AM 05/I.05M **INDEX NUMBER:_____**

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

MATRICULATION CERTIFICATE EXAMINATION
ADVANCED LEVEL
MAY 2005

SUBJECT:	BIOLOGY
PAPER NUMBER:	I
DATE:	16th May 2005
TIME:	9.00 a.m. to 12.00 noon

Directions to Candidates

- *Write your index number in the space at the top right-hand corner of this page.*
- *Answer ALL questions. Write all your answers in the spaces provided in this booklet.*
- *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	Total
Score											
Maximum	14	14	20	11	6	3	8	6	10	8	100

ADVANCED BIOLOGY I

Answer ALL questions.

1. *Eco*RI isolated from *Escherichia coli* was the first restriction endonuclease to be described and the first whose structure was determined.

1.1 What is a restriction endonuclease?

_____

_____

[two marks]

1.2 Which feature of restriction endonucleases makes them such useful tools in modern biotechnology?

_____

_____

[two marks]

*Eco*RI recognises the following sequence:

5' - G A A T T C - 3'
3' - C T T A A G - 5'

It cleaves both strands on the 3' side of the G, leaving a 5' overhanging end.

Assume that the following DNA strand has been treated with *Eco*RI:

5'- G G G A A T T C G T C C G A A T T C C -3'
3'- C C C T T A A G C A G G C T T A A G G -5'

1.3 Draw the resulting fragments in the space below.

[three marks]

1.4 Briefly describe the role of restriction endonucleases in paternity testing.

[two marks]

1.5 Restriction endonucleases are generally harvested from bacteria. What function may these molecules serve in bacteria?

[two marks]

PCR is another fundamental tool in modern biotechnology.

1.6 What do the initials *PCR* represent?

[one mark]

1.7 Why is PCR an important tool in modern biotechnology?

[two marks]

[Total: fourteen marks]

.

2. This question concerns evolutionary change in living organisms.

2.1 What is biological evolution?

_____

_____

[two marks]

2.2 Studies on evolution invariably focus on the study of fossilised organisms. What is a *fossilised organism*?

_____

_____

[two marks]

2.3 List TWO shortcomings of the fossil record as a tool in studying evolutionary processes.

_____

_____

[two marks]

Read the following statements concerning evolutionary change and state whether you consider them to be true or false. Give reasons for your answers.

2.4 The phenomenon of insects developing a resistance to pesticides over the period of a few years may be described as evolutionary change.

_____

_____

[two marks]

2.5 Humans living in developed countries are generally larger than their recent ancestors as a result of better diet and medicine. This may be described as evolutionary change.

_____

_____

[two marks]

2.6 Inbreeding increases the frequency of rare harmful alleles in the population.

_____

_____

[two marks]

2.7 Evolutionary change only proceeds through natural selection (*survival of the fittest*).

[two marks]

[Total: fourteen marks]

3. This question concerns cellular structure and function.

3.1 List THREE advantages of eukaryotic organisation over prokaryotic organisation.

[three marks]

Suggest explanations for the following observations:

3.2 The membranes of some cells are folded into microvilli.

[two marks]

3.3 The inner membrane of a mitochondrion is folded into cristae.

[two marks]

3.4 Old, worn-out organelles are recycled by lysosomes.

[two marks]

3.5 Plant cells generally need large, permanent vacuoles.

[two marks]

3.6 Not all plant cells contain chloroplasts.

[two marks]

3.7 List THREE functions of the cytoskeleton of eukaryotic cells.

[three marks]

3.8 What is a flagellum?

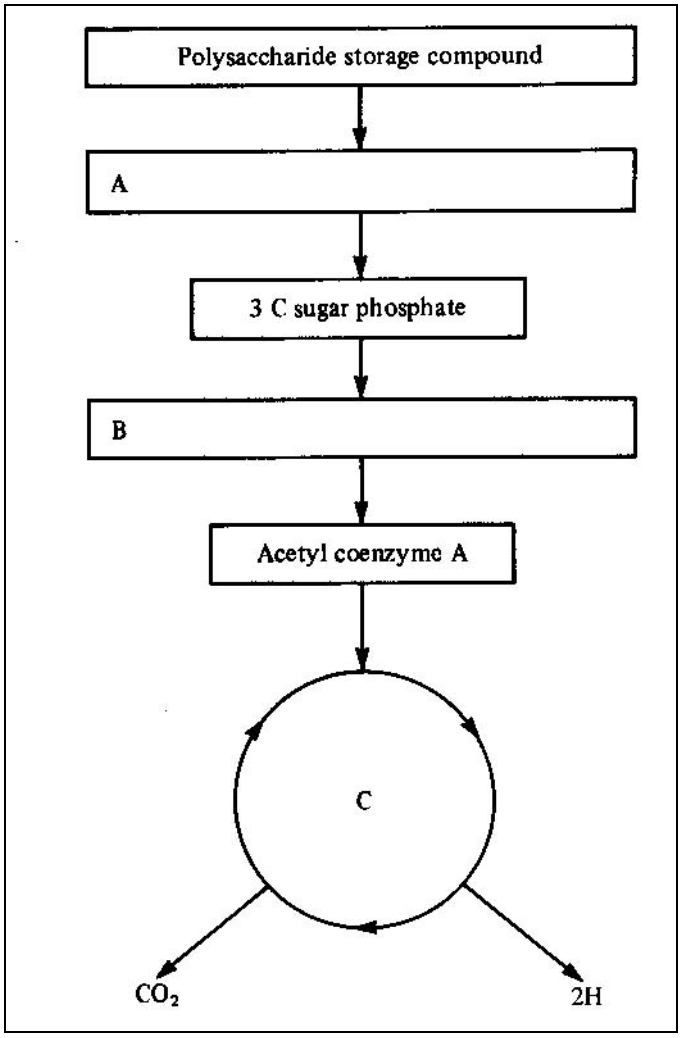
[one mark]

