**

3.3 Epididymis:

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**[two marks]**

3.4 Testosterone:

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**[two marks]**

3.5 Follicle-Stimulating Hormone (FSH):

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**[two marks]**

**[Total: ten marks]**

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4. The starting point of both mitosis and meiosis, in the human body, is a diploid parent cell.

4.1 How many daughter cells does a single mitotic division produce? Are these cells haploid or diploid?

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[one mark]

4.2 How many daughter cells does a complete meiotic division produce? Are these cells haploid or diploid?

---

[one mark]

4.3 Name one function each of mitosis and meiosis:

**Mitosis:**

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**Meiosis:**

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[two marks]

4.4 Which of the two processes (mitosis or meiosis) gives rise to genetic variety in the daughter cells?

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[one mark]

4.5 Briefly describe how cell division can generate genetic variety in daughter cells.

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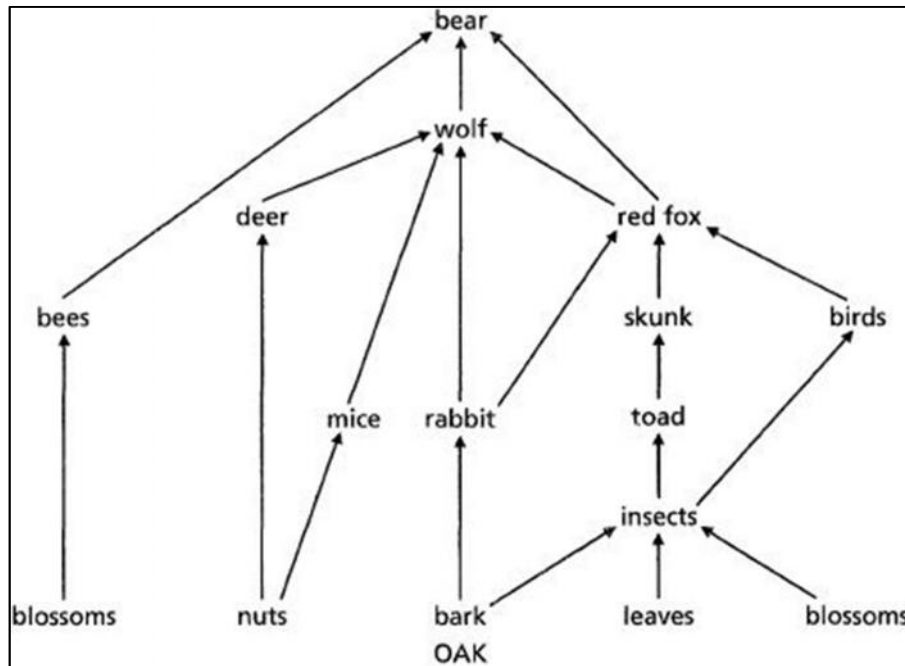
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[two marks]

[Total: seven marks]

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5. The diagram in **Figure 3** represents a food web.



**Figure 3: Food web** (source: <http://www.answers.com/topic/food-web>)

5.1 What is a ‘food web’?

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**[one mark]**

5.2 Name ONE organism from each of the following trophic levels:

**First trophic level:** \_\_\_\_\_

**Second trophic level:** \_\_\_\_\_

**Third trophic level:** \_\_\_\_\_

**[three marks]**

5.3 Assume that ‘nuts’ have been removed from the food web. What effect would this be likely to have on the abundance of each of the following organisms?

**Deer:** \_\_\_\_\_

**Rabbit:** \_\_\_\_\_

**Birds:** \_\_\_\_\_

**[three marks]**

**[Total: seven marks]**

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6. Name the Kingdom of living organisms that best matches each description below:

6.1 Cells without a true nucleus:

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[one mark]

6.2 Cells without membrane-bound organelles:

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[one mark]

6.3 Organisms unicellular, possess a true nucleus, and may or may not possess a cell wall:

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[one mark]

6.4 Organisms multicellular, possess a true nucleus and a cellulose cell wall:

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[one mark]

6.5 Organisms multicellular, possess a true nucleus but lack a cell wall:

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[one mark]

6.6 Organisms possess a true nucleus and characterized by hyphal organisation:

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[one mark]

[Total: six marks]



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**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. A person eats a meal consisting mainly of carbohydrates and proteins. Describe the role of each of the following structures or processes during the breakdown of this meal and during the transport of its breakdown products to the cells.

- 7.1 Chewing (mastication); [two marks]
- 7.2 Saliva; [two marks]
- 7.3 Digestion; [six marks]
- 7.4 Pancreas; [five marks]
- 7.5 Villi; [five marks]
- 7.6 Blood. [five marks]

[Total: twenty-five marks]

8. This question concerns homeostasis.

- 8.1 Describe the role of negative feedback mechanisms in homeostasis. [five marks]
- 8.2 Give an account of the homeostatic processes involved in **EITHER** thermoregulation in humans **OR** regulation of blood glucose level in humans. [twenty marks]

[Total: twenty-five marks]

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9. Compare and contrast the function of the following structures or processes involved in photosynthesis and respiration:

9.1 Chlorophyll *a* and accessory pigments;

[six marks]

9.2 Light-dependent and light-independent reactions during photosynthesis;

[six marks]

9.3 Aerobic respiration and anaerobic respiration as means of energy production.

[thirteen marks]

[Total: twenty-five marks]

10. This question concerns the cell membranes of eukaryotic cells:

10.1 Draw a labelled diagram to show the main structures present in the cell membrane. Give the function of each structure that has been labelled in your diagram.

[eight marks]

10.2 Explain the importance of hydrophobic and hydrophilic properties of phospholipids in the formation of cell membranes.

[six marks]

10.3 Distinguish between passive transport and active transport across membranes.

[five marks]

10.4 Compare and contrast osmosis and diffusion as processes involved in passive transport of molecules across membranes.

[six marks]

[Total: twenty-five marks]

11. Use your knowledge of biology to explain the following statements:

11.1 During DNA replication, DNA is unwound and copied forming a complementary DNA strand;

11.2 Both DNA and RNA have different molecular structures yet are both considered as carriers of genetic information.

11.3 Although DNA does not leave the nucleus, its genetic code is transcribed via the ribosomes outside the nucleus.

11.4 A single base substitution in a DNA sequence can lead to the formation of a slightly different protein.

11.5 Meiosis may lead to trisomy in chromosome 21.

[five marks each]

[Total: twenty-five marks]

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