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FORM TP 2008162

MAY/JUNE 2008

C A R I B B E A N E X A M I N A T I O N S C O U N C I L

A D V A N C E D P R O F I C I E N C Y E X A M I N A T I O N

B I O L O G Y

U N I T 2 – P A P E R 0 2

2 hours 30 minutes

READ THE FOLLOWING INSTRUCTIONS CAREFULLY.

1. This paper consists of SIX questions.
2. Section A consists of THREE questions. Candidates must answer ALL questions in this section. Answers to this section MUST be written in this answer booklet.
3. Section B consists of THREE questions. Candidates must answer ALL questions in this section. Answers to this section MUST be written in the answer booklet provided.
4. The use of silent non-programmable calculators is allowed.

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SECTION A

Answer ALL questions. You must write your answers in the spaces provided in this answer booklet.

1. Figure 1 shows the apparatus used to investigate oxygen uptake in small organisms.

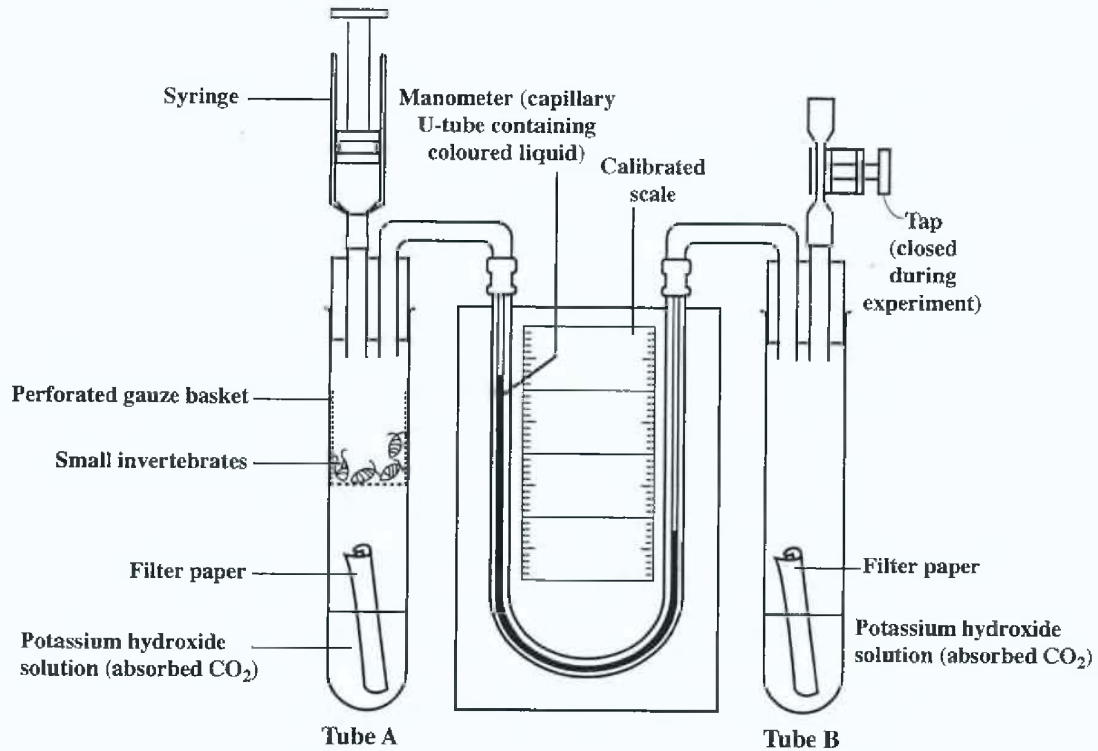


Figure 1. Apparatus to investigate oxygen uptake in small organisms

http://images.google.tt/imgres?imgurl=http://www.biologymad.com/PhotosynResp/Photos19.gif&imgrefurl=http://www.biologymad.com/PhotosynResp/PhotosynResp.htm&h=412&w=563&sz=14&hl=en&start=15&tbnid=5_NcsDmUuRo4zM:&tbnh=97&tbnw=133&prev=/images%3Fq%3D%2560respirometer%2527%26svnum%3D10%26hl%3Den%26lr%3D%26sa%3DN

- (a) Explain how the apparatus is used to measure the rate of oxygen uptake by organisms.

