Index No.:_____ **AM 05/I.13m**

MATRICULATION AND SECONDARY EDUCATION CERTIFICATE EXAMINATIONS BOARD

UNIVERSITY OF MALTA, MSIDA

MATRICULATION EXAMINATION
ADVANCED LEVEL
MAY 2013

SUBJECT:	BIOLOGY
PAPER NUMBER:	I
DATE:	11th May 2013
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. 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	6	10	10	13	9	11	10	11	8	12	**100**

1. Give ONE function for each of the following cellular structures:

1.1. nucleolus;

_____

[one mark]

1.2. centrioles;

_____

[one mark]

1.3. Golgi apparatus;

_____

[one mark]

1.4. smooth endoplasmic reticulum;

_____

[one mark]

1.5. pili;

_____

[one mark]

1.6. lysosomes.

_____

[one mark]
[Total: six marks]

2. Give TWO functions (for each) to illustrate the biological importance of the following:

2.1. the dipole character of water;

_____

_____

_____

[two marks]

2.2. cysteine in proteins;

_____

_____

_____

[two marks]

2.3. hydrogen bonds between nitrogenous bases of nucleic acids;

_____

_____

_____

[two marks]

2.4. DNA polymerase I;

_____

_____

_____

[two marks]

2.5. tubulin.

_____

_____

_____

[two marks]
[Total: ten marks]

3. This question is about pepsin.

3.1. Enzymes are highly specific to their substrate. Outline the model that describes an enzyme catalysed reaction using the pepsin catalysed reaction as an example.

_____

_____

_____

_____

[two marks]

3.2. Enzymes are said to be pH specific. How does the pH influence the activity of pepsin in the human body?

_____

_____

_____

[two marks]

3.3. The peptide, *pepstatin* is a known competitive inhibitor of pepsin. Explain the term 'competitive inhibitor' and the possible effects of *pepstatin* on the rate of the pepsin catalysed reaction.

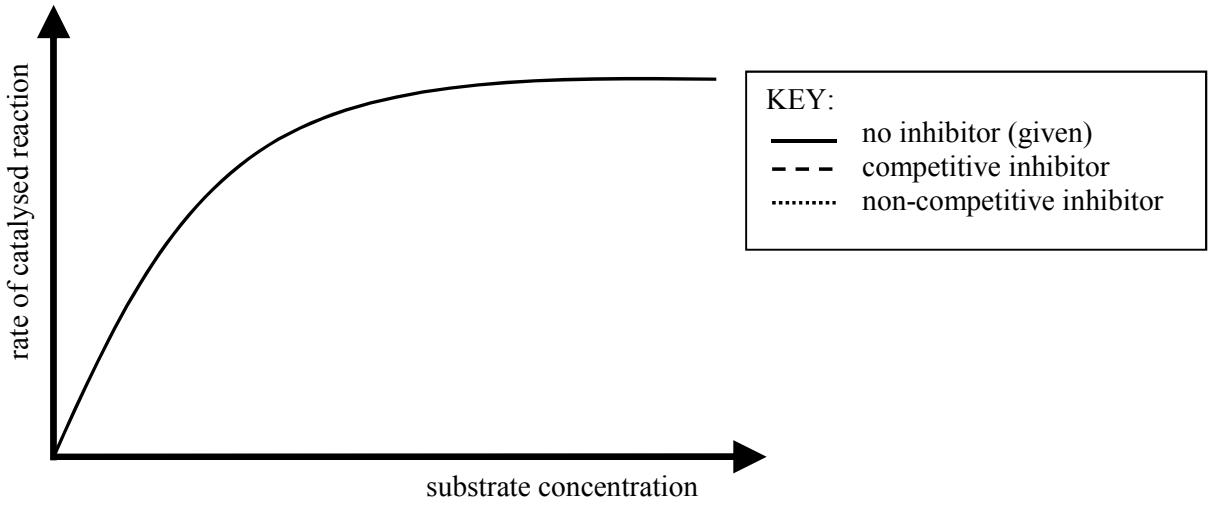
_____

_____

_____

[two marks]

3.4. Using the graph below, illustrate the effects of a 'competitive inhibitor' and that of a 'non-competitive inhibitor' on the rate of an enzyme catalysed reaction.



[one mark]

3.5. The flow diagram below (Figure 1) represents some of the stages involved in the commercial production of a protease enzyme for use in the manufacture of a biological detergent.

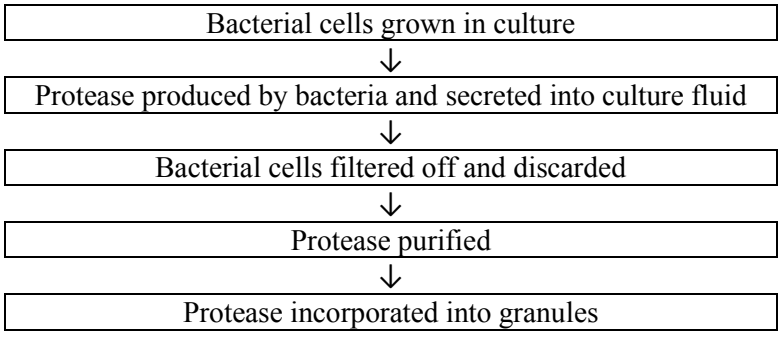


Figure 1

Explain why proteases are incorporated into biological detergents.

