



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

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

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.

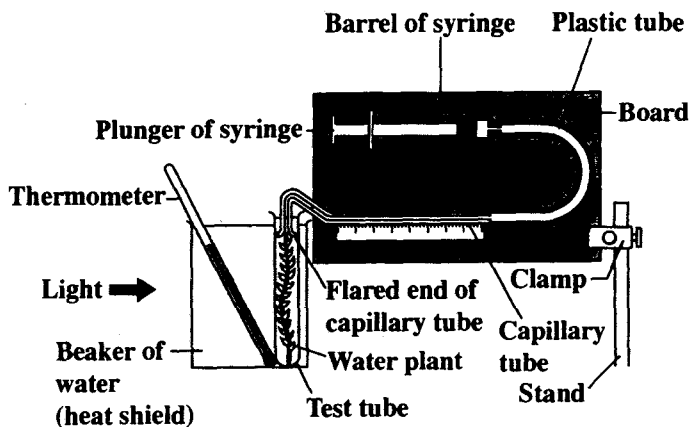


Figure 1

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

[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.

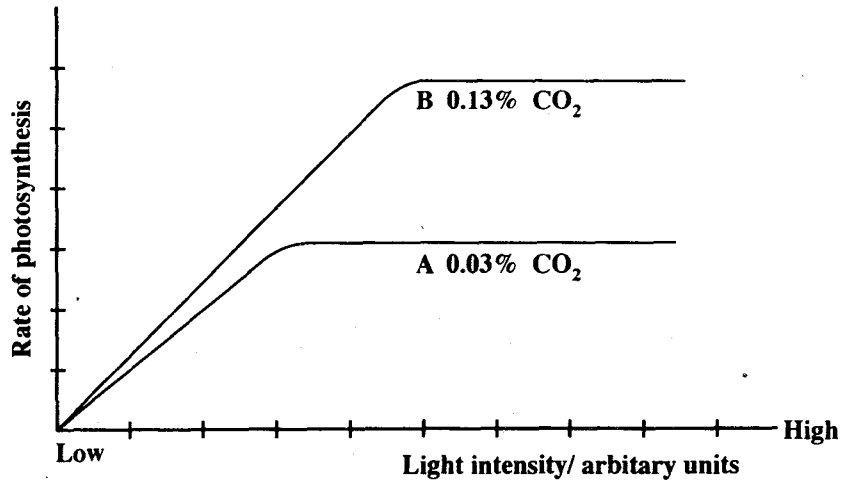


Figure 2.

- (i) Explain the shape of Curve A.

[2 marks]

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

[2 marks]

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

[1 mark]

Total 10 marks

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- (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.

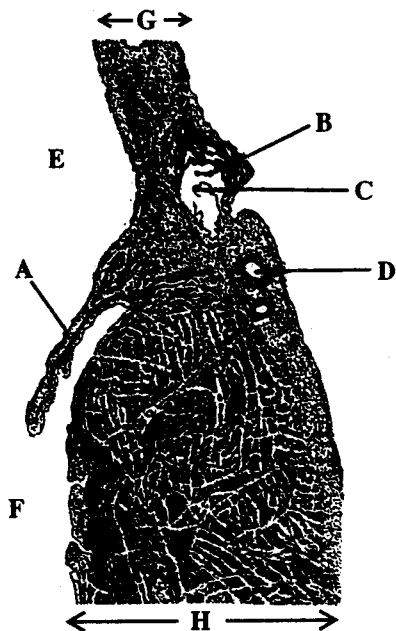


Figure 3 (a)

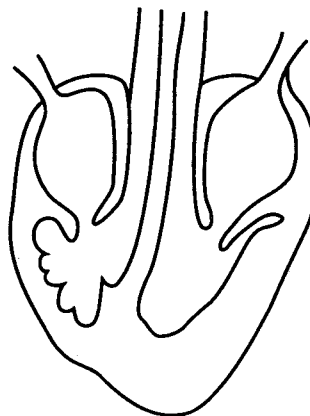


Figure 3 (b)

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.

[3 marks]

GO ON TO THE NEXT PAGE

(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

A _____

B _____

C _____

D _____

(ii) The areas labelled E and F

E _____

F _____

[3 marks]

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

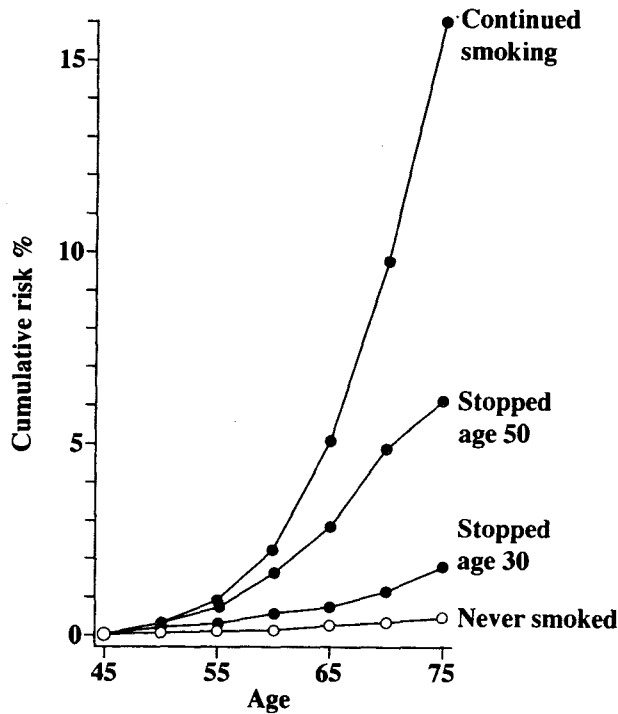
[1 mark]

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

[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.

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?
- _____
- b) the LOWEST cumulative risk?
- _____
- [2 marks]
- (ii) In this study, at what age have all men been considered to have a cumulative risk of zero?
- _____

[1 mark]

GO ON TO THE NEXT PAGE

- (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?

[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.

[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

1. a set of stairs
2. equipment to measure blood pressure
3. a stopwatch.

[4 marks]

Total 10 marks

GO ON TO THE NEXT PAGE

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

- (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.
- (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.
- (ii) Label FOUR additional structures you have clearly drawn.
- (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. [10 marks]
- (b) Clarify the role and mode of action of synapses in the following events.
- (i) The wailing cries of the baby in the bedroom gradually penetrate our awareness.
- (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. [6 marks]
- (c) Discuss FOUR points of difference between the operation of the nervous and endocrine systems in response to stimuli. [4 marks]

Total 20 marks

GO ON TO THE NEXT PAGE

MODULE 3

Answer EITHER Question 8 OR Question 9.

8. (a) (i) Explain how HIV causes AIDS.
- (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

- (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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FORM TP 2006179

MAY/JUNE 2006

CARIBBEAN EXAMINATIONS COUNCIL

ADVANCED PROFICIENCY EXAMINATION

BIOLOGY

UNIT 2 – PAPER 02

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

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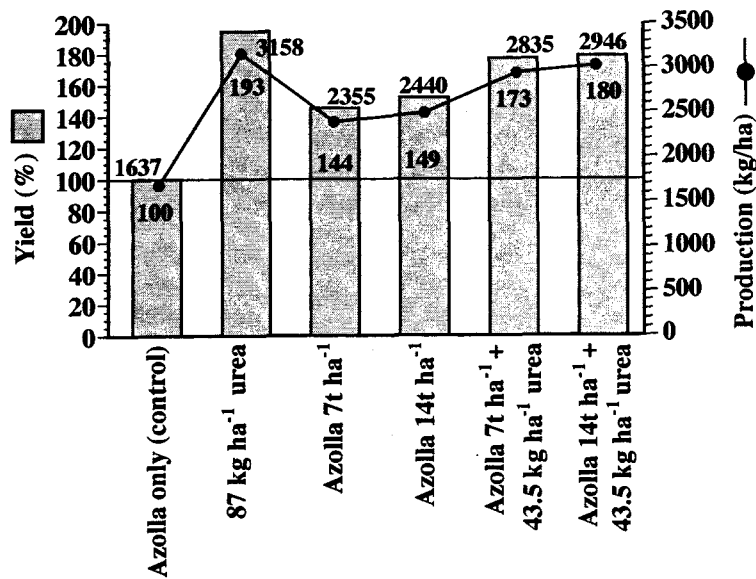
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SECTION A

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

Azolla is an aquatic fern that lives in an association with bacteria that help it to fix nitrogen. It is used as a green manure for fertilizing rice fields in Africa. Experiments were carried out using Azolla plus the chemical fertilizer urea to fertilize the rice fields.