[6 marks]

- (b) Table 1 gives the results of an experiment in which the rates of oxygen uptake, by germinating and dry peas, were measured at two different temperatures over a period of 30 minutes. The results are expressed as the cumulative oxygen consumed (cm^3) by peas at different temperatures.

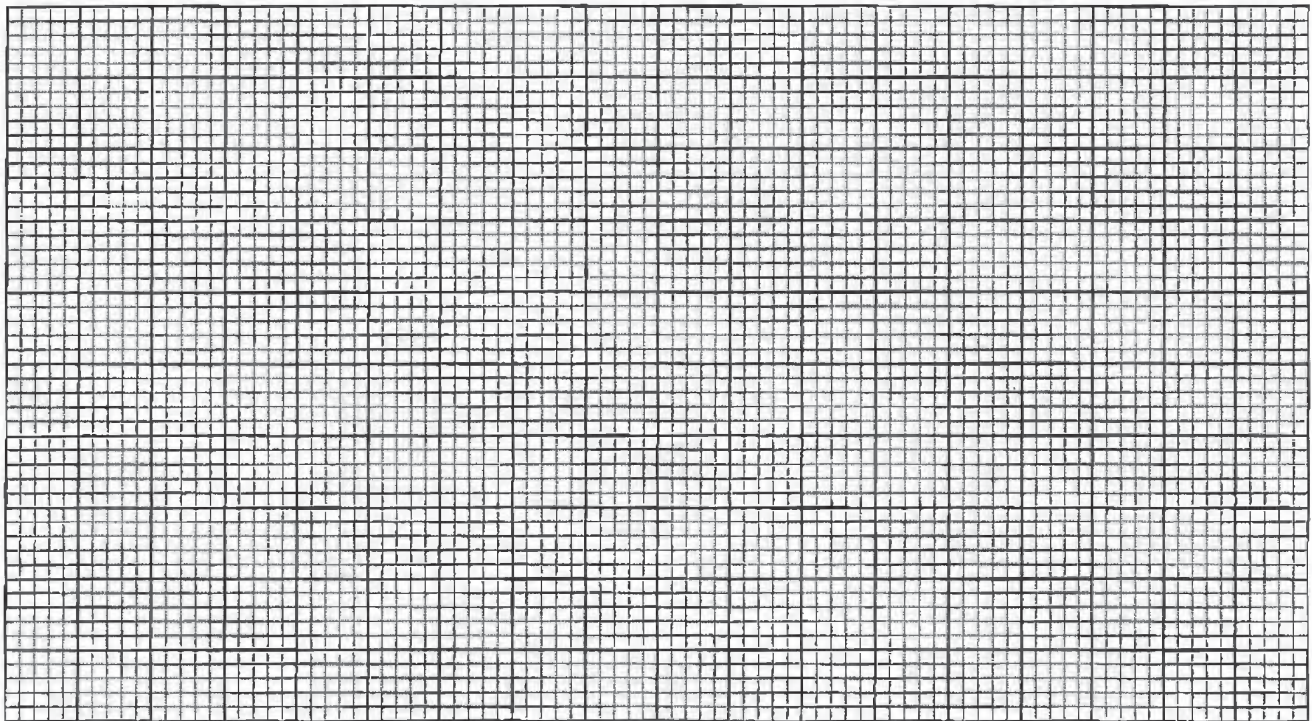
TABLE 1: RATE OF OXYGEN UPTAKE BY GERMINATING AND DRY PEAS

Temperature	Time in minutes	Germinating peas	Dry peas
10° C	0	0	0
	10	2.9	0
	20	6.2	0.2
	30	9.4	0.1
25° C	0	0	0
	10	8.8	0.2
	20	16.0	0.1
	30	23.7	0.0

- (i) Suggest a control for this experiment.

[1 mark]

- (ii) On the graph grid provided below, plot the results for the germinating peas at 25 °C. [4 marks]



GO ON TO THE NEXT PAGE

- (iii) Calculate the rate of oxygen consumption for germinating peas at BOTH temperatures using the time interval between 10 and 20 minutes.

Rate at 10°C: _____

Rate at 25°C: _____

[2 marks]

- (iv) Comment on the differences in oxygen consumption observed between

a) germinating peas at 10°C and 25°C

[1 mark]

b) germinating and dry peas.