_____

_____

[one mark]

3.6. The proteases used in biological detergents are normally extracted from bacteria living in hot water springs (around 45°C). Explain why it is advantageous to use proteases from these bacterial species rather than human pepsin.

_____

_____

_____

[two marks]
[Total: ten marks]

4. This question is about inheritance.
Warfarin, an anticoagulant, may be used as a pesticide to kill rats. Some rats are resistant to *warfarin* and this resistance is controlled by a gene which has two alleles, **W** and **w**. A study was carried out on genotypes of 98 rats trapped from farms where *warfarin* was being used. Moreover it is known that rats with the genotype **WW**, require a lot more vitamin K in their diet than those with the other genotypes.

The data collected from the field study are listed in the table below.

Genotype	Phenotype	Observed Number
WW	Resistant to *warfarin*	4
Ww	Resistant to *warfarin*	76
ww	Killed by *warfarin*	18

Table 1. A table showing the different type of genotypes, phenotypes and number of specimens noted during the field study.

4.1. Determine whether the allele for *warfarin* resistance, is dominant or recessive. Give a reason for your answer.

_____

_____

[one mark]

4.2. Calculate the frequency of the alleles **W** and **w** in the studied population (working must be shown).

_____

_____

allele **W** _____ allele **w** _____

[two marks]

4.3. Give FOUR assumptions that a population must follow for its genetic variability to be in agreement with the Hardy-Weinberg Equilibrium principle.

_____

_____

[two marks]

4.4. Are the allele frequencies of the studied rat population in approximate agreement with predictions of the Hardy-Weinberg Equilibrium principle? (working must be shown).

_____

_____

_____

_____

_____

_____

[three marks]

4.5. Give possible reasons why each of the homozygous genotypes is at a disadvantage compared with the heterozygous genotype.

_____

_____

[one mark]

4.6. The use of this pesticide was discontinued. After six years, another study was carried out in the same geographical region. It was noted that the 81.6% *warfarin* resistance noted in the first study had reduced to 40% after six years. Explain why the number of resistant rats dropped after the *warfarin* was discontinued.

_____

_____

_____

[two marks]

4.7. Suggest why the allele for resistance to *warfarin* was likely to remain in the gene pool when the use of *warfarin* was discontinued.

_____

_____

_____

[two marks]
[Total: thirteen marks]

5. The following question is about viruses and the immune system. The diagram below (Figure 2) shows the structure of a retrovirus.

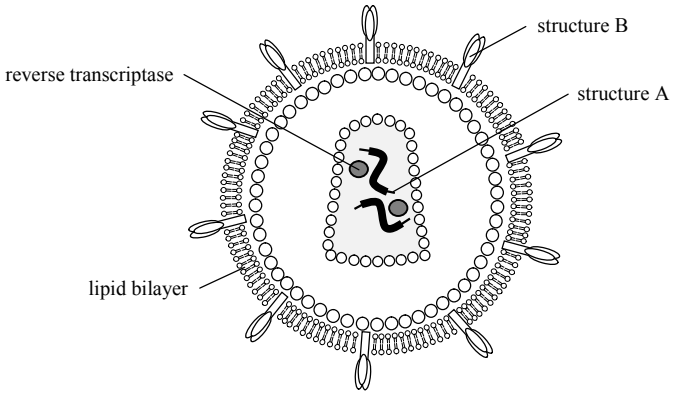


Figure 2

5.1. Name the structures labelled A and B.

Structure A _____ Structure B _____

[one mark]

5.2. What is the function of the reverse transcriptase?

_____

[one mark]

5.3. Distinguish between the lysogenic and the lytic cycle of a virus.

_____

_____

_____

_____

_____

[three marks]

5.4. A person was injected with a vaccine on DAY 1 and again on DAY 36 during a 70 day study. The table below shows the concentration of antibodies to this vaccine in the person's blood at the end of each week during the study.

1st injection ⇩ 2nd injection ⇩

Day	7	14	21	28	35	42	49	56	63	70
Concentration of antibodies in the blood (mg/100ml of blood)	3	15	28	32	10	80	102	112	120	118

Table 2. A table showing the weekly concentration of antibodies to the vaccine.

When compared to the first injection, the second injection caused a higher concentration of antibody production. Identify TWO other differences in the response to the second injection.

_____

_____

[two marks]

5.5. In view of the human immune system, explain the biological significance of the observations noted in the above experiment (Question 5.4.).

