



TEST CODE 002375

FORM TP 21191

MAY/JUNE 2001

CARIBBEAN EXAMINATIONS COUNCIL

ADVANCED PROFICIENCY EXAMINATION

BIOLOGY

Unit 2 – Paper 02

2 hours

In addition to the 2 hours, candidates are allowed a reading time of 15 minutes. Candidates may write in their answer booklets during this 15-minute period.

READ THE FOLLOWING INSTRUCTIONS CAREFULLY

1. This paper consists of NINE questions.
2. Section A consists of THREE questions. Candidates must attempt ALL questions in this section and should spend no more than 30 minutes on this section. Answers to this section MUST be written in this answer booklet.
3. Section B consists of SIX questions. Candidates must attempt THREE questions in this section, ONE question from EACH module. Answers to this section MUST be written in the answer booklet provided.

SECTION A

You must attempt ALL THREE questions in this section. You should NOT spend more than 15 minutes on this section.

1.

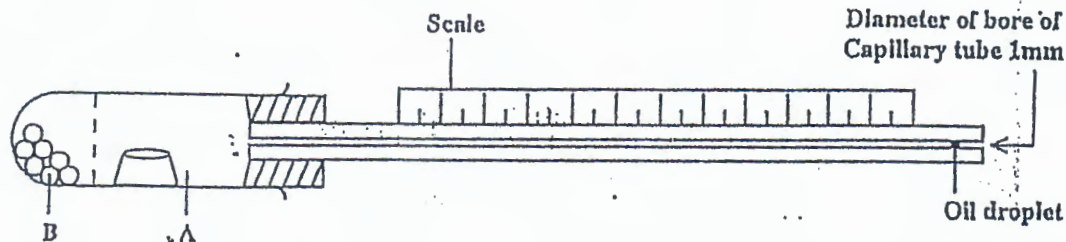


Figure 1

Figure 1 above is a diagram of a respirometer, used to measure the volume of oxygen taken by organisms during respiration. A piece of carrot tissue was placed in the tube at A, and a rubber bung was inserted. The capillary tube had an oil droplet, as shown.

(a) What substance is placed at B, and why?

Substance \_\_\_\_\_

Reason \_\_\_\_\_

[ 2 marks ]

(b) What fact do you need to know about the carrot tissue before sealing the tube?

\_\_\_\_\_

[ 1 mark ]

(c) Describe the procedure you would use and the readings you would take during operation of this apparatus.

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

[ 3 marks ]

(d) State TWO sources of error which could affect the functioning of the apparatus.

\_\_\_\_\_  
\_\_\_\_\_

[ 1 mark ]

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- (c) If the oil droplet moved 25 mm in 5 minutes, and the carrot tissue mass was 5 g, calculate the volume of oxygen taken up per minute per gram of carrot tissue.

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[ 3 marks]

Table 1

Symbol	Location	Value kPa
$\psi_L$	Water potential in leaf	- 1 000
$\psi_S$	Water potential in soil	- 10
$\psi_R$	Water potential in root	- 100
$\psi_A$	Water potential in air	- 25 000

- (a) Use the information in Table 1 above to explain transpiration from the leaf, and water entry into the root.

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[ 3 marks]

- (b) Pure water has the maximum water potential which is defined as zero. If there is pure water as vapour in the air, why is the water potential of the atmosphere - 25 000 kPa?

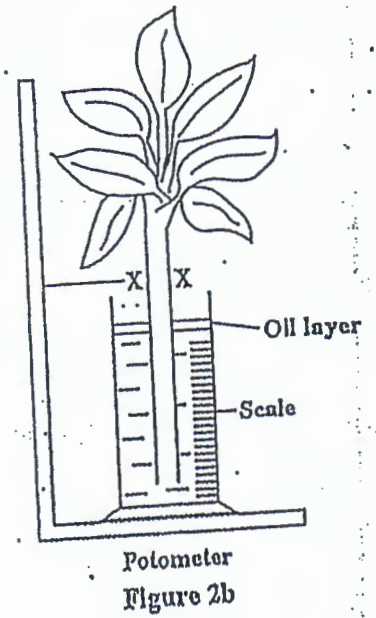
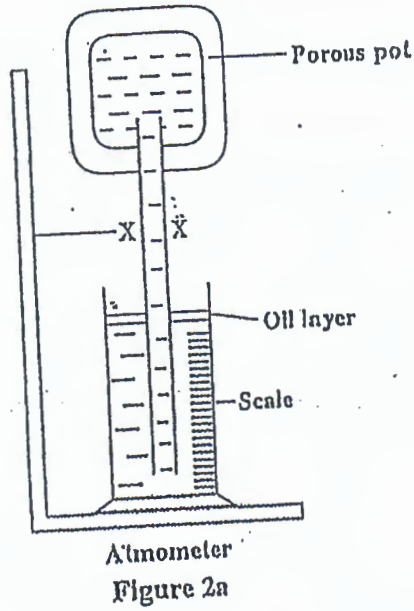
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[ 1 mark ]

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(c) An atmometer and a potometer were set up and exposed to a warm air current, as shown in Figures 2a and 2b below.