[1 mark]

Total 15 marks

2. (a) Water is drawn up the entire xylem system due to a negative pressure created by loss of water from the leaf spaces into the atmosphere. This enormous upward pull on the xylem contents, especially in trees, could cause the xylem walls to cave inwards, (cavitation). In a study of trees, the mean diameters of the xylem vessels were measured in the tree trunks, the shallow roots and the deep roots. Two species were evaluated, Juniper (J) and Quercus (Q). The results are shown in Figure 2.

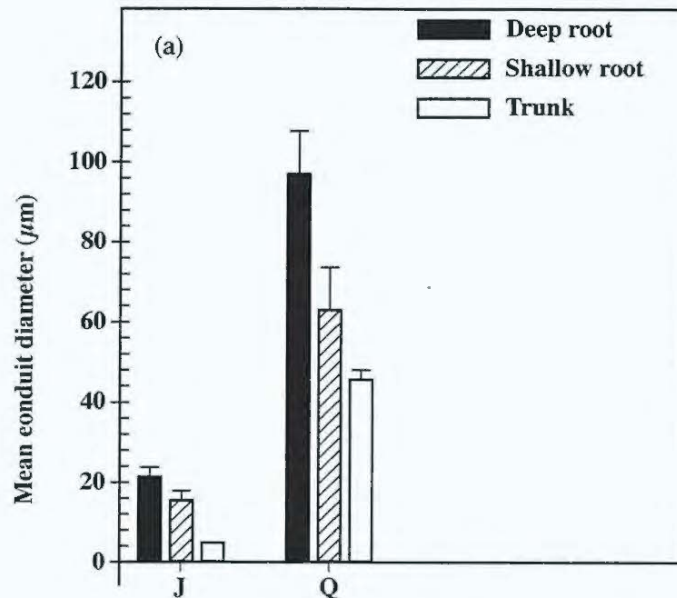


Figure 2. Xylem vessel diameters in trunks and roots

This bar chart has been adapted from McElrone A, Pockman W, Martínez-Vilalta J and Jackson R. Variation in xylem structure and function in stems and roots of trees to 20 m depth. New Phytologist (2004) 163: p. 510.

- (i) Complete the table of xylem diameters for Juniper and Quercus and determine the diameter of the trunk xylem as a percentage of the deep root xylem for Juniper and Quercus.

Diameter in μm	Juniper	Quercus
Deep root xylem		
Trunk xylem		
Diameter of trunk xylem as a percentage of the deep root xylem		

[2 marks]

GO ON TO THE NEXT PAGE

- (ii) Account for the difference in diameter of the xylem between the trunk of the tree and the shallow roots.

[2 marks]

- (iii) State TWO factors, other than transpiration pull from the leaves, that would account for water movement in the xylem of the roots.

[2 marks]

- (b) Figure 3 shows part of a vascular bundle of a dicotyledon in transverse section.

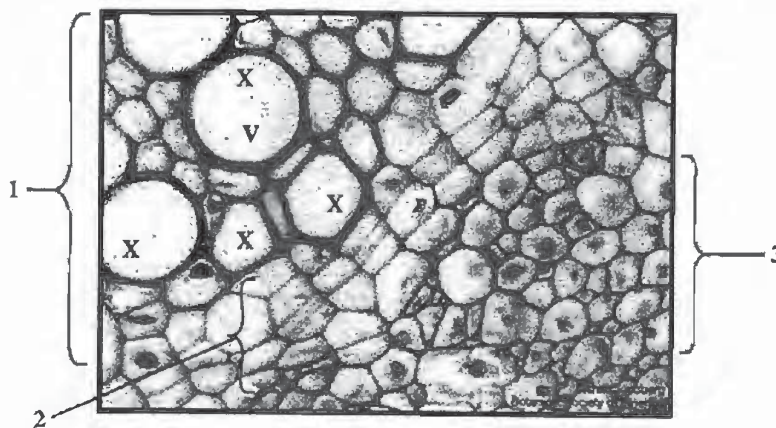


Figure 3. T.S. dicotyledon vascular bundle

<http://www.botany.org/plantimages/ImageData.asp?IDN=B-036h>

- (i) Identify the THREE main tissue types shown.

1. _____

2. _____

3. _____

[1 mark]

GO ON TO THE NEXT PAGE

- (ii) Four cells have an 'X' drawn in them. Draw these cells, and all the cells between them in correct proportion, at a magnification of $\times 2$.

[3 marks]

- (iii) The cell labelled V has been magnified 300 times. What is the actual diameter of this cell?