_____

_____

_____

[two marks]
[Total: nine marks]

6. Distinguish between the following terms, in view of autotrophic nutrition.

6.1. *absorption* and *action spectra;*

_____

_____

_____

[two marks]

6.2. *primary pigment* and *accessory pigment;*

_____

_____

_____

_____

[three marks]

6.3. *C_3* and *CAM plants;*

_____

_____

_____

_____

[three marks]

6.4. *cyclic* and *non-cyclic photophosphorylation*.

_____

_____

_____

_____

[three marks]
[Total: eleven marks]

7. The following question is about the nervous system and stimulus reception in the eye. The diagram below (Figure 3) shows a rod cell from the retina of a mammal.

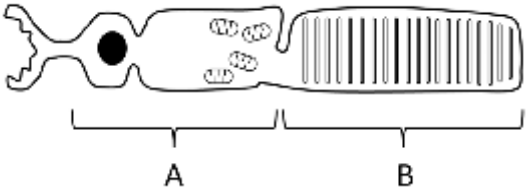


Figure 3

7.1. Name the segments labelled:

Section A _____ Section B _____

[one mark]

7.2. Name the photopigment found in the cell above, and briefly describe its role in generating a potential.

_____

_____

_____

_____

_____

_____

_____

_____

[four marks]

7.3. Distinguish between the rod and cone cells of the human eye.

_____

_____

_____

_____

[three marks]

7.4. Name TWO differences between the human eye and the nocturnal eye, which make the latter more sensitive in low light conditions.

_____

_____

_____

[two marks]
[Total: ten marks]

8. Testosterone, the main male sex hormone in humans, is produced from cholesterol and its production is controlled by a negative feedback mechanism, involving the hypothalamus and the anterior pituitary gland.

8.1. In which group of biological molecules do testosterone and cholesterol belong to?

_____

[one mark]

8.2. Which cells produce testosterone?

_____

[one mark]

8.3. Through the use of a flow diagram, explain how testosterone production is controlled through a negative feedback mechanism.

_____

_____

_____

_____

_____

_____

_____

_____

[four marks]

8.4. The anterior pituitary gland also secretes Follicle-Stimulating Hormone (FSH). Name ONE function of FSH in males?

_____

[one mark]

8.5. Name ONE function of FSH in females?

_____

[one mark]

8.6. List THREE ways in which hormonal control differs from nervous control.

_____

_____

_____

_____

[three marks]
[Total: eleven marks]

9. Relate the following structures to their biological function, in view of locomotion and support:

9.1. *flexor* and *extensor muscles* in insects;

_____

_____

_____

[two marks]

9.2. *circular* and *longitudinal muscles* in the earthworm;

_____

_____

_____

[two marks]

9.3. *spongy* and *compact bone* in the femur;

_____

_____

_____

[two marks]

9.4. *collenchyma* and *sclerenchyma* in plant stems.

_____

_____

_____

[two marks]
[Total: eight marks]

10. This question is about environmental biology.
An area of abandoned grassland was studied over a period of more than 150 years. The table below (Table 3) shows the changes that occurred in the plant communities as well as the number and density of species of small birds.

Time since area was abandoned (years)	0	15	50	150
Plant community	Grass	Shrubs	Pine trees	Mixed woodland
Number of species of small birds	2	8	13	19
Density (pairs of small birds per km^2)	53	338	282	563

Table 3. A table showing the changes in plant communities and birds over a period of time.

10.1. Give TWO possible reasons to why after being abandoned, the grassland community was replaced by the shrub community.

_____

_____

_____

[two marks]

10.2. Give TWO reasons why the density of birds decreased when the shrub community was replaced by pine trees.

_____

_____

_____

[two marks]

10.3. Suggest TWO reasons for the change noted in the number of small bird species as the community changed from pine trees to mixed woodland.

_____

_____

_____

[two marks]

10.4. What is the term used to describe the change in the plant communities illustrated in this question.

_____

[one mark]

10.5. How would you expect the level of nitrates in the soil to change in the area studied over the 150 years period? Give reasons for your answer.

_____

_____

_____

_____

[three marks]

10.6. The final climax vegetation can be stable for very long periods of time. Suggest TWO natural and TWO anthropogenic (human caused) processes by which this stable community may be disturbed.

Natural processes: _____

_____

Anthropogenic processes: _____

_____

[two marks]

[Total: twelve marks]

MATRICULATION AND SECONDARY EDUCATION CERTIFICATE EXAMINATIONS BOARD

UNIVERSITY OF MALTA, MSIDA

MATRICULATION EXAMINATION
ADVANCED LEVEL
MAY 2013

SUBJECT:	BIOLOGY
PAPER NUMBER:	II
DATE:	13th May 2013
TIME:	9.00 a.m. to 12.00 noon

Directions to Candidates

- *Answer the question in Section A, any TWO questions from Section B and ONE question from Section C. Write all your answers in the separate booklet provided.*
- ***If more than two questions from Section B are attempted, only the first two answers shall be taken into consideration.***
- ***If more than one question from Section C is attempted, only the first answer 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.*

SECTION A (this section is **obligatory**)

1. Read the extract below carefully and afterward, from the information given and from your knowledge of biology, answer the questions that follow. The numerals in the left-hand margin are line numbers.

