



TEST CODE 02207010

FORM TP 2004172

MAY/JUNE 2004

CARIBBEAN EXAMINATIONS COUNCIL

ADVANCED PROFICIENCY EXAMINATION

BIOLOGY

UNIT 2 – PAPER 01

$1\frac{1}{2}$  hours

In addition to the  $1\frac{1}{2}$  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. Candidates must answer ALL questions in this paper.
2. Answers are to be written in the spaces provided in this answer booklet.
3. EACH question is worth 10 marks.
4. The use of silent non-programmable calculators is allowed.

## SECTION A

You must attempt ALL THREE questions in this section. You should NOT spend more than 30 minutes on this section.

1. The graph in Figure 1.1 shows the daily photosynthetic carbon gain (units per day) of *Shorea leprosula*. It shows *Shorea leprosula* grown either at ambient or elevated carbon dioxide concentrations in uniform or flecked sunshine.

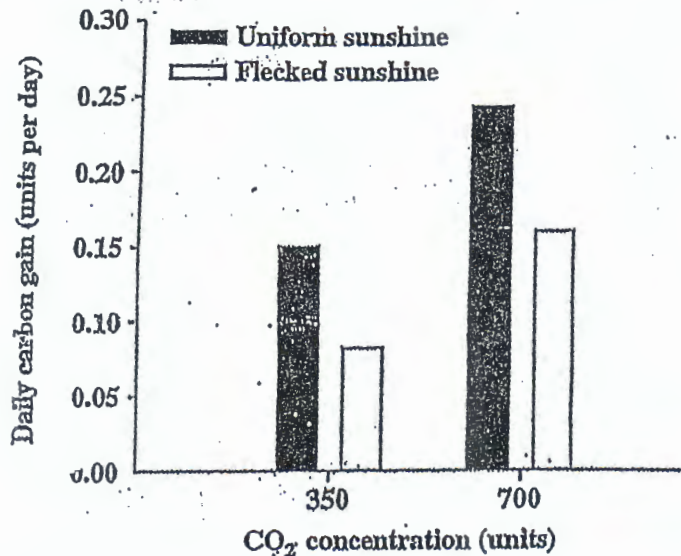


Figure 1.1. Growth of *S. leprosula* in flecked and uniform light

The graph in Figure 1.2 shows the photosynthetic rate of *Shorea leprosula* grown at an ELEVATED carbon dioxide concentration (700 units) and at AMBIENT carbon dioxide concentration in uniform sunlight.

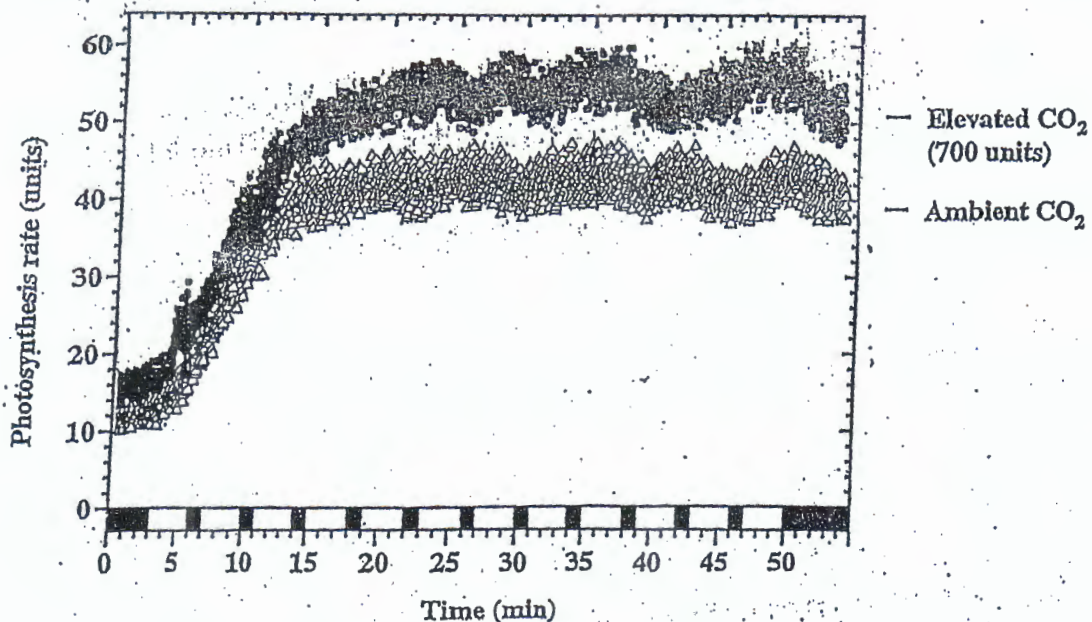


Figure 1.2. Growth of *S. leprosula* in uniform light

Source: Effect of elevated CO<sub>2</sub> upon photosynthesis and growth under uniform light. Plant, Cell and Environment. A.D.B. Leakey et al.