[1 mark]

(c) Figure 4 is an electron micrograph of a plant structure.

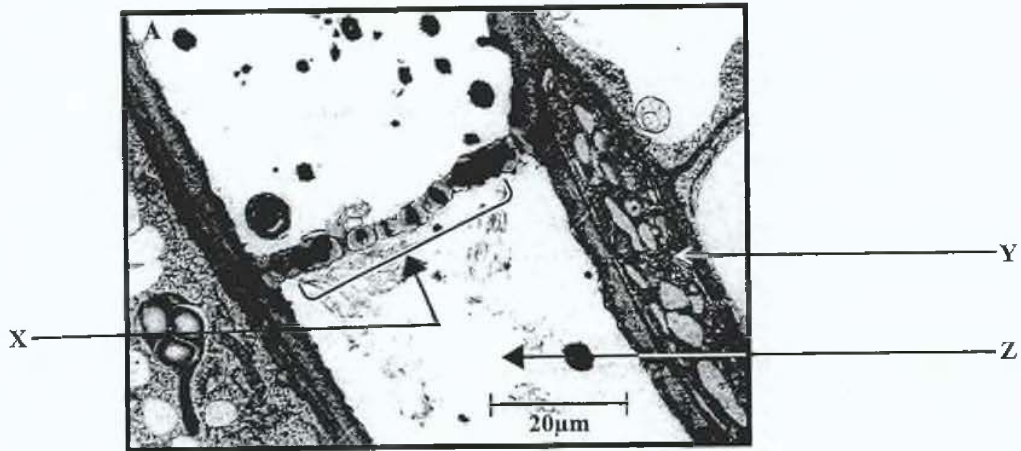


Figure 4. Electron micrograph of a plant structure

*Roberts M., Reiss M. and Monger B., Advanced Biology.
Nelson, 2000, p. 259.*

(i) Identify the structures, X, Y and Z in Figure 4.

X _____

Y _____

Z _____

[1 mark]

(ii) State how EACH of these structures is adapted to its function.

X _____

Y _____

Z _____

[3 marks]

Total 15 marks

GO ON TO THE NEXT PAGE

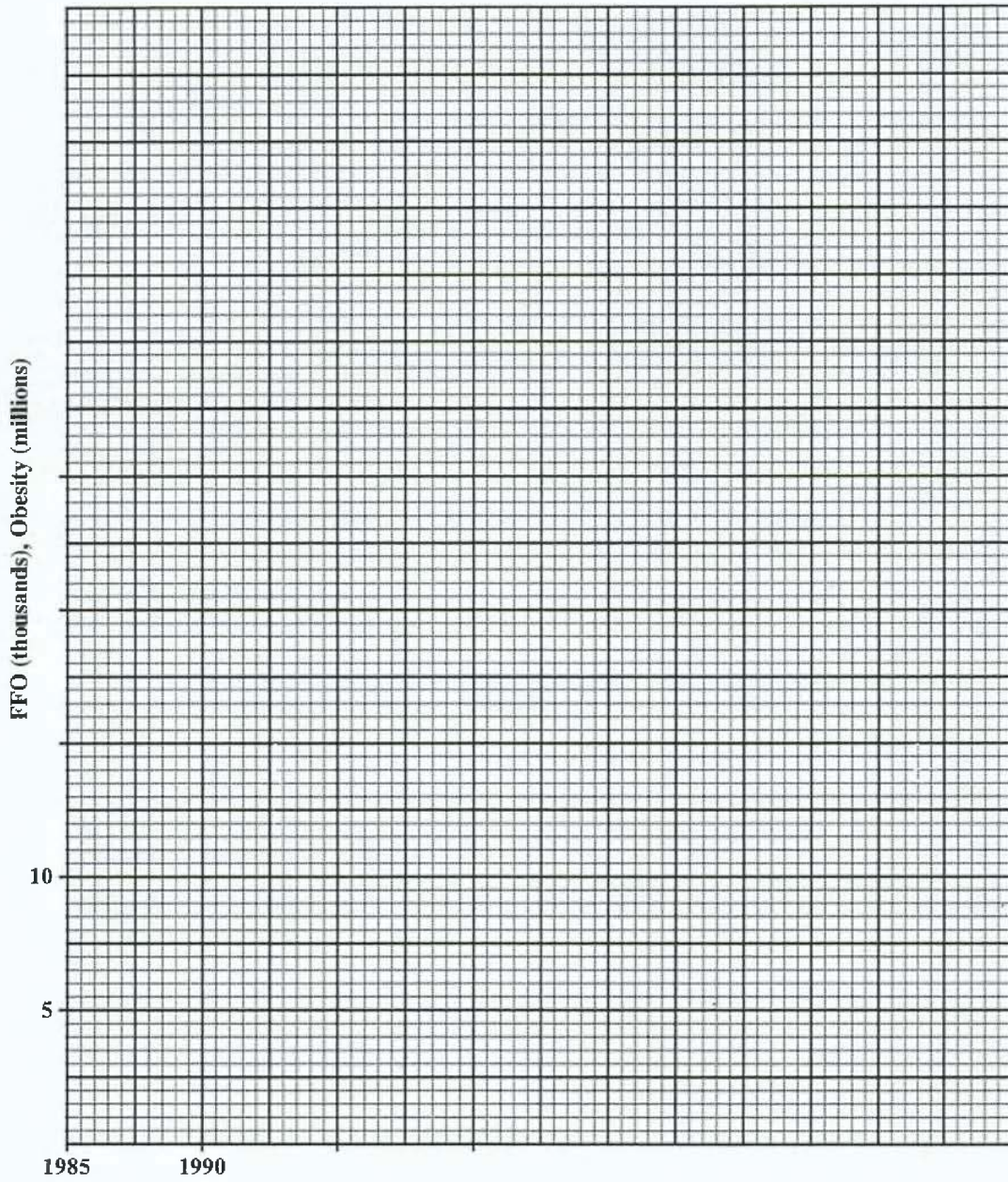
3. In a country with a population of over 300,000,000, a survey was carried out to determine the number of fast food outlets (FFO) and the prevalence of obesity. ('Prevalence' is defined as the number of cases in the population at a specific time). The results of the survey are shown in Table 2.

