



TEST CODE 02207020

FORM TP 2007167

MAY/JUNE 2007

~~CARIBBEAN EXAMINATIONS COUNCIL~~

ADVANCED PROFICIENCY EXAMINATION

BIOLOGY

UNIT 2 – PAPER 02

$2\frac{1}{4}$  hours

Candidates are advised to use the first 15 minutes for reading through this paper carefully.

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.
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. Figure 1 is an illustration of the apparatus used to measure the rate of photosynthesis of a water plant, *Elodea*, over a known period of time.

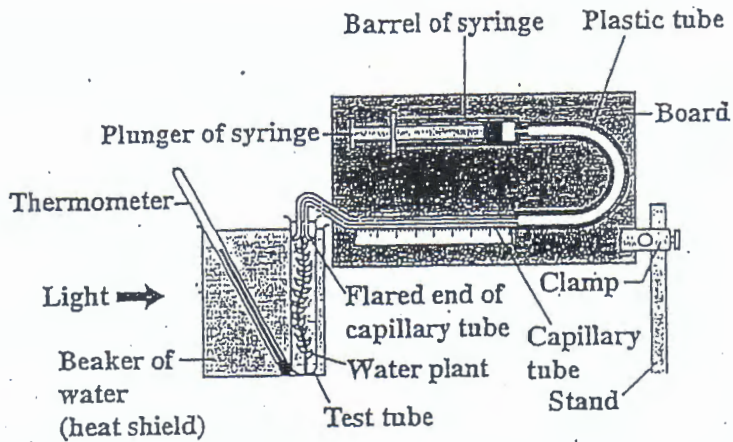


Figure 1

- (a) Explain how the apparatus can be used to measure the rate of photosynthesis.

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[ 5 marks]

- (b) The graph in Figure 2 shows the results of an experiment in which a plant was exposed to light at varying intensities and at different concentrations of carbon dioxide. The rate of photosynthesis was measured as the volume of oxygen per unit time.

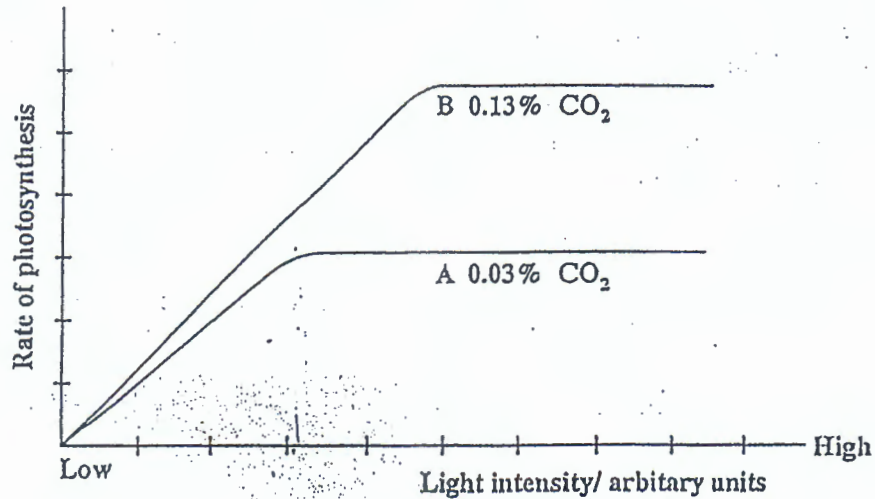


Figure 2.

- (i) Explain the shape of Curve A.

- As <sup>light</sup> intensity increased rate of phot. increased. — light was a limiting factor.
- Increase in light intensity beyond 3 arb. units. Rate remained constant — CO<sub>2</sub> is limiting factor.

[ 2 marks]

- (ii) Compare Curves A and B and account for the observed differences.

- Curve B had a higher rate of phot. than Curve A at the same light intensity.
- Curve B bevelled off at higher light intensity than A. — CO<sub>2</sub> conc. higher in B than A.
- CO<sub>2</sub> — limiting factor.