Squirrels go into the deep freeze

In the Arctic winter, the freezing cold and lack of sunlight cause the temperatures to regularly drop below zero. So each autumn, the Arctic ground squirrel (*Spermophilus parryii*), a herbivorous mammal, heads into underground tunnels to hibernate for eight months. During hibernation, the squirrel goes into a state similar to suspended animation. It cuts itself off from the world and allows its body temperature to drop. However, once it wakes up for the summer, the squirrel can switch its daily clock back on.

The squirrels' sub-zero tolerance was first discovered almost 25 years ago. Curious how the animals manage to survive the frigid Arctic winter, researchers from the University of Alaska implanted radio transmitters into the stomachs of captive Arctic ground squirrels. These transmitters record information on the squirrels' body temperature, where it was noted that once the squirrels went into their deep sleep, their core body temperature dropped from about 36°C to around -3°C, making this the lowest ever body temperature recorded in mammals.

To prevent their blood from freezing, the squirrels cleanse it of any particles that could cause water molecules to form ice crystals around. This allows the blood to remain liquid below zero, a phenomenon known as supercooling. The scientists said that it is still unknown how the squirrels do this, because they lack the 'antifreeze' proteins that allow fish to survive at low temperatures. Moreover their extremely low metabolism probably allows them to make best use of their fat stores. Once the cold months are over, the squirrels wake up. Initially they stay in their burrows eating food they had previously stored.

These extreme temperatures are not the only thing that makes hibernators want to stay in bed. The constant light of the Arctic summer and constant darkness of the winter make it impossible to tune daily biological clocks to any environmental cues. As a result, many Arctic species such as reindeers lack daily rhythms at all. On the other hand, the Arctic ground squirrel seemed to create their own sunrise and sunset by popping out of their burrows every day and retreating at night. This tricked their body clocks into responding to daily cycles during the warmer months.

In a separate study, scientists wanted to determine the limit of the squirrels' supercooled sleep. Thus scientists slowly decreased the ambient temperature of an underground tunnel which had a hibernating squirrel in it. As the temperature dropped, the squirrel stayed asleep, keeping its body temperature around -4°C until the ambient temperature hit -26°C. At this temperature, the squirrel started to shiver and woke up, and its body temperature rose, suggesting that this is the lowest temperature at which it could survive while asleep.

Adapted from ***New Scientist, January 2013***

1.1. To which Phylum do squirrels belong? Give THREE diagnostic features that can be used in the classification of the squirrel in the named Phylum.

[two marks]

1.2. Give TWO reasons why it can be advantageous for the Arctic ground squirrel to go into hibernation rather than staying active throughout winter.

[two marks]

1.3. Propose TWO biological reasons why it is advantageous for the Arctic ground squirrel to hibernate in underground tunnels (line 3).

[two marks]

1.4. The Arctic ground squirrel goes into hibernation, however in other parts of the world some reptiles commonly go into aestivation. Distinguish between hibernation and aestivation.

[two marks]

1.5. How would one expect the rate of the heart beat and that of respiration to change as the Arctic ground squirrel goes into hibernation? Give a reason for your suggestion.

[two marks]

1.6. Explain why fat stores (line 17) are important for the survival of the Arctic ground squirrel?

[three marks]

1.7. What is the evolutionary importance of the mechanism that triggers the Arctic ground squirrel to wake up if the temperature goes below -26°C?

[two marks]

1.8. What is the importance of shivering (line 30) when the Arctic ground squirrel starts to wake up?

[one mark]

1.9. Once the Arctic ground squirrel wakes up, instead of going out of its burrow, it would eat food previously stored in its burrow (lines 18-19). What is the importance of this behaviour?

[two marks]

1.10. It is said that in the Arctic it is impossible to tune daily biological clocks to any environmental cues (line 22). Name TWO environmental cues which are important in setting the daily rhythm noted in most animals.

[two marks]

1.11. Describe TWO anatomical features you would expect to find in the Arctic ground squirrel that would differentiate it from squirrels living in warmer regions. Give reasons for your answers.

[two marks]

1.12. Not all Arctic animals are able to undergo supercooling (line 15). Name ONE behavioural mechanism used by such Arctic animals to ensure the success of their species.

[one mark]

1.13. Describe TWO physiological responses (not named in the text above) present in humans that help us to cope with the changes in ambient temperatures.

[two marks]

[Total: twenty five marks]

SECTION B

(Answer any **TWO** questions from this section; your answers should take the form of essays. Each question carries twenty five marks).

2. Compare and contrast the metabolic pathways of aerobic respiration and fermentation.

3. Write an account on tracheophytes and their adaptation to a terrestrial mode of life.

4. Give an account on genetic variation and its biological importance in evolution.

5. Modern biotechnology utilizes several techniques to make products related to the pharmaceutical industry and agriculture. Discuss this statement using specific examples.