The graph of Figure 1 shows the average production and yield in a rice field.



(kg ha⁻¹) Kilograms per hectare
(t ha⁻¹) Tonnes per hectare

Figure 1. Average production (kg ha⁻¹) and yield of rice (compared to control)

*The above graph has been reproduced from Kannaiyan:
Biotechnology of Biofertilizers.
Copyright 2002 Narosa Publishing House, New Delhi, p 290.*

- (a) With reference to the graph in Figure 1 determine which fertilizer regimen gives the HIGHEST yield of rice.

[1 mark]

- (b) What is the PERCENTAGE increase in yield when the amount of Azolla is doubled from 7 t to 14 t as the sole fertilizer administered.

[1 mark]

GO ON TO THE NEXT PAGE

- (c) Determine the difference in rice production, in kg ha^{-1} , between the following fields:

One treated with urea only, at a rate of 87 kg ha^{-1} and the other treated with both urea, at 43.5 kg ha^{-1} and Azolla at 14 t ha^{-1} .

[1 mark]

- (d) Name TWO factors, **other than** availability of nutrients from fertilizer, that would affect rice yield.

[1 mark]

- (e) Name ONE type of plant compound that requires the functionally useful element in urea.

[1 mark]

- (f) Suggest TWO reasons why it is better to use plant or animal manure rather than chemical fertilizers alone for fertilizing crops.

[1 mark]

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(g) Figure 2 below shows a transverse section through the leaf blade of *Syringa vulgaris*.

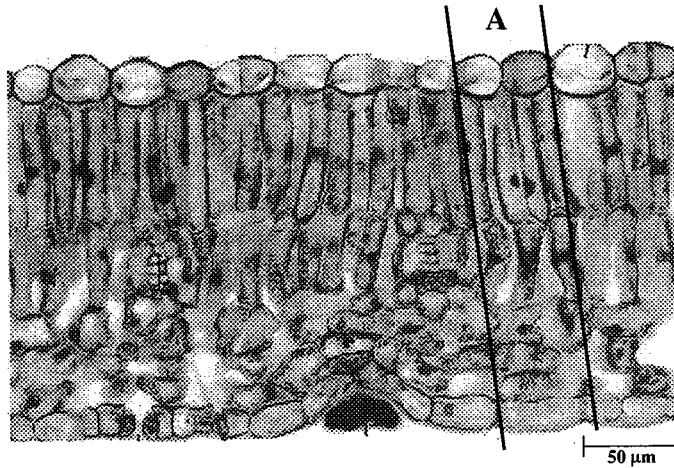
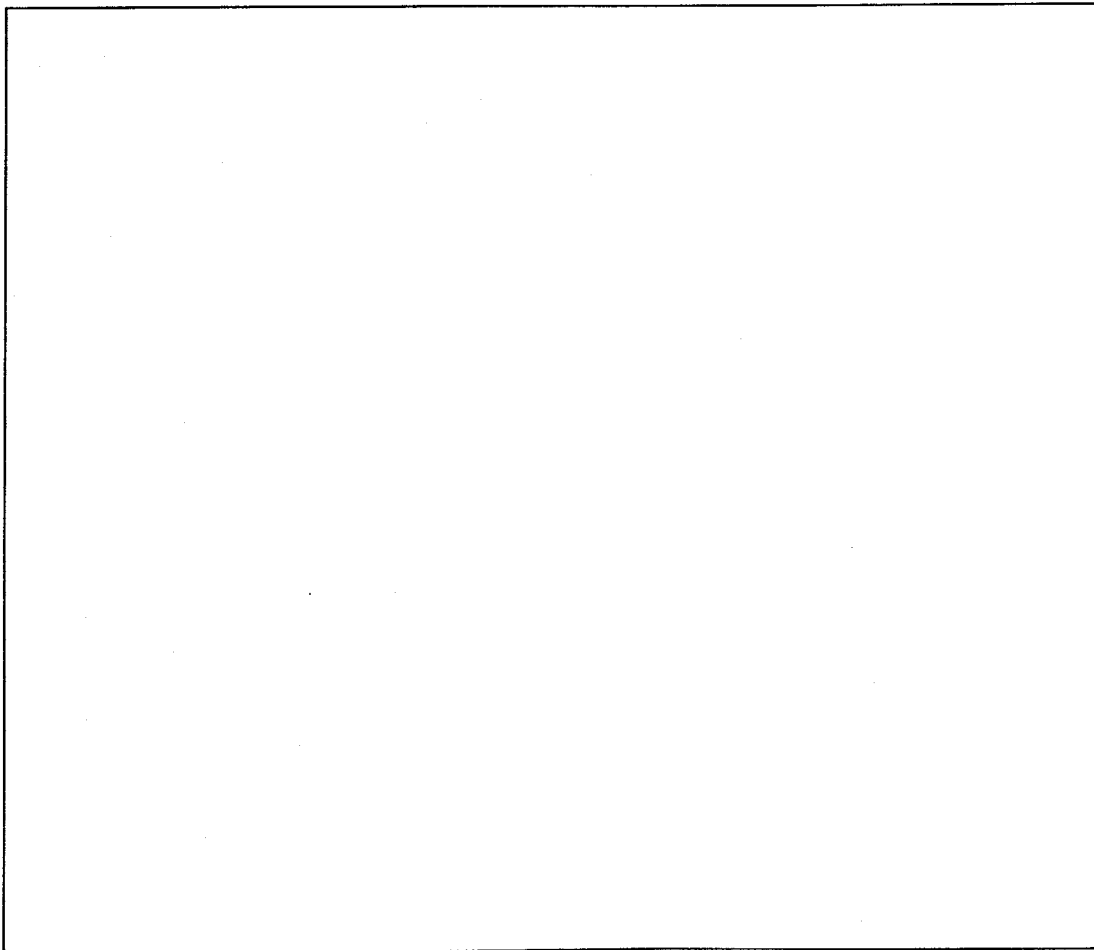


Figure 2. Transverse section through leaf of *Syringa vulgaris*

*P. H. Raven et. al. Biology of Plants 6th Edition
W. H. Freeman and Company-Worth Publishers, 1999, p 290.*

In the box provided below, draw and label the cells in A, between the parallel lines, in Figure 2.