Answer questions (a) to (e) by referring to Figures 1.1 and 1.2.

- (a) Explain why daily carbon gain in *Shorea leprosula* is higher in uniform sunlight than in flecked (streaked/irregular) sunlight.

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[ 2 marks]

- (b) Determine the difference in daily carbon gain in *Shorea leprosula*, grown in flecked sunshine and uniform sunshine at

- (i) 350 units of carbon dioxide \_\_\_\_\_  
(ii) 700 units of carbon dioxide \_\_\_\_\_

[ 2 marks]

- (c) Determine the average, MAXIMUM photosynthetic rate of *Shorea leprosula* at

- (i) elevated carbon dioxide concentration (700 units)

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- (ii) ambient carbon dioxide concentration:

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- (d) Calculate the difference in photosynthetic rate between the elevated and ambient carbon dioxide concentrations in (c) (i) and (ii).

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[ 3 marks]

- (e) Explain why the daily carbon gain in *Shorea leprosula* is higher at 700 units of CO<sub>2</sub> than at 350 units of CO<sub>2</sub>.

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[ 2 marks]



(f) Suggest why carbon gain does not double as  $\text{CO}_2$  concentration doubles.

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[ 1 mark ]

Total 10 marks

2. Figure 2 shows a longitudinal view of phloem tissue.

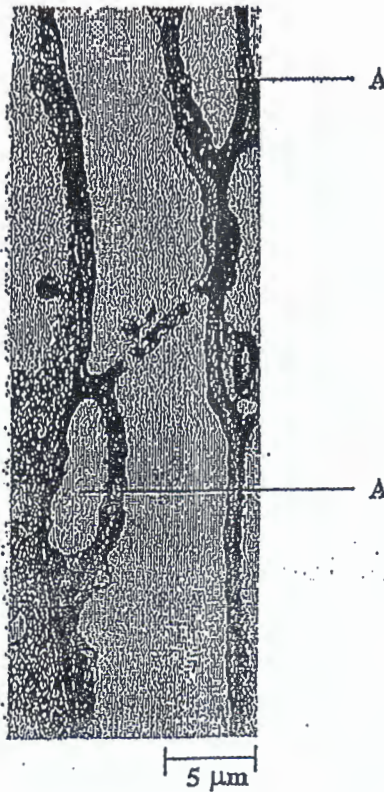


Figure 2. Phloem tissue

*Biology of Plants 6th Edition P.H. Raven,  
Ray E. Evert, S.E. Eichhorn 1999  
W.H. Freeman & Company Worth Publishers*

(a) Name the cells labelled A in Figure 2.

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

(b) Suggest the effect on the phloem, if the cells labelled A in Figure 2, were killed.

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

(c) Determine the average diameter of the pores in the sieve plate in Figure 2.

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

(d) The graph in Figure 3 shows water uptake in a mango tree.

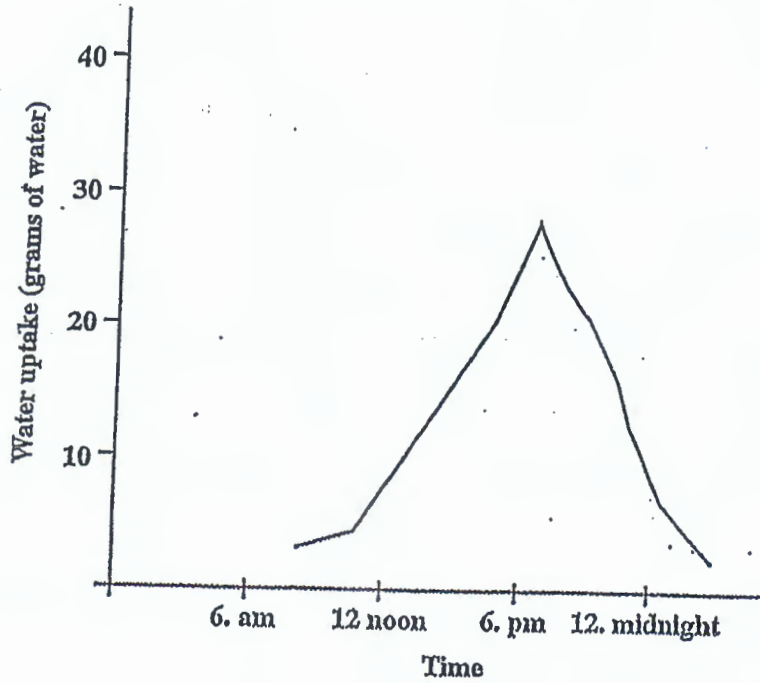


Figure 3. Water Uptake

The graph in Figure 4 shows the rate of transpiration in a mango tree.