[ 2 marks]

- (iii) Suggest a possible hypothesis for this experiment.

- [CO<sub>2</sub>] affects the rate of photosynthesis.
- Light intensity.

[ 1 mark]

2. (a) Figure 3 (a) is a longitudinal section of part of the wall of the heart, as seen on a microscope slide. Figure 3 (b) is a diagram of the structure of the heart.

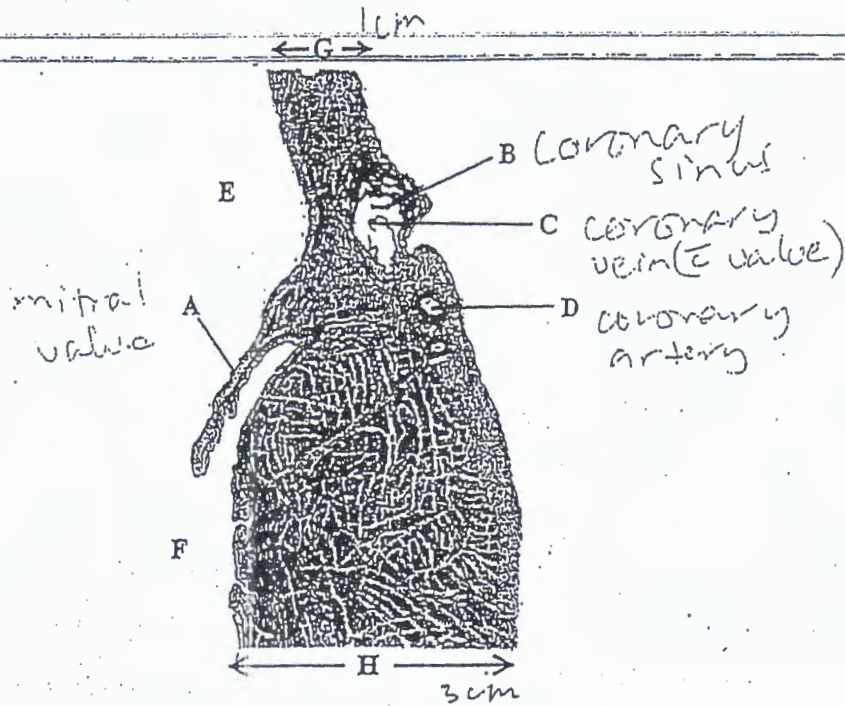


Figure 3 (b)

Figure 3 (a)

Adapted from M. S. H. Difoire, *Atlas of Normal Histology*, Lea and Febiger, 1989, p 91.

- (i) By means of a plan drawing (without drawing actual cells), draw in outline the structures shown in Figure 3 (a). Use the space below and a magnification of x1.

- well drawn - 2  
- fair - 1 } Drawing →  
- correct mag - 1

D - 2  
M - 1

[ 3 marks]

(ii) By means of a ruled square or rectangle, indicate on Figure 3 (b), the location of the drawing you provided in (a) (i). [ 1 mark ]

(b) On the drawing of Figure 3 (a), use labels to identify EACH of the following:

(i) The identity of the structures marked A, B, C, D

ans 2  
= 1 mark

A mitral valve / bicuspid valve / A.V. val

B vein / cuneate (coronary)

C valve (in vein)

D arteriole (coronary) / artery / blood vessel

(ii) The areas labelled E and F

E (left) atrium

F (left) ventricle

[ 3 marks ]

(c) State the width of the wall at G as a proportion of the wall width at H.