[4 marks]

Total 10 marks

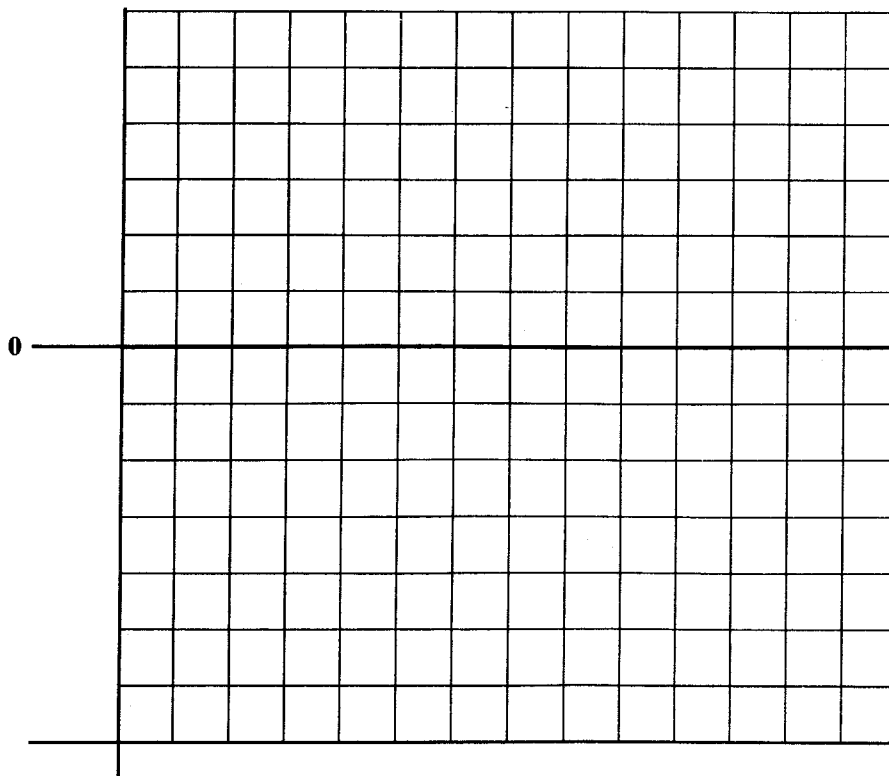
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A group of students investigated the effect of sodium ions on the production of action potentials in the large neurons extracted from squids. Since the squid is a marine mollusc, they used a bathing solution of seawater. One neuron was placed in normal strength seawater (A), and the other in seawater diluted 50:50 with distilled water, (B). They stimulated both neurons, and recorded the strength of the action potential in millivolts (mV). The results are set out in Table 1.

TABLE 1. MEMBRANE POTENTIALS IN TWO SOLUTIONS

Time Milliseconds	Membrane Potential mV	
	Normal Seawater A	Normal Seawater: distilled water, 50:50 B
0.0	-50	-50
0.2	-50	-50
0.4	+50	-30
0.6	+20	0
0.8	-60	+15
1.0	-70	-50
1.2	-60	-60
1.4	-50	-50

(a) (i) Use the grid provided to show these results graphically.



[6 marks]

GO ON TO THE NEXT PAGE

(ii) State TWO differences between the peaks in A and B.

1. _____

2. _____

[2 marks]

(iii) State ONE cause of the differences between the membrane potentials reached in A and B.

[1 mark]

(b) Figure 3 shows a specialized type of cell.

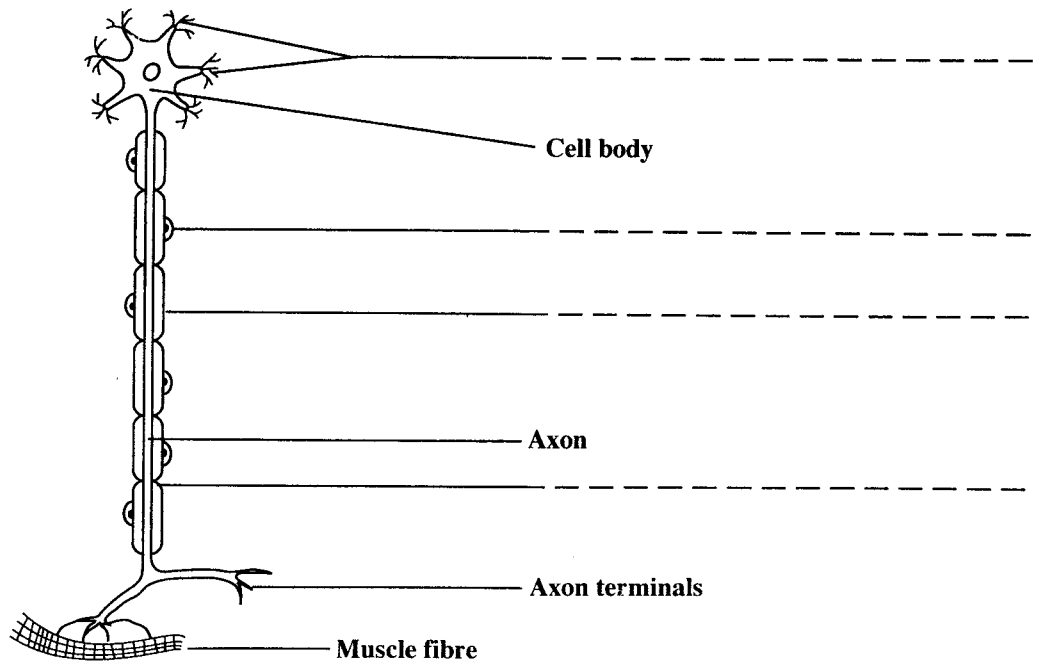


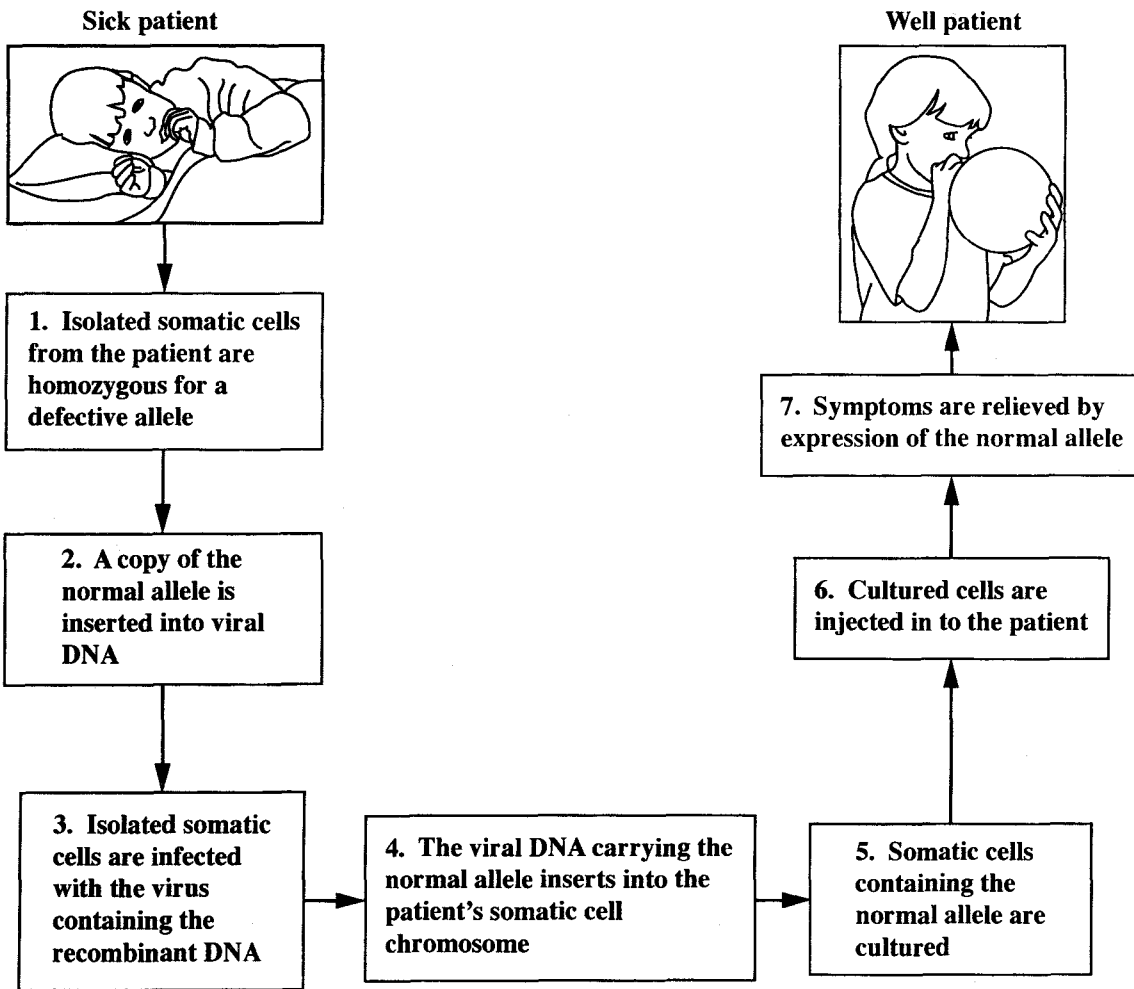
Figure 3. A nerve cell

On the diagram in Figure 3, complete the labelling of the nerve cell.

