

## MATRICULATION AND SECONDARY EDUCATION CERTIFICATE EXAMINATIONS BOARD

## UNIVERSITY OF MALTA, MSIDA

MATRICULATION EXAMINATION  
INTERMEDIATE LEVEL  
SEPTEMBER 2013

---

<b>SUBJECT:</b>	BIOLOGY
<b>DATE:</b>	7th September 2013
<b>TIME:</b>	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.*
- 

**For examiners' use only:**

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

DO NOT WRITE ABOVE THIS LINE

---

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

1. Distinguish between each of the following pairs of terms:

1.1 Plasmid and chromosome;

---

---

---

**[two marks]**

1.2 Cell wall and cell membrane;

---

---

---

**[two marks]**

1.3 Chlorophyll and chloroplast;

---

---

---

**[two marks]**

1.4 Chlorophyll and accessory photosynthetic pigments;

---

---

---

**[two marks]**

1.5 Rough endoplasmic reticulum and the Golgi apparatus.

---

---

---

**[two marks]**

**[Total: ten marks]**

DO NOT WRITE ABOVE THIS LINE

2. Enzymes are often referred to as ‘biological catalysts’.

2.1 Why are enzymes considered as ‘biological catalysts’?

---



---

[one mark]

2.2 Briefly describe the ‘lock and key’ hypothesis of enzyme action.

---



---



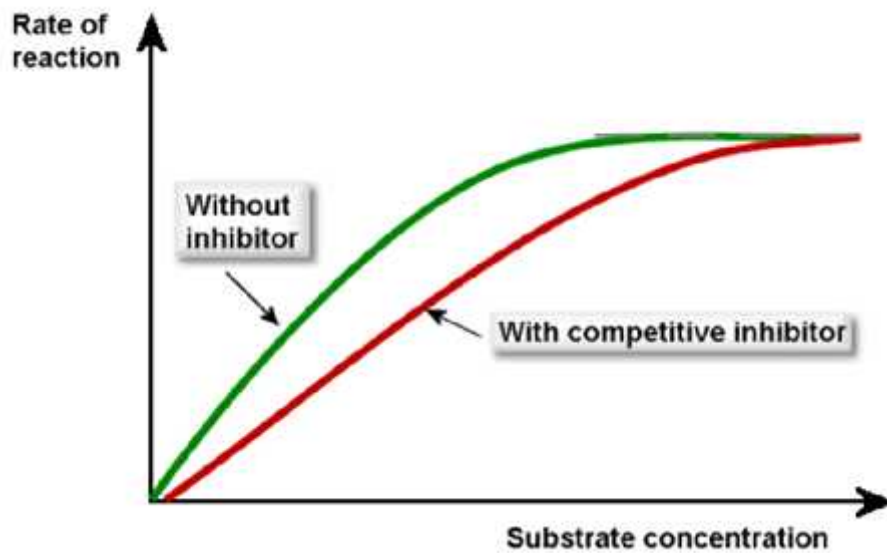
---



---

[four marks]

The graph in Figure 1 shows the variation in the rate of reaction of an enzyme when a competitive inhibitor is present and when no inhibitors are present.



**Figure 1: Rate of reaction of an enzyme against substrate concentration, with and without a competitive inhibitor.** (Image source: <http://alevelnotes.com/Enzyme-Inhibitors/148>)

2.3 How does the competitive inhibitor affect the rate of enzyme action?

---



---

[one mark]

DO NOT WRITE ABOVE THIS LINE

2.4 Why does the presence of a competitive inhibitor affect enzyme action?

---



---



---

[two marks]