[Total: fifty marks]

SECTION C

(Answer **ONE** question from this section).

6. Use your knowledge of biology to explain each of the following observations:

6.1. Hermaphroditism is common in sessile organisms.
6.2. Mammals are ureotelic (urea-excreting).
6.3. Saprophytic organisms play a key role in the carbon cycle.
6.4. IAA is produced mainly in the shoot tips of plants.
6.5. Desert plants are mostly species with a short life.

[five marks each]

7. The following statements are linked to human physiology. Use your knowledge of biology to write short notes on each of the following.

7.1. The affinity of haemoglobin to oxygen is linked to carbon dioxide concentration.
7.2. Gluconeogenesis aids in maintaining adequate sugar levels in the blood during strenuous physical exercise.
7.3. Adrenaline is released in times of stress.
7.4. The liver plays an important role in the digestion of lipids.
7.5. The double circulatory system in humans is more efficient than the single circulatory system in fish.

[five marks each]

[Total: twenty five marks]

Index No.:_____ **AM 05/III.13m**

MATRICULATION AND SECONDARY EDUCATION CERTIFICATE EXAMINATIONS BOARD

UNIVERSITY OF MALTA, MSIDA

MATRICULATION EXAMINATION
ADVANCED LEVEL
MAY 2013

SUBJECT:	BIOLOGY
PAPER NUMBER:	III
DATE:	18th May 2013
TIME:	9.00 a.m. to 10.30 a.m.

Directions to Candidates

- *Write your index number in the space at the top left-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. Unless otherwise specified, you are advised to list results to one decimal place.*
- *The use of electronic calculators is permitted.*

For examiners' use only:

Question	1	2	3	Total
Score				
Maximum	15	20	15	50

1. A scientist intends to study mitosis in the root-tip cells of an onion (*Allium cepa*).

1.1 Why did the scientist select cells from the root-tip for this study?

_____

[one mark]

1.2 The diagram in Figure 1 shows part of the root tip of an onion. Label the part of the root-tip that the scientist should carry out detailed studies on.

[two marks]

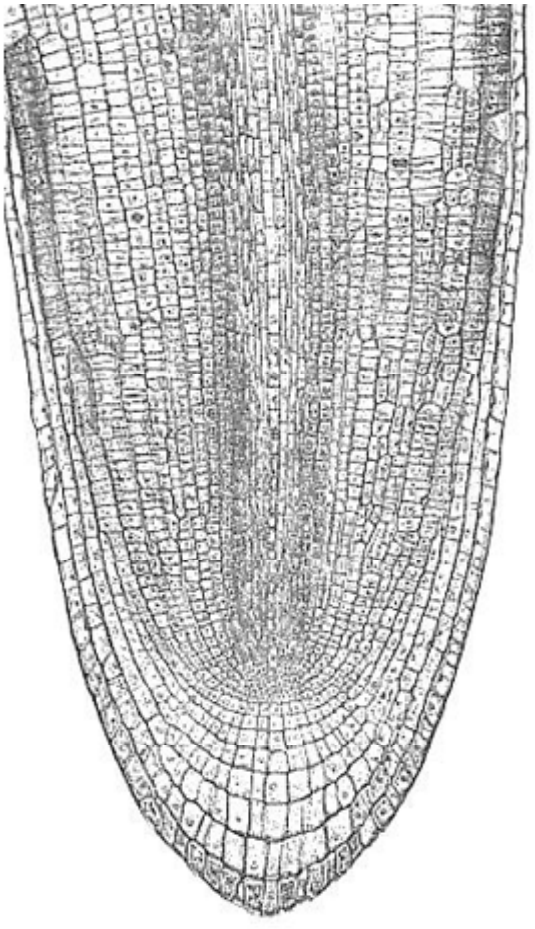


Figure 1: Root-tip of *Allium cepa*

(Image source: http://www.marietta.edu/~biol/)

1.3 Describe how the scientist may prepare a temporary microscope slide showing mitosis in root-tip cells of an onion.

[nine marks]

After preparing the microscope slides, the scientist recorded the process of mitosis through micrographs, one of which is shown in Figure 2.