[1 mark]

Total 10 marks

Figure 4 below shows the stages in the therapy which a sick child undergoes.



*W. Purves et al. Source: Life The Science of Biology 6th Ed.
W. H. Freeman and Company, 2001, p 348.*

Figure 4. Stages in the therapy of a sick child

(a) Name the type of therapy that the child is undergoing.

_____ [1 mark]

(b) Identify the type of enzymes used to remove the normal allele from the genome of the donor whose genes are being used in the treatment.

_____ [1 mark]

GO ON TO THE NEXT PAGE

- (c) Suggest ONE benefit and ONE hazard of the technique in Figure 4.

Benefit: _____

Hazard: _____

[2 marks]

- (d) Can the change in the genome be passed on to the individual's offspring? Give ONE reason for your answer.

[2 marks]

- (e) The bacterium *Escherichia coli* has a plasmid, A, in its cytoplasm. Plasmid A carries genes for resistance to two antibiotics, tetracycline and kanamycin. The gene for tetracycline resistance has a site for restriction enzyme A to cut and disrupt it.

The genome for corn has two sites for restriction enzyme A on either side of the gene for corn protein. Restriction enzyme A cuts out an entire functional gene for corn protein.

Restriction enzyme, A, plasmid A DNA and corn genome DNA are mixed together and recombinant DNA is formed. The recombinant DNA is mixed with a new *E. coli* strain that does not have any plasmid A. This *E. coli* takes up the recombinant DNA.

Briefly outline a method of detection and what you would observe if

- (i) *E. coli* has taken up no DNA

[2 marks]

- (ii) *E. coli* has taken up recombinant DNA.

[2 marks]

Total 10 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.

- (a) Clarify the **actions** and **purposes** of the oxidative and decarboxylative reactions which occur in the mitochondria during the following events:
- (i) Entry and processing of pyruvic acid [4 marks]
 - (ii) Rotation of the Krebs's cycle [6 marks]
- (b) With the aid of a diagram, give an account of the process of oxidative phosphorylation (the electron transport chain), to show the roles of hydrogen and electron carriers, phosphate compounds and oxygen in the production of ATP. [10 marks]

Total 20 marks

- (a) Define the following terms:
- (i) Ecosystem [1 mark]
 - (ii) Habitat [1 mark]
 - (iii) Ecological niche [1 mark]
 - (iv) Food chain [1 mark]
- (b) Discuss how the components in an ecosystem function to achieve and maintain ecological balance. [4 marks]
- (c) (i) Explain why the flow of energy through ecosystems is linear and **NOT** cyclical. [3 marks]
- (ii) Explain why food chains are generally limited to three or four links. [3 marks]
- (d) In a forest there is a large tree that supports 500 caterpillars and 200 snails. There are five sparrows that live in the tree feeding on the caterpillars while one large hawk feeds on the sparrows. Consider this tree and its associated organisms as an ecosystem.
- Describe the tree ecosystem in terms of: a pyramid of biomass, a pyramid of numbers and a pyramid of energy. [6 marks]

Total 20 marks

GO ON TO THE NEXT PAGE

MODULE 2

Answer EITHER Question 6 OR Question 7.

6. (a) Define the following terms and exemplify EACH one with reference to the glucose concentration of the blood **and** the endocrine-related actions of the pancreas and/or the liver:
- (i) Homeostasis [2 marks]
 - (ii) Set point [2 marks]
 - (iii) Detectors [3 marks]
 - (iv) Regulators [3 marks]
- (b) What reactions does the liver perform on protein material to process it to the body's advantage? [10 marks]

Total 20 marks

7. (a) Describe the ascent of water in plants from outside the root to the intercellular spaces of the leaf. Include the role of root pressure, capillarity, cohesion, adhesion, transpiration pull and stomata. [10 marks]
- (b) Relate the structure of xylem vessels to their function. [4 marks]
- (c) Plant 1 is placed in a pot with its roots immersed in a dilute solution of potassium cyanide and an atmosphere of 20 per cent humidity.

Plant 2 is placed in a pot with its roots in distilled water and an atmosphere of 100 per cent humidity.

Discuss the effects these conditions would have on water uptake, mineral ion transport and transpiration. [6 marks]

Total 20 marks

GO ON TO THE NEXT PAGE

MODULE 3

Answer EITHER Question 8 OR Question 9.

- (a) Describe the mode of action of:
- (i) Phagocytes [2 marks]
 - (ii) Plasma cells [2 marks]
- (b) Distinguish between B and T lymphocytes in relation to their origin and maturation process. [6 marks]
- (c) Chloe gets a positive pregnancy test on a kit that she has used at home. The box label says it contains monoclonal antibodies. Her husband doesn't know whether to trust it. Chloe, who has studied Biology, persuades him that it is based on sound technology and is accurate.
- What convincing points could she make? [4 marks]
- (d) Active artificial immunity and passive artificial immunity are two methods of controlling disease, in cases where recipients do not have the necessary antibodies.
- Compare TWO situations in which EACH of these methods is used to BEST advantage. Give examples to support your comparison. [6 marks]

Total 20 marks

- (a) Using appropriate examples, recommend the appropriate diet for the following individuals:
- (i) A lactating mother [2 marks]
 - (ii) Sedentary grandparents [2 marks]
 - (iii) An agricultural labourer [2 marks]
- (b) For the TWO diseases, HIV/AIDS and diabetes
- (i) state the disease categories under which EACH falls [4 marks]
 - (ii) discuss reasons for their global distribution. [5 marks]
- (c) Betty, aged 38, eats mainly rice, potato chips, sweet potatoes, macaroni and cheese, cake and carbonated beverages. Betty is unwell and goes to the doctor who tells her that she is obese, and has developed diabetes. The doctor also tells Betty that she is malnourished but she indignantly responds that she eats plenty of good food.
- With reference to the meaning of the term 'healthy', explain why the doctor considers Betty to be malnourished. [5 marks]

Total 20 marks

END OF TEST

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TEST CODE **02207010**

FORM TP 2006178

MAY/JUNE 2006

CARIBBEAN EXAMINATIONS COUNCIL

ADVANCED PROFICIENCY EXAMINATION

BIOLOGY

UNIT 2 – PAPER 01

1 $\frac{3}{4}$ hours

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READ THE FOLLOWING INSTRUCTIONS CAREFULLY.

1. Candidates must attempt 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.

1. (a) Name the MAJOR pigment and ONE accessory pigment used by plants in photosynthesis.

[1 mark]

- (b) State the wavelengths of light absorbed by Photosystems I and II.

- (i) Photosystem I:

- (ii) Photosystem II:

[1 mark]

- (c) Figure 1 shows how electrons are transported through Photosystem I and Photosystem II in the light-dependent stage of photosynthesis.