Water uptake in arbitrary units/au

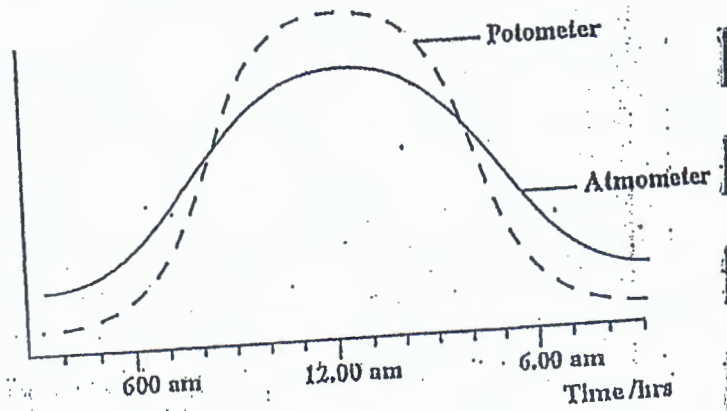


Figure 2c



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Explain why, in Figure 2c, the

(i) potometer reading exceeds the atmometer at 12.00 am

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[ 2 marks]

(ii) atmometer reading exceeds the potometer at 7.00 pm.

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[ 2 marks]

(d) If  $6.3 \text{ mm}^3$  water are taken up by the plant in the potometer in 10 minutes, what is the absorption rate?

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[ 1 mark ]

(e) How does the absorption rate in the potometer relate to the transpiration rate?

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[ 1 mark ]

3. The record in Figure 3 was obtained using a computer respirometer, on a subject using a running machine to train for a 100 m race.