1/3 / 1:3 [ 1 mark ]

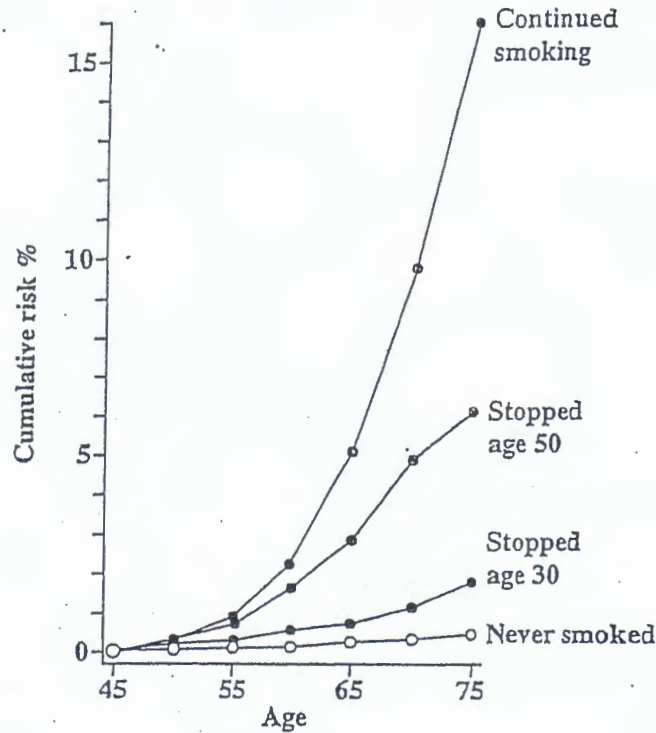
(d) Give a reason for the differences in width you gave in your answer to (c).

→ only has to pump blood into ventricle / <sup>short distance</sup> / with  
- # has to pump blood into aorta and around body  
→ little resistance from mitral valve  
# must overcome resistance of systemic circulation

[ 2 marks ]

Total 10 marks

3. Figure 4 shows the outcome of a study among men whose cumulative increase in risk for developing lung cancer (as a %) was determined in association with the age at which they stopped smoking.



Source: P. Vines, M. Alavanja, P. Buffer et al.  
Commentary: Tobacco and Cancer: Recent Epidemiological Evidence,  
*Journal of the National Cancer Institute,*  
Vol 96, No. 2, January 2004, pp 99 - 106.

before

Figure 4

(a) Use the data from the graph to answer the following questions:

(i) At age 75 which group has

a) the HIGHEST cumulative risk?

Continued Smoking

b) the LOWEST cumulative risk?

Never Smoked

[ 2 marks ]

(ii) In this study, at what age have all men been considered to have a cumulative risk of zero?

45 yrs.

[ 1 mark ]

(iii) At age 65, what is the difference in risk between those who stopped smoking at 30, compared with those who stopped smoking at age 50?

2.0 - 2.4 %

[ 1 mark ]

(iv) Suggest how the failure of 50-year-old men in 2007 to quit smoking will affect their risk of developing lung cancer in 2027 in comparison with those who never smoked.

Their risk will increase - 1mk.

The never smoked increases to 0.5% and/or

the continuously smoking increases to approx.

9.8% - 1mk.

[ 2 marks ]

(b) Ten 35-year-old women comprise 5 smokers (Group A) and 5 non-smokers (Group B). How could you precisely design an experiment, and what measurements would you take in order to determine which group is the fittest in relation to their pulse rate (P), their blood pressure elevation (BP) and their breathing rate, (BR), following exercise. The equipment you are provided with is

Cover all steps  
precisely - 4mks

cover all steps  
initially - 3mks

some steps  
correct - 2mks

Brief answer  
few details  
- 1mk

1. a set of stairs

2. equipment to measure blood pressure

3. a stopwatch.

- Separate Gp. A and Gp. B.

- For each individual of Gp. A immediately before exer

- Take blood pressure (BP)

- Take pulse (P)

- Take breathing rate (BR)

- Subject them to timed exercise on the stairs.

- Stop exercise and re-measure BP, pulse, BR at end.

- Calculate differences (before and after)

- Record

- Calculate averages for the Gp A, for BP, P, BR.

- Do same entire procedure on each indiv. of Gp B.

- Compare the means bet. Gp A and Gp B for BP, P, BR.

- Make deductions and give results.