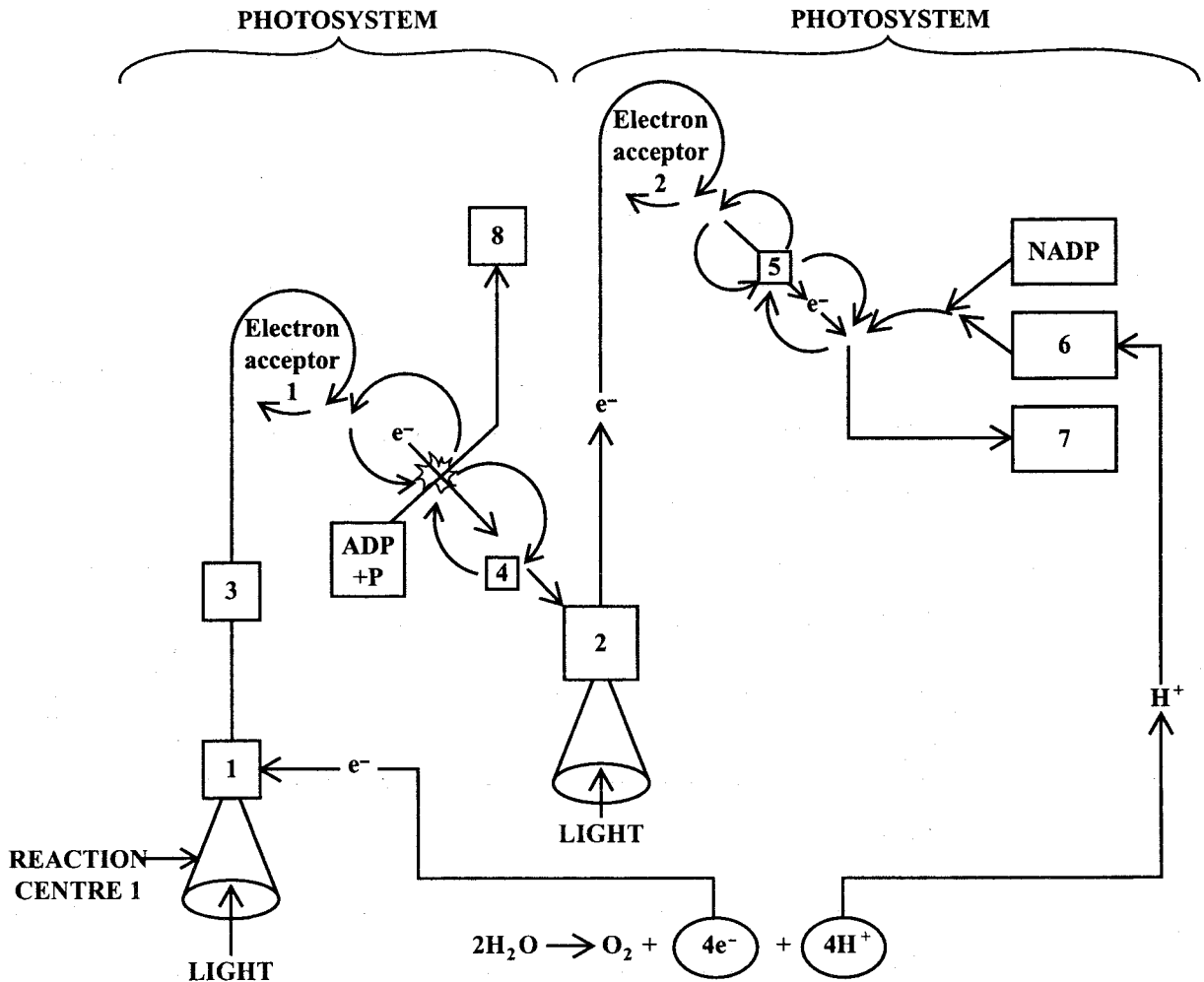


Figure 1. Light-dependent stages of photosynthesis

GO ON TO THE NEXT PAGE

With reference to Figure 1, answer questions (i) to (v).

- (i) Identify the photosystems labelled at Boxes 1 and 2.

Photosystem at Box 1:

Photosystem at Box 2:

[1 mark]

- (ii) Briefly explain

- a) TWO events caused by incident light at Reaction Centre 1

Event 1: _____

Event 2: _____

[1 mark]

- b) why electrons enter Box 1.

[1 mark]

- (iii) State TWO events which occur between Boxes 3 and 4.

Event 1: _____

Event 2: _____

[2 marks]

- (iv) State TWO events which occur between Boxes 4 and 5.

Event 1: _____

Event 2: _____

[1 mark]

(v) Identify the substances in Boxes 6, 7 and 8.

Box 6 _____

Box 7 _____

Box 8 _____

[1 mark]

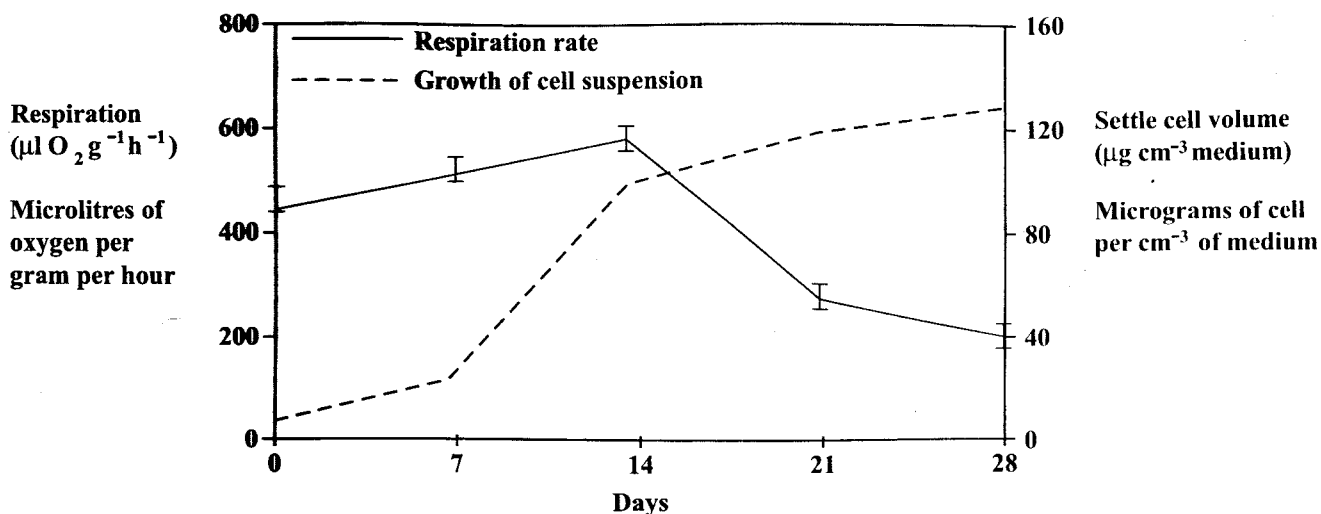
(d) Each thylakoid has a flattened disc-like shape, and is composed of a thylakoid membrane enclosing an oval thylakoid space.

Which substance, e^- or H^+ , is stored in the thylakoid space?