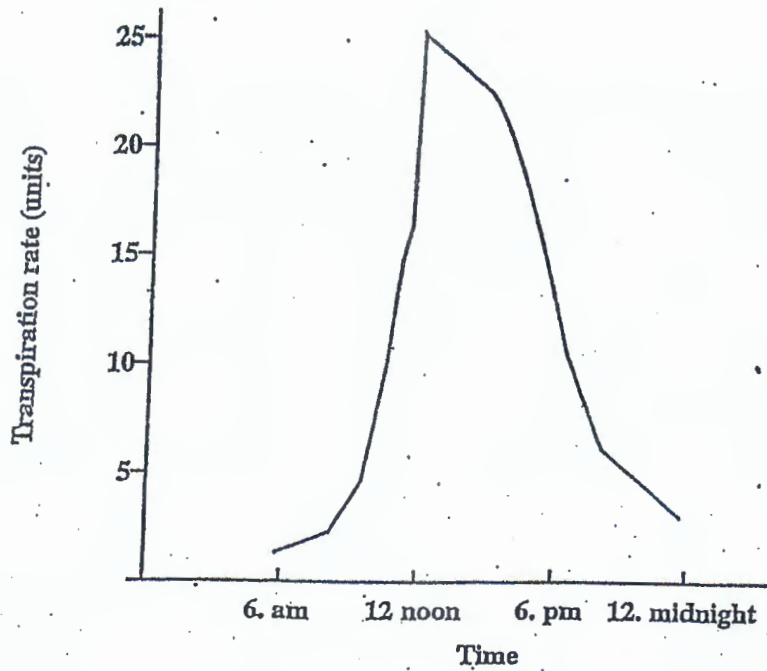


Figure 4. Transpiration rate

Use the graphs in Figures 3 and 4, to answer questions (i) to (v).

(i) With reference to Figure 3, relate water uptake in the mango tree to the time of day.

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[ 1 mark ]

(ii) With reference to Figure 4, relate transpiration rate in the mango tree to the time of day.

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[ 2 marks ]

(iii) Deduce why the graph in Figure 3, which shows water uptake in the mango tree, lags in time behind the graph showing transpiration rate in Figure 4.

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[ 2 marks ]

(iv) What is the rate of transpiration of the tree, when its water uptake is 22 grams?

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[ 1 mark ]

(v) Suggest the purpose for which the excess water that is retained by the mango tree, is used.

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[ 1 mark ]

Total 10 marks

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3. Figure 5 shows data in a histogram format, presented by a Caribbean Data Centre (CDC) on reported AIDS cases over a 10-year period.