[ 4 marks ]

{ 1) Must have referred to the separate gps A and B. Total 10 marks  
1mk

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) For living organisms state TWO specific cellular processes that require energy, giving brief explanations as to why energy is required. [ 2 marks]
- (b) (i) What is meant by the term 'glycolysis'?
- (ii) Describe, in their correct sequence, SIX major steps in glycolysis. [ 8 marks]
- (c) (i) 'Anaerobic respiration' is considered to be inefficient, in terms of energy, when compared to aerobic respiration.
- Discuss this statement referring to SIX points in your discussion.
- (ii) Discuss, using FOUR points, the importance of the production of lactate when a person does sustained vigorous exercise. [10 marks]

Total 20 marks

5. (a) In an ecosystem, energy and nutrients flow through three nutritional groups, namely producers, consumers and decomposers. State the sources and the differences between energy flow and nutrient flow through these nutritional levels. [ 6 marks]
- (b) When nutrients cycle through an ecosystem, point out the advantages of a food web over a food chain. [ 4 marks]
- (c) In tropical rainforests, leaves, fruits and branches fall to the ground and are subject to the action of micro-organisms and chemical actions which regenerate minerals essential for further plant growth. Apply your knowledge of the nitrogen cycle to explain, in detail, how deforestation/slash-and-burn interferes with EACH stage of the cycle. [10 marks]

Total 20 marks



MODULE 2

Answer EITHER Question 6 OR Question 7.

6. (a) (i) Draw a large, labelled diagram to illustrate the detailed structure of a nephron of a mammalian kidney. [10 marks]
- (ii) Outline the role of the 'Loop of Henle' in water conservation. [10 marks]
- (b) Discuss the effect that pregnancy has on the functioning of the kidney. [2 marks]
- (c) High glucose and protein levels were detected in a urine sample from a 60-year-old patient. Discuss the clinical significance of this result. [8 marks]

Total 20 marks

7. (a) (i) Give a large, clear drawing of a section through a synapse, and label the pre- and post-synaptic membranes. 4
- (ii) Label FOUR additional structures you have clearly drawn. 3 mks
- (iii) Describe briefly the sequential steps which occur in the transmission of an impulse across a synapse, and its reception at the post-synaptic membrane. 5  
[10 marks] (12)
- (b) Clarify the role and mode of action of synapses in the following events. 2
- (i) The wailing cries of the baby in the bedroom gradually penetrate our awareness. 2
- (ii) A dish of food given to you is painfully hot and your reflex action urges you to drop it. However, it is your mother's favourite china and you immediately hold on even though your fingers are burning. [4 mks] 6 marks
- (c) Discuss FOUR points of difference between the operation of the nervous and endocrine systems in response to stimuli. 4  
[4 marks]

Total 20 marks

N.S	E.S
1. use axons / specific routes	1. use blood system for distribution
2. target cells precise	2. target cells diffuse
3. specific action stimulates	3. general action by many cells
4. short lived	4. longer duration
5. chemical changes	5. protein molecules / receptors / hormones

MODULE 3

Answer EITHER Question 8 OR Question 9.

8. (a) (i) Explain how HIV causes AIDS. [12 marks]
- (ii) Outline FIVE symptoms of AIDS.
- (iii) Discuss the impact of AIDS in the Caribbean. [12 marks]
- (b) (i) Briefly explain how malaria is transmitted to humans.
- (ii) Discuss the role of biological factors in the prevention and control of malaria. [ 8 marks]

Total 20 marks

9. (a) (i) Explain what is meant by the term 'restriction enzymes' and state their normal function in life.
- (ii) Describe how restriction enzymes are used in genetic engineering using plasmids, bacteria and gene probes to produce recombinant DNA, which includes a specific transplanted gene. [10 marks]
- (b) (i) Comment on the therapeutic procedures used to treat a genetic disorder.
- (ii) Gene therapy can be applied to both germ cells and somatic cells. Most countries prohibit the application of germ cell therapy in humans. Give reasons for their decision. [10 marks]

Total 20 marks

END OF TEST

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