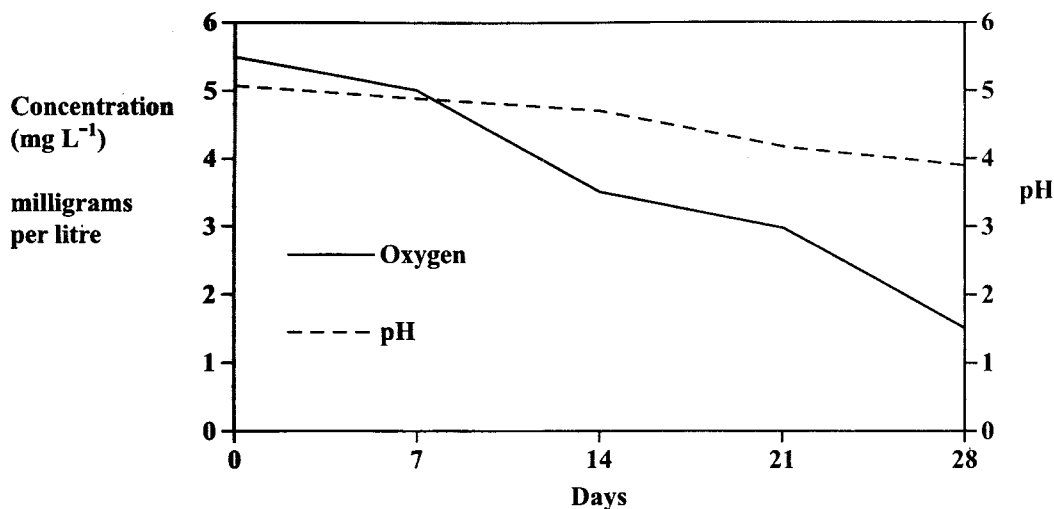
[1 mark]

Total 10 marks

2. The graphs in Figure 2 below show the rate of respiration and the rate of growth of cells in a culture medium as well as the changes in oxygen concentration and pH that take place in the culture medium.



Respiration rate and growth rate of the cell suspension in a culture medium



Changes in pH and oxygen concentration in the culture medium

Figure 2. Changes during growth of cell suspension

Adapted from: Bui Viet and Tran Huong, "Growth of Cell Suspensions of *ev. Cau man*". *Info Musa The International Journal on Banana and Plantain*, Vol. 13 No. 1. June 2004, pp. 2 - 3.

Examine the graphs in Figure 2 and answer the following questions.

- (a) Determine the maximum respiration rate of the cell suspension.

[1 mark]

GO ON TO THE NEXT PAGE

- (b) Determine the concentration of oxygen in the cell suspension medium on the day of MAXIMUM respiration.

_____ [1 mark]

- (c) Deduce what type of respiration is being carried out on Day 3 and Day 28. Give ONE reason for your answer.

Day 3: _____

Day 28: _____

[1 mark]

Reason: _____

[1 mark]

- (d) Suggest why the pH of the cell suspension medium changes over the period of the experiment.

_____ [2 marks]

- (e) Determine the increase in the mass per cm^3 of cells in the cell suspension medium between Day 0 (start of the experiment) and Day 28.

_____ [1 mark]

- (f) Explain why the number of cells present in the medium does NOT continue to increase indefinitely.

_____ [1 mark]

- (g) Write a balanced equation for the fermentation of glucose to ethanol and state ONE use of this process.

Equation:

_____ [1 mark]

Use of the process:

_____ [1 mark]

Total 10 marks

GO ON TO THE NEXT PAGE

3. Figure 3 shows the nitrogen cycle.

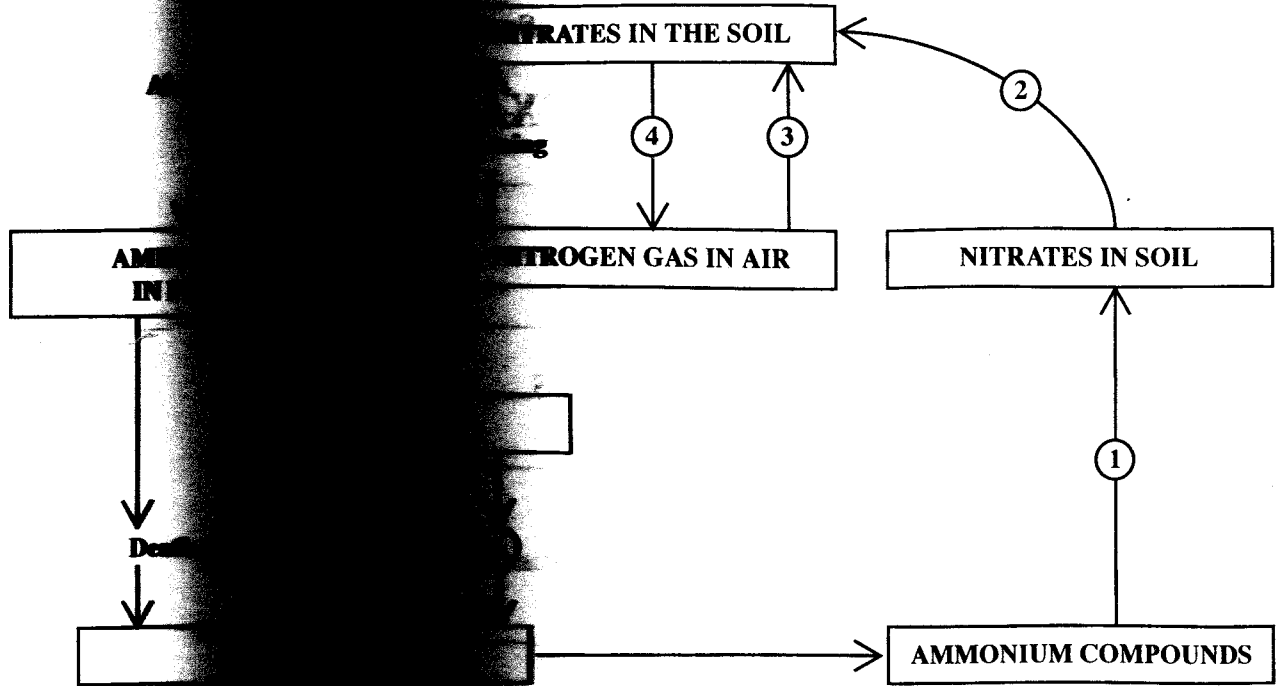


Figure 2. The nitrogen cycle

(a) Name the organisms represented by the numbers 1 – 6 in Figure 3.

[3 marks]

(b) Figure 3 represents a mutualistic relationship. Define the term

[1 mark]

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TEST CODE **02207010**

FORM TP 2006178

MAY/JUNE 2006

CARIBBEAN EXAMINATIONS COUNCIL
ADVANCED PROFICIENCY EXAMINATION

BIOLOGY
UNIT 2 – PAPER 01

NOTE TO CANDIDATES

ERRATUM SHEET

Page 8 – Question 3

The diagram for question 3 is to be labelled

Figure 3. The nitrogen cycle

4.1 below, there
(iii) Logging of trees for timber in tropical forests has ecological consequences for the ecosystem.

(a) Identify E.A.C.
Briefly describe TWO prominent biological effects of logging.

[2 marks]

(b) State TWO ways that bacteria derive from being part of the nitrogen cycle.

[2 marks]

(c) Suggest the effect that flooding of farm fields would have on the

[1 mark]

(d) In the nitrogen cycle, some of the stages of the cycle contain greater reserves of nitrogen. Identify the stage with the greatest reserve, which is the LARGEST reserve.

