AM 05/III. 05m **INDEX NUMBER:_____**

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

MATRICULATION CERTIFICATE EXAMINATION
ADVANCED LEVEL
MAY SESSION 2005

Subject Title	**BIOLOGY**
Paper No./Title	**Paper 3**
Date	**25th May 2005**
Time	**4:00 p.m. to 5:30 p.m.**

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. 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	20	15	15	50

ADVANCED BIOLOGY III

1. A researcher is investigating the flora and fauna of a rocky shore on the northern coast of the Maltese Islands. She uses a belt-transect (ladder-transect) method to assess variations in abundance of five plant species with increasing perpendicular distance from the shoreline. The raw data is recorded in Table 1.

Table 1: abundance of five plant species at increasing perpendicular distance from the shoreline

Distance from shore (m)	***Anthemis urvilleana***	***Inula crithmoides***	***Arthrocnemum macrostachyum***	***Crithmum maritimum***	***Limonium virgatum***
0-10	0	0	0	0	0
10-20	0	0	0	0	0
20-30	0	0	0	0	0
30-40	0	0	4	0	0
40-50	0	2	5	1	1
50-60	2	6	0	7	2
60-70	6	15	0	8	1
70-80	4	23	0	6	1
80-90	8	19	0	7	2
90-100	10	16	0	4	1

1.1 Complete the following table:

	Total abundance	Mean abundance
Anthemis urvilleana		
Inula crithmoides		
Arthrocnemum macrostachyum		
Crithmum maritimum		
Limonium virgatum		

[five marks]

1.2 Suggest another parameter (apart from total abundance and mean abundance) that may be included in the table above and that would summarise the degree of variability within the data.

_____

[one mark]

1.3 Using the same scales and axes, summarise the data listed in Table 1 in graphical form. **Use the squared paper at the end of this answer booklet.**

[four marks]

1.4 Which of the species followed in this investigation appears to be the most specialised? Give ONE reason for your answer.

[two marks]

1.5 Suggest explanations for the observed plant distribution in the following ranges:

0m – 30m

50m – 100m

[two marks]

1.6 List, and briefly describe, TWO adaptations (structural, physiological or ecological) that may be characteristic of plants in this ecosystem.

[two marks]

1.7 Describe ONE method through which the researcher may assess the size of animal populations in this ecosystem.

[four marks]

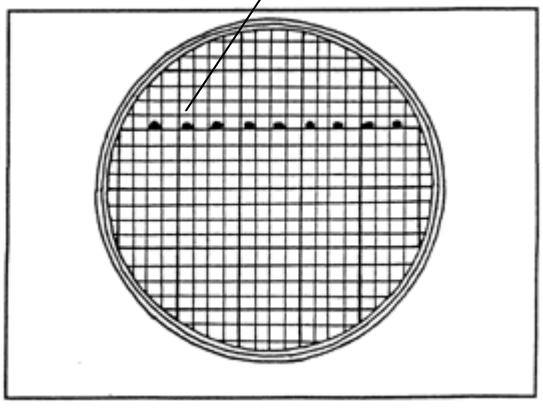
[Total: twenty marks]

ADVANCED BIOLOGY III

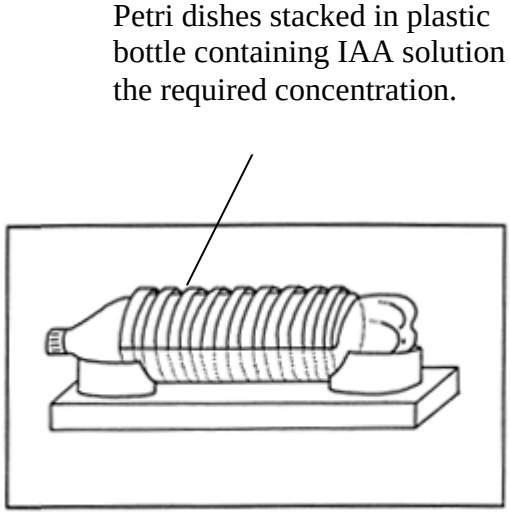
2. A group of students is investigating the effect of Indole acetic acid (IAA), an auxin, on root growth. Mustard seeds were exposed to different IAA concentrations by growing them in Petri-dishes placed vertically in a plastic bottle containing 200cm^3 of the appropriate IAA solution as shown in the diagram below. Mustard seedlings were chosen in this activity as they are relatively sturdy and have large root hairs at the top of the root. When setting up the experiment, a stock solution of 100ppm was prepared by dissolving 0.1g IAA in a few drops of 95% ethanol and then adding 1 litre of distilled water. The results obtained are recorded in Table 2 below:

Table 2: Effects of IAA on root growth

Concentration of IAA	**Length of seedling roots/mm for each Petri dish**									**Mean length**
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	
0	14.3	14.0	14.1	14.6	14.4	14.7	15.2	13.9	14.2	
10^{-4}	16.5	16.2	15.8	16.6	15.7	16.4	16.0	15.7	14.3	
10^{-3}	14.3	14.8	14.8	14.5	14.0	13.8	14.7	15.2	14.9	
10^{-2}	12.4	12.8	11.6	12.5	12.7	11.5	11.8	11.7	12.6	
10^{-1}	8.1	8.8	8.5	8.3	8.1	8.7	8.4	8.2	7.9	
1	1.6	2.8	2.4	1.9	1.8	2.2	2.3	2.5	2.7	



Seeds being grown in a Petri-dish with filter paper soaked in the appropriate IAA concentration.



Plastic bottle, containing about 200 cm^3 of the appropriate IAA solution. 9 Petri dishes with 9/ 10 seedlings each were exposed to the same concentration of IAA solution.

2.1 Calculate the mean length of seedling roots for each IAA treatment. Record your results in the appropriate spaces in Table 2.

[two marks]

2.2 Summarise the data listed in Table 2 in graphical form. **Use the squared paper at the end of this answer booklet.**

[two marks]

2.3 Several dilutions were required in this experiment. How would you prepare a 1ppm IAA solution from the stock solution?

_____

_____

[two marks]

2.4 Suggest a suitable control for this experiment.

_____

_____

[two marks]

2.5 Comment on the biological significance of any trends suggested by the results.

_____

_____

_____

[four marks]

2.6 Use your knowledge of plant biology to comment on whether extrapolating these results to other species of plants would be valid.

_____

_____

[two marks]

2.7 Suggest **ONE** possible source of error that may be influencing the result obtained.

_____

[one mark]

[Total: fifteen marks]

3. A researcher is investigating the effects of temperature on rates of oxygen consumption by germinating seeds and by dry seeds that are not germinating. A number of seeds were collected from the same plant. Half of them were placed in moist cotton wool whilst the other half in dry cotton wool. The seeds were placed in moist cotton wool started germinating whilst those placed in dry cotton wool did not. The oxygen consumption of both sets of seeds was measured over a period of forty minutes. This experiment was first carried out at a temperature of 22°C and subsequently repeated at a temperature of 10°C. The results obtained, corrected for changes in temperature and pressure, were recorded in Table 3 and Table 4 below:

Table 3: Cumulative Oxygen Consumption (ml) at 22^{o}C

Time (minutes)	**0**	**10**	**20**	**30**	**40**
Seeds on wet cotton wool	0.0	17.6	32	47.4	64
Seeds on dry cotton wool	0.0	0.0	0.1	0.2	0.2

Table 4: Cumulative Oxygen Consumption (ml) at 10^{o}C

Time (minutes)	**0**	**10**	**20**	**30**	**40**
Seeds on wet cotton wool	0.0	5.8	12.4	18.8	25
Seeds on dry cotton wool	0.0	0.1	0.2	0.1	0.2

3.1 Suggest a suitable null hypothesis for this investigation

_____

[one mark]

3.2 Why were all the seeds collected from the same plant?

_____

_____

[two marks]

3.3 Using the same scales and axes, summarise the data listed in Table 3 and Table 4 in graphical form. **Use the squared paper at the end of this answer booklet.**

[four marks]

3.4 Comment on the biological significance of the results obtained.

_____

_____

[two marks]

3.5 Name a statistical test that may be used to determine whether the effect of temperature on oxygen consumption is statistically significant. Justify your choice of technique.

Statistical test: _____

Justification: _____

_____

_____

[three marks]

3.6 Suggest a suitable control for this experiment.

_____

_____

[two marks]

3.7 Name **ONE** possible source of error that may be influencing the result obtained.

_____

[one mark]

[Total: fifteen marks]

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