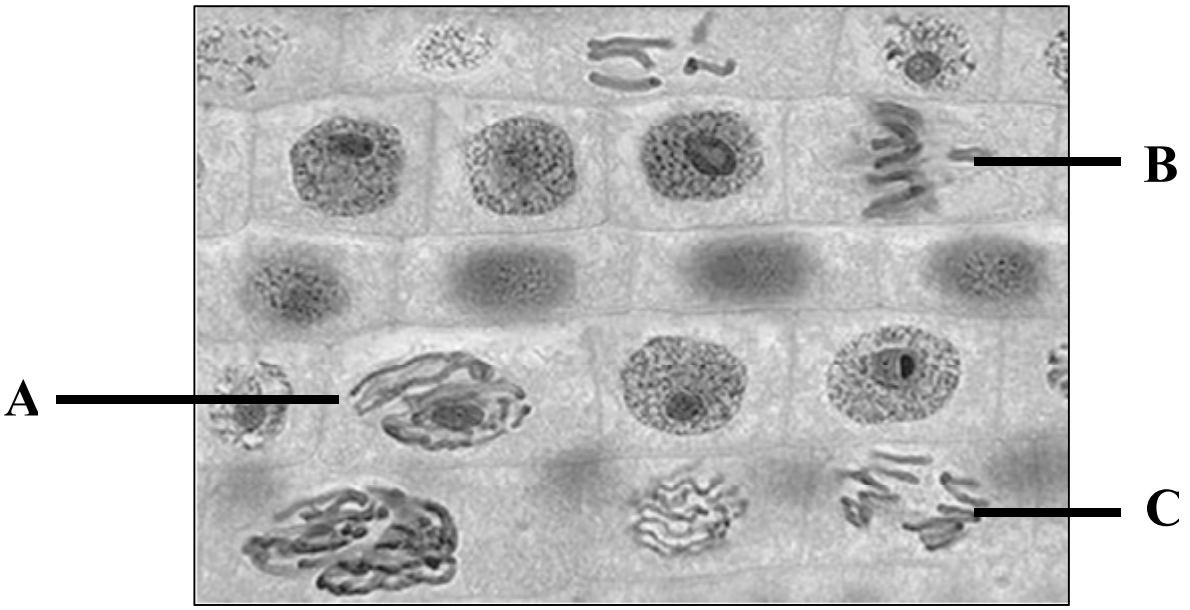


Figure 2: Root-tip cells of *Allium cepa* undergoing mitosis

(Image source: http://www.microscopy-uk.org.uk/micropolitan)

1.4 Identify the stage of mitosis that cells A, B and C are likely to be undergoing.

A: _____

B: _____

C: _____

[three marks]

[Total: fifteen marks]

2. A biologist investigated the contribution of individual leaves to the rate of transpiration in a cut shoot of beech (*Fagus* sp.). She set up a simple potometer, consisting of a glass capillary tube, rubber tubing and a measuring scale, and inserted a Beech shoot with eight leaves into it. An illuminated bench lamp was placed approximately 20 cm from the shoot. The biologist measured the distance moved by the meniscus in the capillary tubing over a ten-minute period and recorded the results.

She then applied a layer of petroleum jelly to the underside of the two leaves closest to the apex of the shoot (the apical leaves), and recorded the distance moved by the meniscus over a ten-minute period.

She subsequently detached the two apical leaves from the shoot and measured the distance moved by the meniscus over a ten-minute period. This procedure was repeated, with successive pairs of leaves being detached from the shoot, until no more leaves remained.

The results obtained were the following:

Condition of twig	**Distance travelled by meniscus in ten minutes (cm)**	**Water uptake (cm^3)**
Intact; all leaves present	15.4	0.483
Two leaves with petroleum jelly	12.9	0.405
Two leaves removed	12.3	0.386
Four leaves removed	7.5	0.235
Six leaves removed	4.0	0.126
Eight leaves removed	0.9	0.028

2.1 How did the biologist convert the distance moved by the meniscus into the volume of water taken up by the Beech shoot?

[two marks]

2.2 Calculate the mean volume of water lost from a single leaf over a ten-minute period.

[two marks]

2.3 In the case of the apical leaves, calculate the percentage of water lost from the upper leaf surfaces only.

[three marks]

2.4 Why do the upper and lower leaf surfaces lose water at different rates?

[one mark]

2.5 Why did the shoot still lose water after all the leaves had been detached?

[one mark]

2.6 The biologist noted that the leaves were not all identical in size. How may the experiment be modified to take this factor into account?

[three marks]

Other scientists evaluated this experiment and concluded that the results may have been different if the leaves had not been detached from the shoot. They also stated that the reliability of the results obtained would have been greater if some simple modifications were made to the design of the experiment.

2.7 How may detachment of the leaves have affected the results obtained?

[two marks]

2.8 Suggest how the objectives of the investigation could have been met without detaching any leaves from the shoot.

[two marks]

2.9 Briefly describe TWO modifications that would give the results obtained greater reliability.

[four marks]

[Total: twenty marks]

3. Figure 3 to Figure 6 show a number of non-animal organisms (labelled as Organism A through to Organism D). Name ONE major taxonomic group within which each organism is classified, and give TWO characteristic features of each organism. The answers should be entered in the appropriate spaces in the table on page 9.