[1 mark]

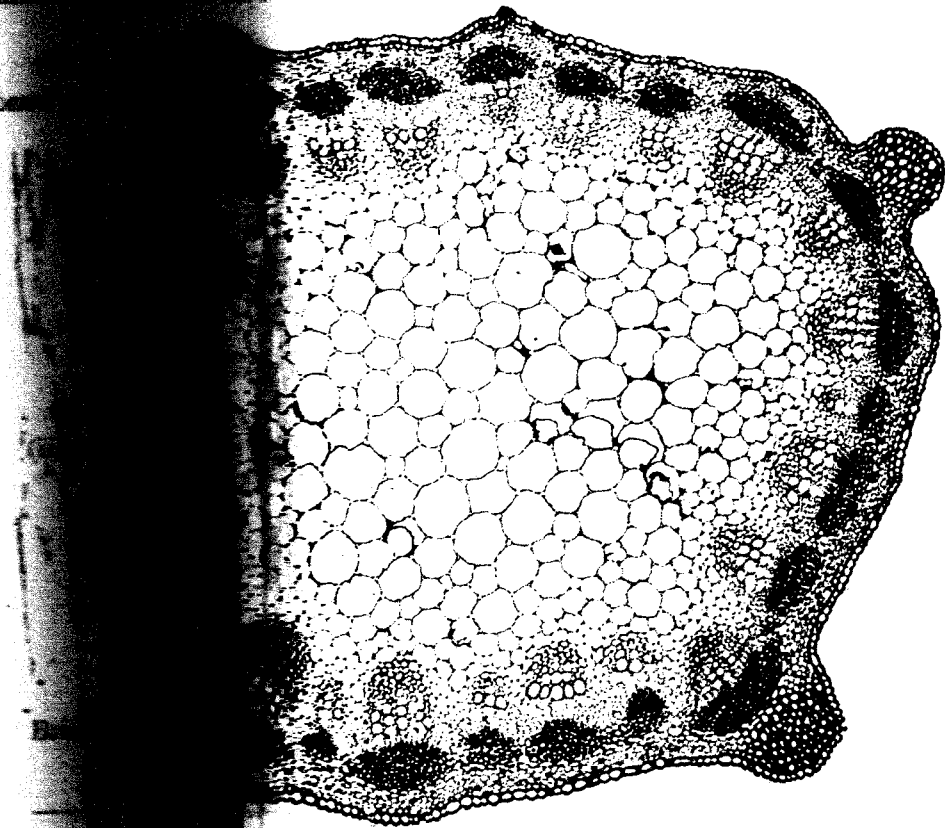
Total 10 marks

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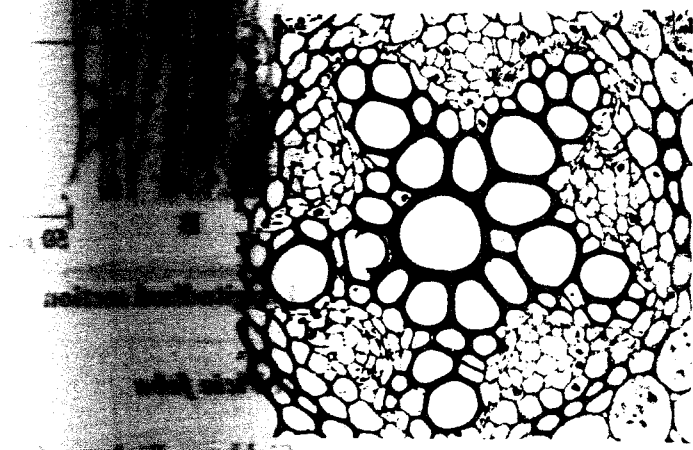
4. In Figure 4.1 are micrographs of transverse sections of two plant organs.

(a) Label each micrograph of EACH organ, label ONLY the phloem. [2 marks]

(b) Name EACH plant organ in Figure 4.1. [2 marks]



Name of plant organ: _____



(Centre portion only, shown)

Name of plant organ: _____

Figure 4.1. Transverse sections of two plant organs

Sylvia S. Mader, Biology Evolution, Diversity, and the Environment, McGraw Hill, pp. 382 and 388.

- (b) The leaf of the broad bean *Vicia faba*, is exposed to radioactive carbon dioxide for 35 minutes. Both transverse and longitudinal sections are made of the leaf to display the vascular bundles. The sections are placed in contact with an autoradiographic film, which shows up radioactivity as dark grains on the film. The film is left in contact with the sections for 32 days and then developed.

Figure 4.2 shows longitudinal and transverse sections of the vascular bundle.

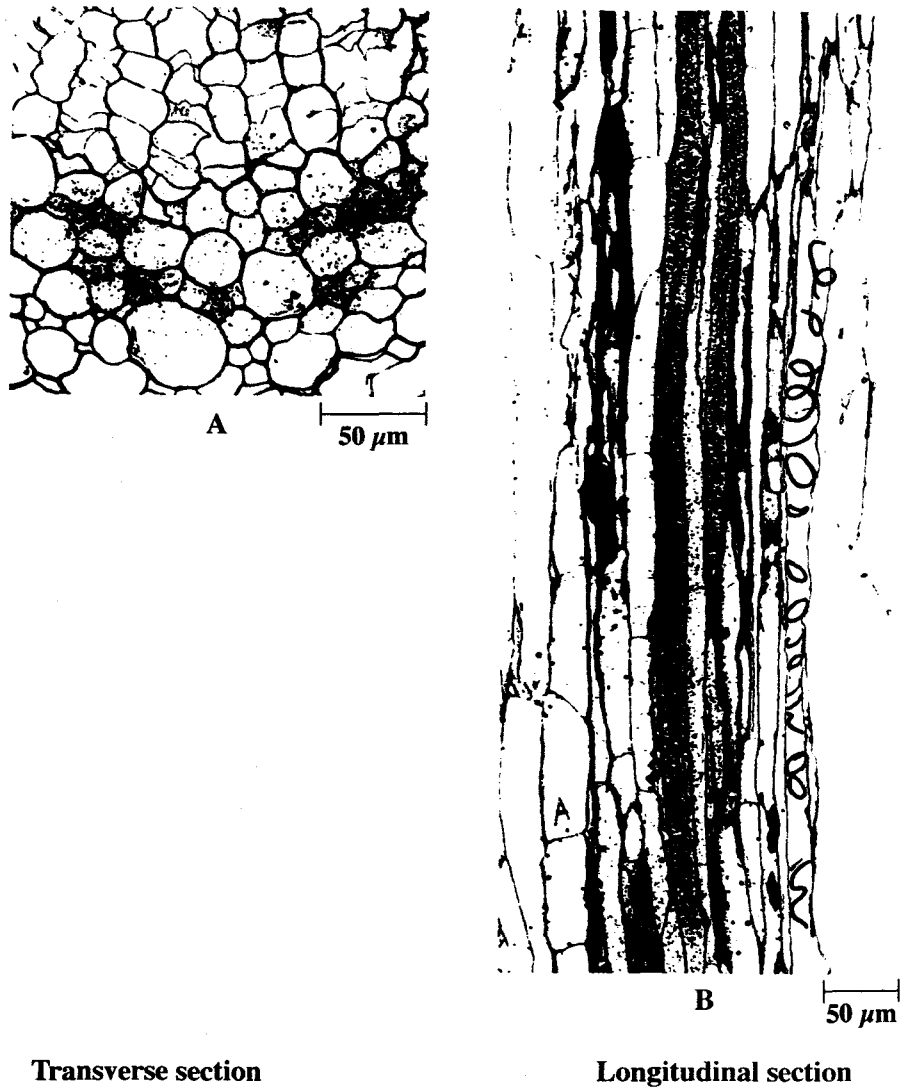


Figure 4.2. Sections of vascular bundles of *Vicia faba*

P. Raven, R. Evert and S. Eichhorn, Biology of Plants 6th Ed, W. H. Freeman and Company-Worth Publishers, 1999, p 766.

(i) Identify the groups of plant cells in Figure 4.2 that appear dark.

_____ [1 mark]

(ii) Explain why ONLY these cells appear dark.

_____ [2 marks]

(iii) Calculate the width of the cell labelled A in the longitudinal section in Figure 4.2.

_____ [1 mark]

(c) Briefly state the pressure flow hypothesis.

_____ [2 marks]

Total 10 marks

5. Figure 5.1 shows the relationship between the proximal convoluted tubules and a peritubular capillary, in longitudinal section.