2.5 Many enzymes do not function at high temperatures as they are *denatured*. What is a denatured enzyme?

---



---

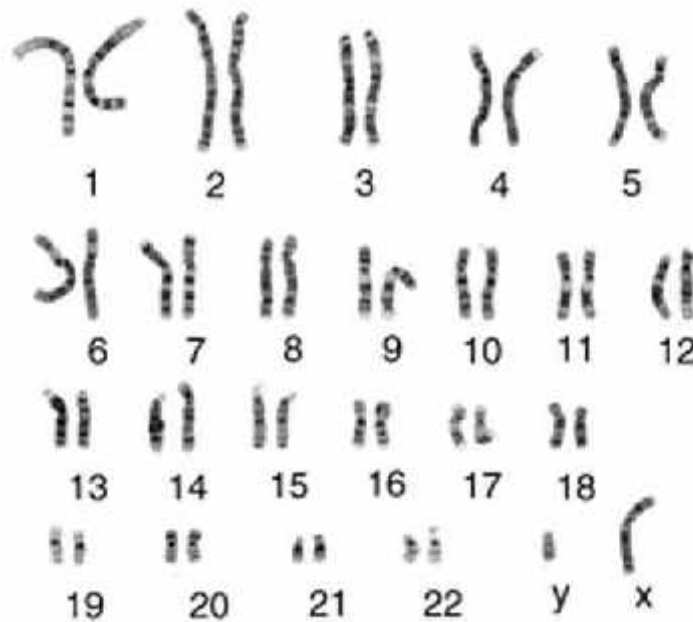


---

[two marks]

[Total: ten marks]

3. The photograph in Figure 2 shows the karyotype (a complete set of chromosomes) of a human male.



**Figure 2: Karyotype of a human male.** (Image source: <http://www.biotechnologyonline.gov.au>)

3.1 What is the haploid number of chromosomes in humans?

---

[two marks]

DO NOT WRITE ABOVE THIS LINE

---

Down's Syndrome is a condition that arises due to a chromosomal mutation. This mutation is caused by non-disjunction of chromosomes during meiosis.

3.2 In what way would the karyotype of a person affected by Down's Syndrome differ from the one shown in Figure 2?

---

---

**[two marks]**

3.3 Define the following terms:  
(a) Mutation;

---

---

**[two marks]**

(b) Non-disjunction;

---

---

**[two marks]**

(c) Meiosis;

---

---

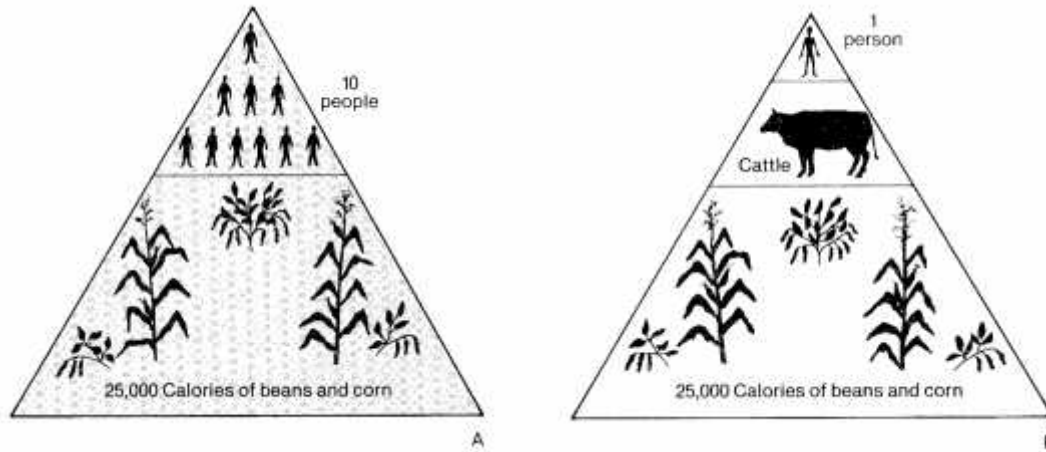
**[two marks]**

**[Total: ten marks]**

*Please turn the page*

DO NOT WRITE ABOVE THIS LINE

4. The diagram in Figure 3 shows two pyramids of energy, labelled A and B, representing food chains that humans may form part of.



**Figure 3: Pyramids of energy.** (Image source: Turk, J. & Turk, A. *Environmental Science*, 1988)

- 4.1 What is a pyramid of energy?

---

---

**[two marks]**

The two pyramids of energy suggest that if most of the global human population had to adopt a vegetarian diet (Pyramid A), this would allow current food supplies to support many more people.

- 4.2 Explain, in terms of ecological relationships, why a diet that includes meat (Pyramid B) would support fewer people than a vegetarian diet (Pyramid A).