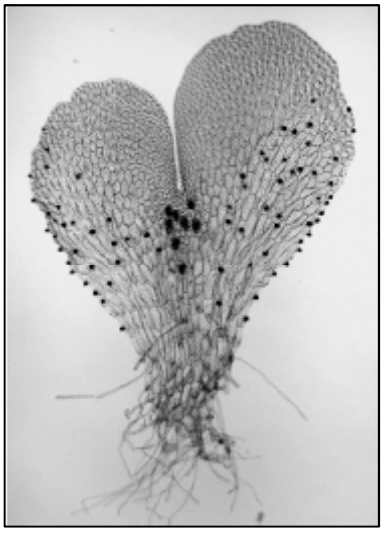


Figure 3: Organism A

(magnification x5)
(Image source: http://www4.uwsp.edu/biology)

Figure 4: Organism B

(magnification x8)
(Image source: http://analogicalplanet.com)

Figure 5: Organism C

(magnification x0.75)
(Image source: http://24.media.tumblr.com/tumblr_ltcsgwJTKD1r1dqlho1_500.jpg)

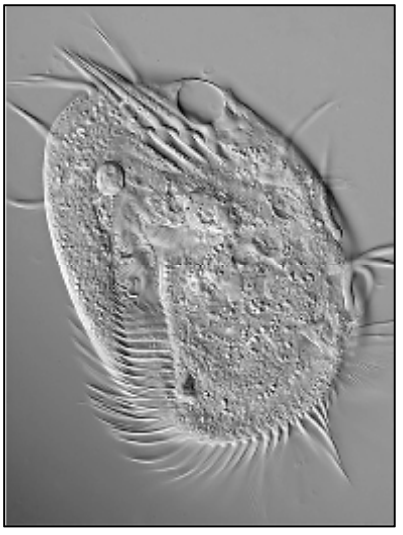


Figure 6: Organism D

(magnified x200)
(Image source: http://www.photomacrography.net)

3.1 Complete the table below:

Organism	Major taxonomic group	TWO characteristic features of the organism
A		
B		
C		
D		

[half-mark for each correct major group]
[one mark for each correct feature]

[ten marks]

3.2 Using visible features, design a dichotomous key that would enable a biologist to identify the four organisms.

[four marks]

3.3 Suggest **ONE** limitation of the key that you have designed in Question 3.2.

_____

_____

[one mark]

[Total: fifteen marks]

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MATRICULATION AND SECONDARY EDUCATION CERTIFICATE EXAMINATIONS BOARD

UNIVERSITY OF MALTA, MSIDA

MATRICULATION EXAMINATION
ADVANCED LEVEL
MAY 2013

SUBJECT:	BIOLOGY
PAPER NUMBER:	IV – *Practical*
DATE:	10th June 2013
TIME:	1 hr 30 min

Directions to Candidates

- *Write your index number in the space at the top left-hand corner of this page.*
- *Answer all parts of the question. Write all your answers in this booklet. Drawings of biological material and graphical representations of data are to be made on the appropriate pages within 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	Total
Score	
Maximum	40

1. You are required to implement an experimental procedure to investigate the responses of celery stalks (*Apium graveolens*) when immersed in solutions of sodium chloride (NaCl).

   You are provided with the following materials:
   Celery stalks (*Apium graveolens*);
   1M stock solution of sodium chloride (labelled as 'Solution A');
   Distilled water;
   A number of plastic containers;
   Other laboratory apparatus as required.

1.1 Prepare solutions of 1.0M, 0.75M, 0.50M, 0.25M and 0.0M NaCl in the plastic containers provided. The **total** volume of each solution should be 40ml. Show your calculations by completing the table below:

Concentration	**Volume of water (ml)**	**Volume of 1M NaCl solution (ml)**	**Total volume (ml)**
1.0M			40
0.75M			40
0.50M			40
0.25M			40
0.00M			40

[five marks]

Cut the celery stalks provided into segments approximately 3cm in length. Take a number of these stalk segments, mark their mid-point, and using a scalpel blade, bisect one half of each stalk segment lengthwise into halves of approximately equal thickness (Figure 1). The cut ends of the stalk segment may then move apart. Place the celery stalk segments in the solutions that you have prepared, and measure the distance between the cut ends of each stalk segment at the end of a ten-minute period. Record the results in the space provided within Question 1.3.

1.2 Suggest a suitable null hypothesis for this investigation.

_____

_____

[two marks]

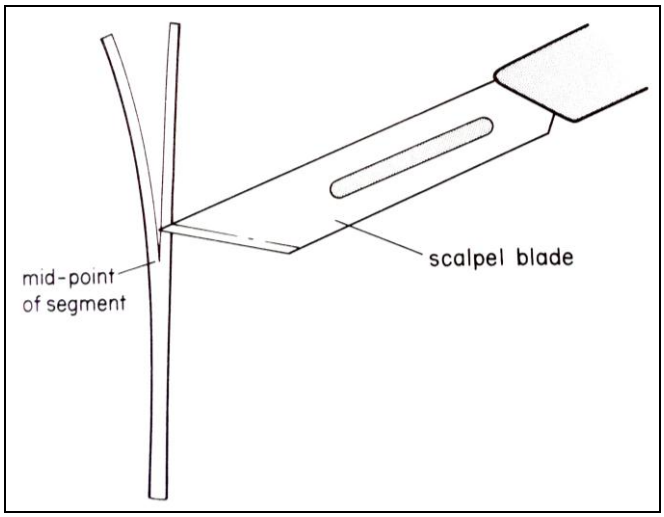


Figure 1: Method of bisecting a celery stalk using a scalpel blade

1.3 Record the results in the space below.

[seven marks]