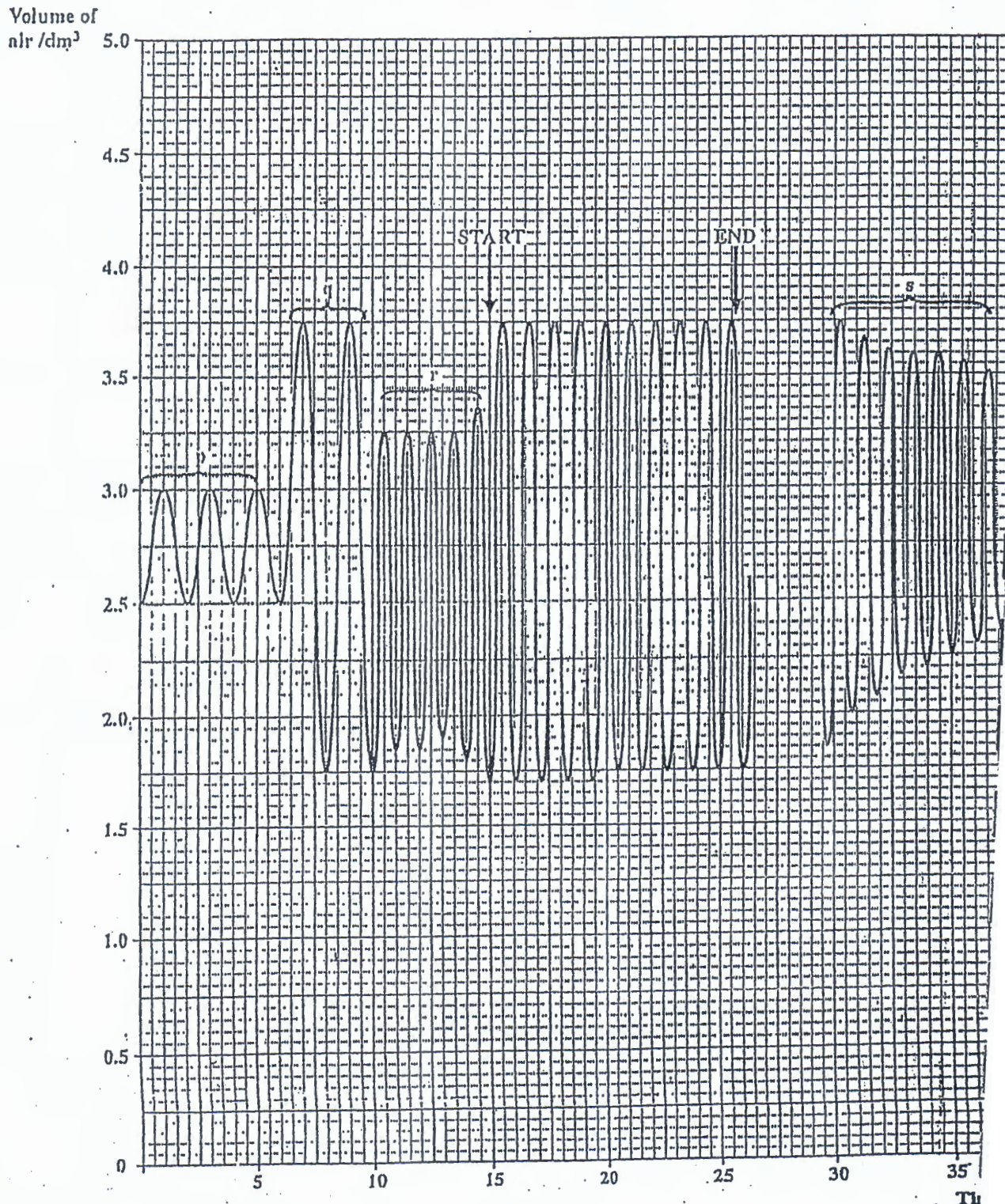


Figure 3

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(a) During the pre-race phase, p, what is the

(i) breathing rate per minute?

\_\_\_\_\_ [ 1 mark ]

(ii) volume of gas taken in during 1 minute?

\_\_\_\_\_ [ 1 mark ]

(b) What is the physiological purpose of the breathing pattern at q?

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_ [ 2 marks ]

(c) Why are the readings closer together at r?

\_\_\_\_\_  
\_\_\_\_\_ [ 1 mark ]

(d) The race is marked 'START' and 'END'. During Period s following the race, the breathing pattern has not returned to normal. State TWO processes going on in the body which are dependent on Phase s.

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_ [ 2 marks ]

(e) The average person produces 20 kJ of energy with every 1 000 cm<sup>3</sup> of oxygen taken up. During the race, how many kJ of energy are produced?

\_\_\_\_\_ [ 1 mark ]

(f) During the race, a ready source of carbohydrate fuel is needed. What TWO sources does the body access first?

\_\_\_\_\_  
\_\_\_\_\_ [ 2 marks ]

SECTION B

You must answer THREE questions in this section. Answer ONE question EACH from Modules 1, 2 and 3. You MUST write your answers in the answer booklet provided.

MODULE 1

Answer EITHER Question 4 OR Question 5.

4. (a) What are the differences in the fate of pyruvic acid in animals and plants in the absence of oxygen and what is the advantage of this fate, to glycolysis? [ 8 marks]
- (b) Since the non-availability of oxygen in a typical plant or animal cell affects only the terminal (cytochrome) oxidase of the electron transport chain, how does this eventually prevent pyruvic acid from entering the mitochondria? [10 marks]
- (c) Explain TWO uses of anaerobic respiration of microorganisms by humans. [ 2 marks]

Total 20 marks

5. (a) Describe how ATP and NADPH are produced in the process of photosynthesis. [ 8 marks]
- (b) Using your knowledge of photosynthesis, suggest strategies that may be employed to increase food supply. [10 marks]
- (c) Glucose is the major product of photosynthesis. Describe TWO major uses of this sugar in the plant. [ 2 marks]

Total 20 marks



MODULE 2

Answer EITHER Question 6 OR Question 7.

6. (a) Explain how a nerve impulse passes across a synapse. [ 7 marks]
- (b) Relate the process of conduction in a myelinated axon to the axon structure. [ 8 marks]
- (c) Trace the sequence of events which occurs to the heart from the start of exercise to the effective cardiac response. [ 5 marks]

Total 20 marks

7. (a) Explain how the filtrate is produced into the Bowman's capsule. [ 7 marks]
- (b) Relate the structure of the Loop of Henle to its function. [ 8 marks]
- (c) A test for glucose in the urine is found to be positive. Trace the steps from the absorption of glucose in the hepatic portal vein to the presence of glucose in the bladder which accounts for this elevated level. [ 5 marks]

Total 20 marks

MODULE 3

Answer EITHER Question 8 OR Question 9.

8. (a) Describe the symptoms of anthracnose disease on the aerial parts of a yam plant. [ 4 marks]
- (b) Discuss how the changes to the leaves caused by this disease affect the development of the yam tuber. [ 5 marks]
- (c) Describe the conditions required for the spread of the disease, and state the methods that can be used to control the disease. [ 5 marks]
- (d) The yam export industry in St. Vincent and St. Lucia was severely affected by an outbreak of anthracnose. Account for the economic impact on the farmers. [ 6 marks]

Total 20 marks

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9. (a) Make a list of FOUR differences between B- and T- lymphocytes. [ 4 marks]
- (b) To what extent does the manufacture of monoclonal antibodies reflect our understanding of a variety of cell mechanisms? [10 marks]
- (c) What is a vaccine, and to what extent does it contribute towards immunity? [ 6 marks]

Total 20 marks

END OF TEST