TABLE 2. THE NUMBER OF FFO (FAST-FOOD OUTLETS) AND THE PREVALENCE OF OBESITY, 1985 - 2005

Year	Fast food outlets (FFO) thousands	Obesity prevalence (millions of cases)
1985	6	4
1990	10	5.5
1995	14	8
2000	18.5	13
2005	23	20

- (a) Complete the graph provided on page 11, to construct the two 'best fit' lines to show the data. Use the same pair of axes for each graph, and provide a key to identify the two graph lines. [6 marks]
- (b) With reference to the data (1985 – 2005), describe the relationship between the number of FFO (in thousands) and the prevalence of obesity (in millions).

[3 marks]



- (c) By means of a sketched line, project the existing graph lines for FFO's and obesity to the year 2015. What is the projected relationship between them in 2015? Use the data to support your answer.

[3 marks]

- (d) What **THREE** factors **other than** FFO (fast-food outlets) could be causative of obesity in our societies? Explain your answer.

[3 marks]

Total 15 marks

SECTION B

Answer ALL questions. You must write your answers in the answer booklet provided.

4. (a) Describe the structure of the thylakoids and explain clearly how they are adapted to their function. [4 marks]
- (b) Clarify the pathway and productivity of a ground electron from its entry into Photosystem I to its incorporation into a reduced phosphate containing product. [4 marks]
- (c) Explain the term 'ecological pyramid' and distinguish between the THREE major types of ecological pyramids. [4 marks]
- (d) Discuss how energy flows through an ecosystem. [3 marks]

Total 15 marks

5. (a) Describe the ways in which red blood cells and haemoglobin molecules are effective in maximising the uptake of oxygen. [4 marks]
- (b) The Bohr Effect has implications for the stability of oxyhaemoglobin in active muscle tissue. Explain this effect. [4 marks]
- (c) The normal concentration of glucose in human blood is 90 mg per 100 cm³ and even after the heaviest meal the level rarely exceeds 150 mg per 100 cm³.
Discuss the hormonal processes involved in keeping this level constant. [7 marks]

Total 15 marks

6. (a) Give a drawing of an antibody molecule using annotated labels to relate the MOST important structural features to its functions. [4 marks]
- (b) Distinguish between and describe the modes of action of mature B and T cells in humoral and cell-mediated responses. [4 marks]
- (c) Distinguish between physical and psychological drug dependence. [4 marks]
- (d) Discuss the long-term consequences of alcohol consumption on the liver. [3 marks]

Total 15 marks

END OF TEST

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