1.4 Draw a graph showing the effect of different sodium chloride concentrations on the movement of the cut ends of the celery stalks. *Use the graph paper provided on page 6 of this booklet.*

[six marks]

1.5 Briefly *describe* the results obtained.

[three marks]

1.6 Give a plausible explanation for the observed responses of the cut ends of the celery stalks in different solutions.

[six marks]

1.7 When freshly cut celery stalk segments are bisected, the cut ends move a few millimeters apart. Describe how the experiment you have performed can be used to find the approximate water potential of freshly cut celery stalks.

[three marks]

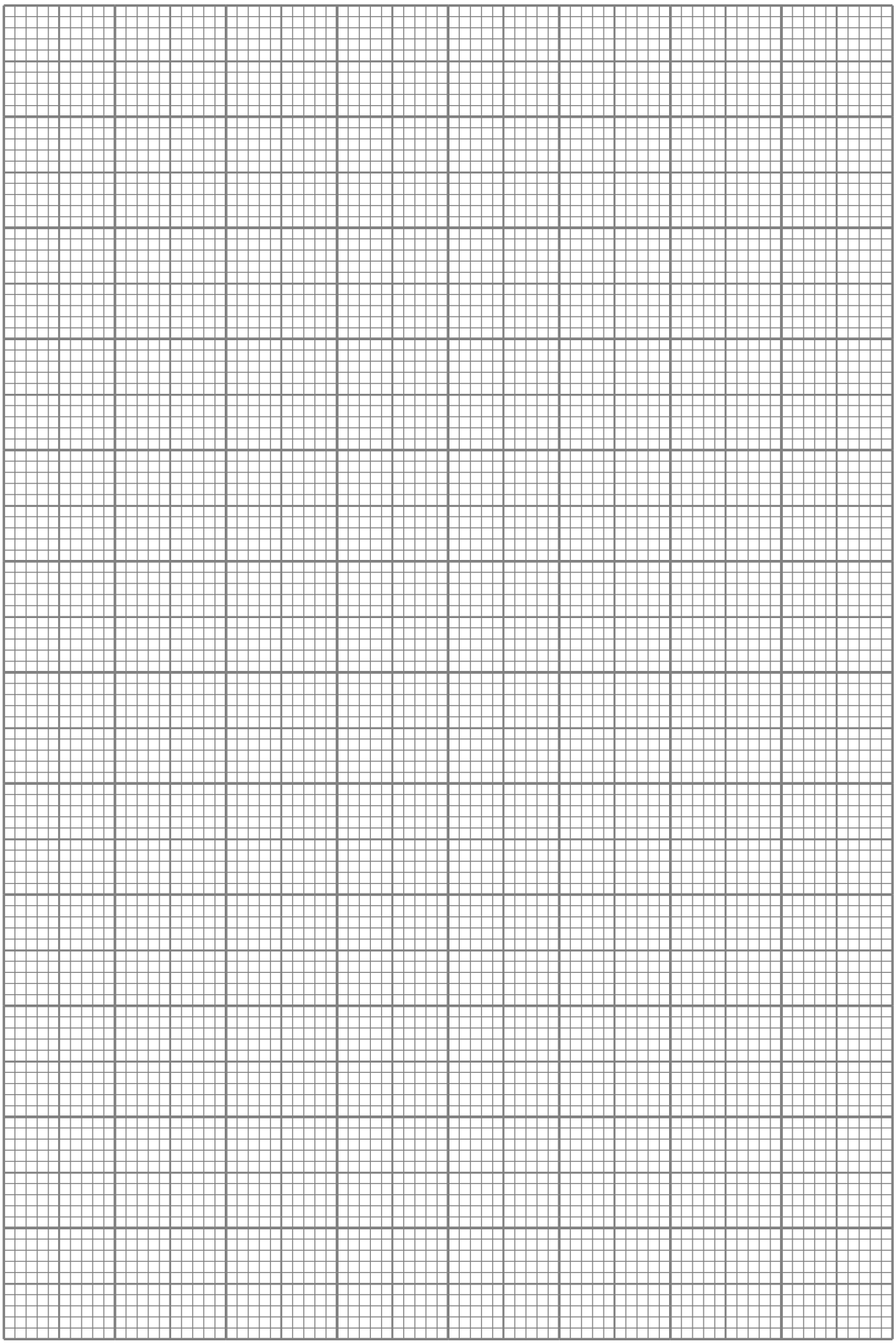
1.8 Describe **TWO** ways in which the experimental procedure could be modified to produce results that are more reliable.

[four marks]

1.9 List **TWO** sources of error and explain how they might have influenced your result.

[four marks]

[Total: forty marks]



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