3.9 Briefly describe the structure of a eukaryotic flagellum.

[three marks]

[Total: twenty marks]

4. The flowchart below represents stages in cellular respiration.



4.1 What is respiration?

_____

[one mark]

4.2 Fill in the name of ONE missing compound in each of boxes A and B in the diagram above.

[two marks]

4.3 What name is given to stage C?

_____

[one mark]

4.4 What happens to the hydrogen removed during stage C?

_____

_____

_____

[three marks]

4.5 Where, in a cell, does Stage A to Stage B occur?

_____

[one mark]

4.6 Where, in a cell, does Stage C occur?

_____

[one mark]

4.7 How would you expect the process represented in the flowchart to change if no oxygen was available?

_____

[one mark]

4.8 How would you expect the process represented in the flowchart to change if cyanide were added to the cell?

_____

[one mark]

[Total: eleven marks]

5. Briefly describe each of the following interspecific interactions giving ONE example of each.

5.1 Amensalism

_____

_____

[two marks]

5.2 Commensalism

_____

_____

[two marks]

5.3 Mutualism

_____

_____

[two marks]

[Total: six marks]

6. Read the passage below and insert the appropriate term in the blank spaces provided.

The brain and spinal cord are hollow and filled with a tissue fluid called _____ fluid. This fluid also fills the space between two of the three membranes that completely surround the brain and spinal cord. The largest part of the mammalian brain is called the _____. It is divided longitudinally by a deep cleft and the two halves are connected by white matter deep within the brain. The part of the brain concerned with posture and balance is called the _____ whilst the _____ contains the cardiac and respiratory centres which are concerned with the control of heartbeat and breathing. The _____, also part of the brain, is linked to the pituitary glands and is mainly concerned with the maintenance of a stable internal environment, a process called _____.

[Total: three marks]

7. Briefly outline three main characteristics of the following groups of plants and give one local example of each.

Group	Three diagnostic characteristics	Local Example
Bryophyta		
Polypodiophyta		
Pinophyta		
Magnoliophyta		

[Total: eight marks]

8. Distinguish between the following pairs of terms associated with the classification of living organisms:

8.1 Segmentation and tagmatisation

_____

_____

[two marks]

8.2 Thread cells and flame cells

_____

_____

[two marks]

8.3 Polyp and Medusa

_____

_____

[two marks]

[Total: six marks]

9. Enzymes are organic catalysts which catalyse specific reactions by lowering their activation energy.

9.1 What is the *activation energy* of a chemical reaction?

_____

[one mark]

Explain the meaning of the following terms in the context of enzyme activity:

9.2 Organic catalyst

_____

_____

[one mark]

9.3 Active site

_____

_____

[one mark]

9.4 Denaturation

_____

_____

[one mark]

9.5 Briefly describe how the shape of an enzyme is related to its catalytic function.

_____

_____

[two marks]

9.6 Briefly describe how the shape of an enzyme is related to allosteric control of its activity.

[two marks]

9.7 Briefly describe how negative feedback loops may regulate enzyme activity.

[two marks]

[Total: ten marks]

10. Urea is the principal nitrogenous waste of mammals and is generally derived from deamination of amino acids.

10.1 What is deamination?

[two marks]

Ammonia, the product of oxidative deamination reactions, is toxic, even in low concentrations and is therefore converted into urea and subsequently eliminated from the body.

10.2 Briefly describe the sequence of events through which ammonia is converted into urea.

[three marks]

10.3 In which organ does this sequence of reactions occur?

[one mark]

10.4 What is the ultimate fate of the urea produced during this process?

[two marks]

[Total: eight marks]