AM 05/III. 04s **INDEX NUMBER:_____**

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

MATRICULATION CERTIFICATE EXAMINATION
ADVANCED LEVEL
SEPTEMBER SESSION 2004

Subject:	**BIOLOGY**
Paper Number:	**Paper 3**
Date:	**6th September 2004**
Time:	**9:00 a.m. to 10:30 a.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	15	15	20	50

ADVANCED BIOLOGY III

1. The London Plane (*Platanus acerifolia*) is a deciduous tree that sheds its leaves in autumn. Prior to being shed, the leaves gradually change colour from green, through yellow to brown. This colour change is accompanied by a change in the starch content and reducing sugar content of the leaf.

1.1 Describe how an investigator may compare the photosynthetic pigments present in green, yellow and brown leaves.

[four marks]

1.2 Describe a method through which the starch content of a leaf may be determined.

[two marks]

1.3 Describe a method through which the reducing sugar content of a leaf may be determined.

[two marks]

1.4 Why are some sugars referred to as "reducing" sugars?

[two marks]

1.5 Describe a non-chemical method through which the starch content of a leaf may be estimated.

[two marks]

1.6 Briefly outline possible sources of error that may arise when testing for biochemicals in tissue, rather than in pure solution.

[one mark]

1.7 Describe **ONE** precaution that may be taken to reduce the possibility of error when testing for biochemicals in tissue.

[two marks]

[Total: fifteen marks]

ADVANCED BIOLOGY III

2. The enzyme catalase, which is very abundant in liver cells, is known to catalyse the breakdown of hydrogen peroxide into water and oxygen according to the following equation:

$$2H_2O_2 \rightarrow 2H_2O + O_2$$

2.1 Describe how a cell-free extract of the enzyme may be prepared from a piece of liver tissue.

[three marks]

2.2 Suggest a suitable method that may be used to determine the rate of enzyme action.

[two marks]

A researcher intends to investigate the effect of *p*H on the rate of enzyme action.

2.3 Use the space below to sketch the apparatus that the researcher may use for this purpose.

[three marks]

2.4 How may the researcher vary the *p*H during this experiment?

[two marks]

2.5 Draw up a suitable table of results clearly indicating what measurements the researcher would need to take in order to determine the effect of *p*H on enzyme action.

[three marks]

2.6 Give **ONE** reason as to why this particular reaction would not be suitable for determining the effect of changes in temperature on an enzyme-controlled reaction.

[two marks]

[Total: fifteen marks]

3. A scientist is using a volumetric method to investigate the water relations of potato tissue and swede root, both of which contained stored carbohydrates. Potato tubers store starch while swede roots store sucrose. The investigator prepared six different samples of potato tissue and six different samples of swede root, each in a separate container. Each sample was placed for 24 hours in 90cm^3 of one of the following solutions:

Tap water (negligible chloride concentration)
0.25M sodium chloride solution
0.50 M sodium chloride solution
0.80 M sodium chloride solution
1.00 M sodium chloride solution
Solution X (a saline solution of unspecified molarity)

At the end of the 24 hour period, the volume of fluid surrounding each sample was measured and the results recorded in the table below:

Concentration of saline solution	**Initial volume of fluid (cm^3)**	**Volume of fluid after 24h period (cm^3)**	
		Potato	**Swede**
Tap water (~ 0M)	90	84	80
0.25M	90	91	85
0.50M	90	95	90
0.80M	90	95	91
1.00M	90	95	91
Solution X	90	92	86

3.1 Briefly describe how the investigator would prepare 1.00M sodium chloride solution.

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_____

[two marks]

3.2 Complete the following table:

Concentration of saline solution	**Volumetric difference after 24h period (cm^3)**	
	Potato	**Swede**
Tap water (~ 0M)	-6	-10
0.25M		
0.50M		
0.80M		
1.00M		
Solution X		

[one mark]

3.3 Using the same scale and axes, plot graphs showing volumetric difference against molarity for potato tissue and swede root. **Use the squared paper at the end of this answer booklet.**
[four marks]

Use the graphs that you have drawn to estimate the following (you should indicate *how* the graphs have been used for each purpose):

3.4 Molarity of potato tissue fluid.

[two marks]

3.5 Molarity of swede root fluid.

[two marks]

3.6 Molarity of Solution X.

[two marks]

3.7 If a molar saline solution exerts an osmotic pressure of 2269.68 kPa, calculate, in kPa, the osmotic pressure of potato tissue fluid and swede root fluid. All working should be shown clearly.

potato tissue fluid:

swede root fluid:

[two marks]

3.8 Suggest **THREE** improvements in technique that would have enabled more accurate results to be obtained.

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_____

[three marks]

3.9 How could differences in the nature of the stored carbohydrates in potato tissue and swede root account for differences in the osmotic potential of their cell fluids?

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[two marks]

[Total: twenty marks]

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