---

---

---

---

**[three marks]**

- 4.3 Briefly describe the importance of each of the following in food chains:  
(a) Photosynthesis;

---

---

**[two marks]**

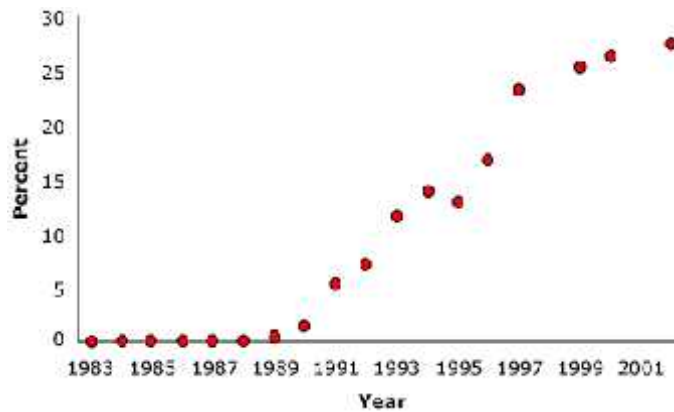
DO NOT WRITE ABOVE THIS LINE

(b) Decomposer organisms.

[two marks]

[Total: nine marks]

5. The graph in Figure 4 shows the percentage of strains of bacteria that evolved resistance to the antibiotic Vancomycin in the USA in the 1990s. Current scientific opinion is that overuse of antibiotics will render them less useful since bacteria will evolve resistance to them.



**Figure 4: Percentage of strains of bacteria resistant to Vancomycin in the USA in the 1990s.**  
 (Image source: <http://evolution.berkeley.edu/>)

5.1 What is biological evolution?

[one mark]

5.2 Briefly explain, in evolutionary terms, why overuse of antibiotics will lead to increased antibiotic resistance in bacteria.

[four marks]

[Total: five marks]

DO NOT WRITE ABOVE THIS LINE

---

6. Briefly define each of the following terms associated with the transport system of the human body:

6.1 Tissue fluid;

---

---

**[one mark]**

6.2 Blood plasma;

---

---

**[one mark]**

6.3 Arteries;

---

---

**[one mark]**

6.4 Veins;

---

---

**[one mark]**

6.5 Erythrocytes;

---

---

**[one mark]**

6.6 Leucocytes.

---

---

**[one mark]**

**[Total: six marks]**



DO NOT WRITE ABOVE THIS LINE

---

**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. Describe the importance of each of the following biomolecules for living organisms:

7.1 Water;

[ten marks]

7.2 Proteins;

[five marks]

7.3 Carbohydrates;

[five marks]

7.4 Lipids.

[five marks]

[Total: twenty-five marks]

8. The use of recombinant DNA is an important aspect of gene technology.

8.1 What is recombinant DNA?

[five marks]

8.2 Describe the processes involved in the production of recombinant DNA and its use in the production of human insulin.

[twenty marks]

[Total: twenty-five marks]

9. This question concerns the immune system of the human body.

9.1 What is the 'immune system'?

[five marks]

9.2 Outline the role of the circulatory system of the human body in defence against disease.

[twelve marks]

9.3 Briefly describe the mode of action of vaccines and their role in the immune system.

[eight marks]

[Total: twenty-five marks]

DO NOT WRITE ABOVE THIS LINE

---

10. This question concerns the nervous system of the human body:

10.1 Give an overview of the structure of the nervous system of the human body.

**[fifteen marks]**

10.2 Describe the propagation of a nerve impulse through a neuron.

**[five marks]**

10.3 How does a nerve impulse propagate across a synapse?

**[five marks]**

**[Total: twenty-five marks]**

11. Negative feedback is a key process in homeostasis.

11.1 What is 'negative feedback'?

**[five marks]**

11.2 Give an overview of the role of negative feedback in the regulation of blood glucose levels in the human body.

**[twenty marks]**

**[Total: twenty-five marks]**

DO NOT WRITE ABOVE THIS LINE

---

**Blank Page**

DO NOT WRITE ABOVE THIS LINE

---

**Blank Page**