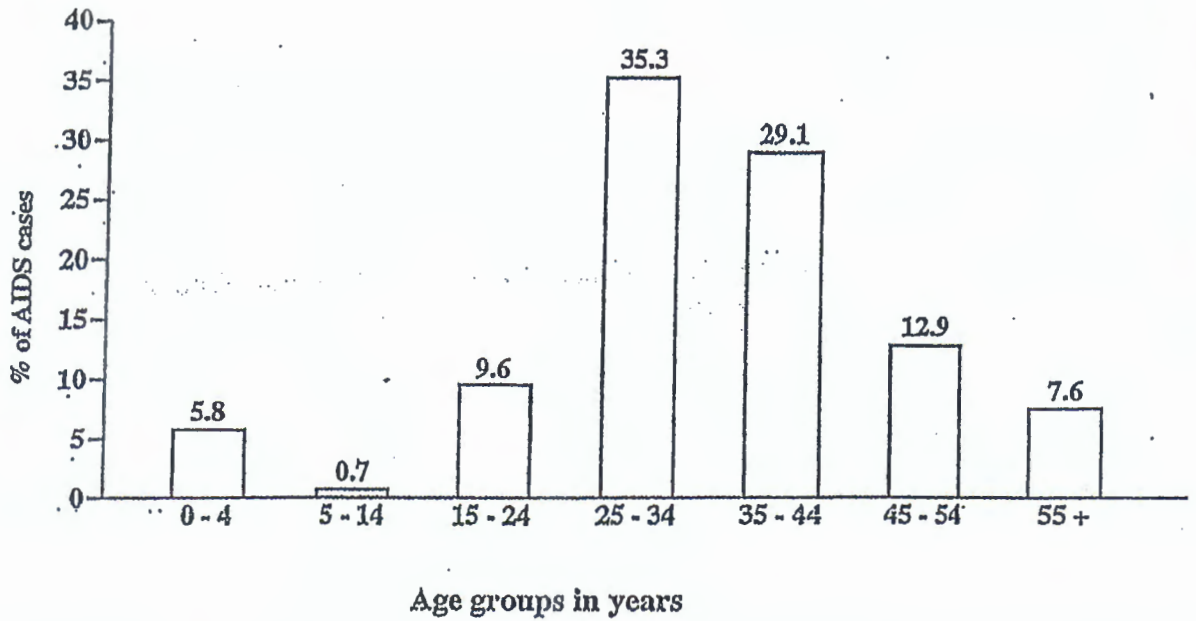


Figure 5. Reported AIDS cases over a 10 year period

Caribbean Epidemiology Centre (CAREC)

- (a) Give the MOST likely methods of transmission of AIDS in

- (i) the 0 - 4 age group

sexual transmission  
breast feeding

[ 2 marks ]

- (ii) the 5 - 14 age group.

[ 1 mark ]

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(b) "The anaerobic pathway used by animals has more potential for energy conservation than anaerobic respiration in plants."  
Discuss this statement by reference to the TWO pathways. [ 5 marks]

(c) Discuss the value to humans of ethanol production by microorganisms. [ 5 marks]

Total 20 marks

5. (a) Describe the carbon cycle. [10 marks]

(b) Distinguish between a food web and a food chain. Discuss which one is the more accurate representation of feeding relationships in an ecosystem. [ 5 marks]

(c) "The flow of energy is fundamentally different from the flow of nutrients through ecosystems."  
Discuss this statement. [ 5 marks]

Total 20 marks

## MODULE 2

Answer EITHER Question 6 OR Question 7.

6. (a) (i) Describe the structure of a red blood cell. [ 2 marks]

(ii) Explain how red blood cells have the ability to carry large amounts of oxygen. [ 4 marks]

(iii) Describe how old erythrocytes are removed from the blood and disposed of in the body. [ 2 marks]

(iv) Explain why haemoglobin is NOT lost from the blood into the urine. [ 2 marks]

(b) (i) During a space mission, a fault in the air filters caused an increase in carbon dioxide in the air. Discuss how this affects the oxygenation of the blood and the offloading of oxygen in the tissues. [ 8 marks]

(ii) On earth, at sea level, an oxygen partial pressure of 5 kPa results in a 50% saturation of haemoglobin by oxygen, and a partial pressure of 10 kPa results in a 95% saturation of haemoglobin.

What would be the effect, in the space capsule, of the high CO<sub>2</sub> concentration on the percentage saturation at 5 kPa and 10 kPa, AND how would it alter the oxygen dissociation graph curve?

[ 2 marks]

Total 20 marks

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7.

- (a) (i) Distinguish between a motor and a sensory neuron. [ 2 marks]
- (ii) Describe the specialised structures AND the functions of the parts of a neuron. [ 8 marks]
- (b) Cocaine blocks the re-uptake of the neurotransmitter dopamine into the pre-synaptic neuron. Acetylcholine is the only neurotransmitter released at the synapses between neurons and skeletal muscles. Acetylcholine is always excitatory and the drug curare blocks acetylcholine receptors.
- Suggest the effects that cocaine and curare would have on transmission. [ 5 marks]
- (c) Compare the transmission of an action potential along a myelinated neuron with transmission along an un-myelinated neuron. [ 5 marks]

Total 20 marks

### MODULE 3

Answer EITHER Question 8 OR Question 9.

8. (a) (i) Describe the short term and long term effects of alcohol on the brain. [ 8 marks]
- (ii) What is meant by alcohol tolerance? [ 2 marks]
- (b) "Cigarette smoking especially affects the respiratory and cardiovascular systems." Discuss this statement. [10 marks]

Total 20 marks

9. (a) Define the term 'transgenic animal' OR 'transgenic plant'. Outline the method by which a transgenic plant AND a transgenic animal can be produced. [10 marks]
- (b) Discuss the environmental safety and ethical implications of genetically modified foods AND human clones. [ 5 marks]
- (c) Define the term 'restriction enzyme'. Design, in outline, an experiment to show how a restriction enzyme can be used to remove a section of a genome. [ 5 marks]

Total 20 marks

END OF TEST

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