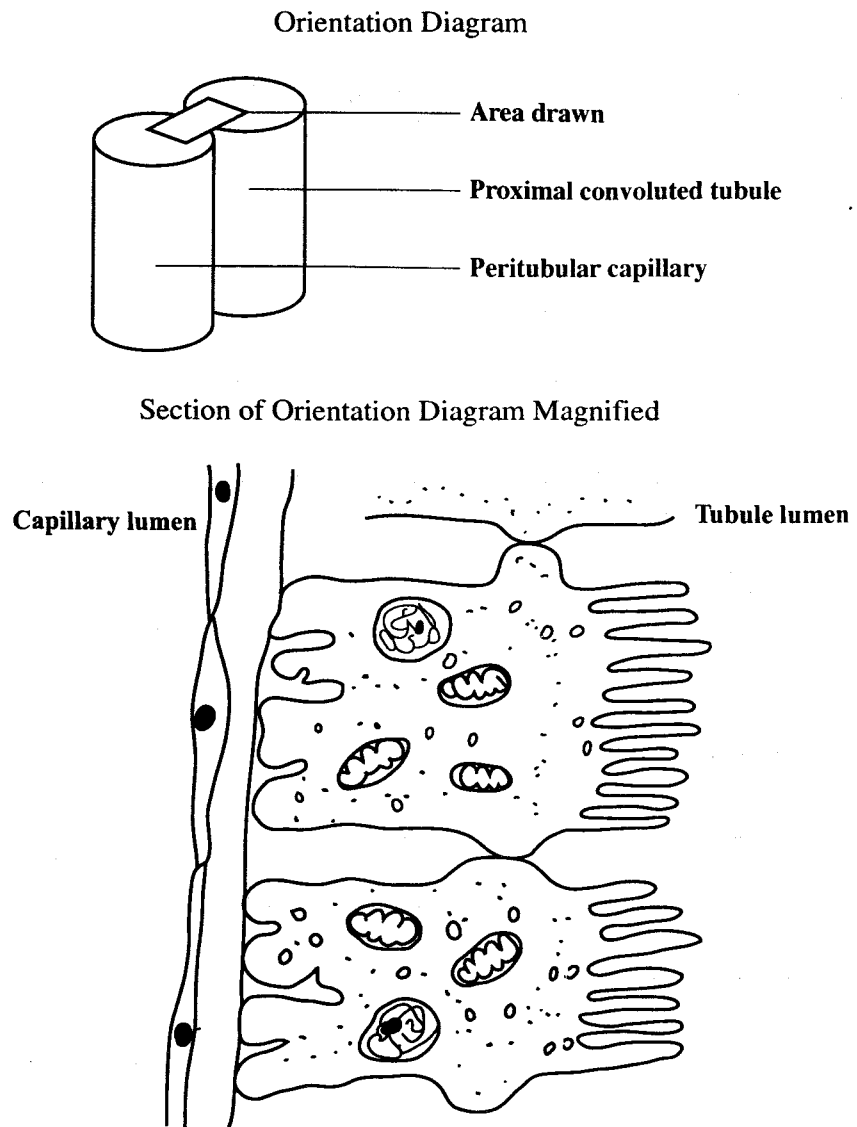


Figure 5.1. Proximal convoluted tubule and peritubular capillary

- (a) (i) State FOUR substances, **other than** water and mineral ions, present in the tubule lumen in Figure 5.1 which will be absorbed by the tubule cells.

Substance 1: _____

Substance 2: _____

Substance 3: _____

Substance 4: _____

[2 marks]

- (ii) Describe THREE processes used to transport **named** substances from the tubule lumen mentioned in (a) (i) into the tubule cells.

Process 1: _____

Process 2: _____

Process 3: _____

[3 marks]

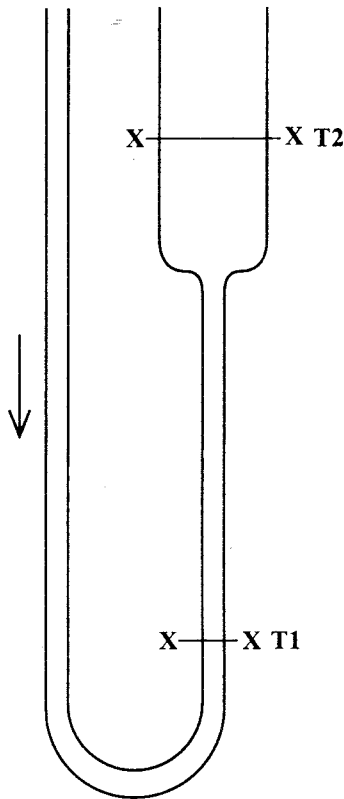
- (iii) Give TWO reasons why substances which accumulate at the intercellular space between the tubule and capillary move into the capillary and do NOT return to the tubule lumen.

[2 marks]

(b) Figure 5.2 below represents the loop of Henle.

- (i) Based on your knowledge of kidney structure, sketch transverse sections of the tube at areas T1 and T2 to show the differences between their cellular structure. (Make EACH drawing X5 the diameter of the tube).

Transverse Section T1



Transverse Section T2

Figure 5.2. Loop of Henle

[2 marks]

- (ii) Suggest the functional reason for the differences between T1 and T2.

[1 mark]

Total 10 marks

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6. (a) ... are controlled by the

...)

[1 mark]

(AVN)

[1 mark]

[1 mark]

(b) ... to the following:

... delay between the effect of the SAN and the AVN?

[1 mark]

... stimulating the contraction of the ventricles to begin at ... from the AVN, and not their apex, next to the AVN?

[1 mark]

- (c) Two campers are awakened from rest when a jaguar looks into their tent. Frightened, the campers jump up and rush off. Their pumping leg muscles squeeze blood up the veins, back to the heart, and reserve blood from the spleen enters the circulation. Diaphragm muscles increase the breathing movements.

Complete Table 1 to identify the structures associated with this response, and the body's actions.

TABLE 1: STRUCTURES, LOCATIONS OR EFFECT OF BODY'S RESPONSES

ACTION IN BODY	ANSWER
(i) Location of structures which respond to the stimulus of increased blood flow in the cardiac area	
(ii) Type of nerve which carries stimulus to the brain.	
(iii) Name of area of brain which responds to stimulus and generates a reaction.	
(iv) Type of nerve which transmits the stimulus back to the heart.	
(v) Location in heart which receives the stimulus.	
(vi) Effect of stimulus on cardiac output.	

[3 marks]

(d) Non-nervous control of the heart may be affected by several factors. For each of the following stimuli, state its effect on the heart rate.

(i) Low pH

(ii) Low body temperature

[2 marks]

Total 10 marks

7. In 1999 – 2000, a British crime survey analysed alcohol-related crimes in relation to acts of violence performed against strangers (persons unknown to the perpetrators) or acquaintances (family or friends).

TABLE 2: INCIDENCE RATE OF CRIME AGAINST STRANGERS AND ACQUAINTANCES BY AGE AND GENDER OF THE ASSAULTER

Gender	Age	Number of victims (per 10 000 adults)	
		Strangers	Acquaintances
Male	16 – 19	749	559
	20 – 24	569	426
	25 – 29	339	277
	30 – 34	326	148
	35 – 39	101	64
	40 – 45	94	61
	45+	66	46
	Female	16 – 19	157
20 – 24		122	88
25 – 29		70	96
30 – 34		54	68
35 – 39		15	56
40 – 45		20	68
45+		5	36

*Adapted from: T. Budd, "Alcohol-related assault: findings from the British Crime Survey".
Home Office Online Report 35/3, 2003, p. 25.*

- (a) (i) **Using references to the data in Table 2, comment on the aggressiveness, under the influence of alcohol, of**
- a) **drinkers in relation to their age**

[2 marks]

b) males and females in relation to their choice of victim.

[4 marks]

(ii) Give ONE possible behavioural reason for your answer in (a) (i) b).

[1 mark]

(b) Figure 6 below shows the incidence rates of alcohol-related assaults on strangers, acquaintances and total assaults in 1999 by unit consumption.

(i) On the histogram in Figure 6, write in the missing data above the columns which represent the totals. [1 mark]

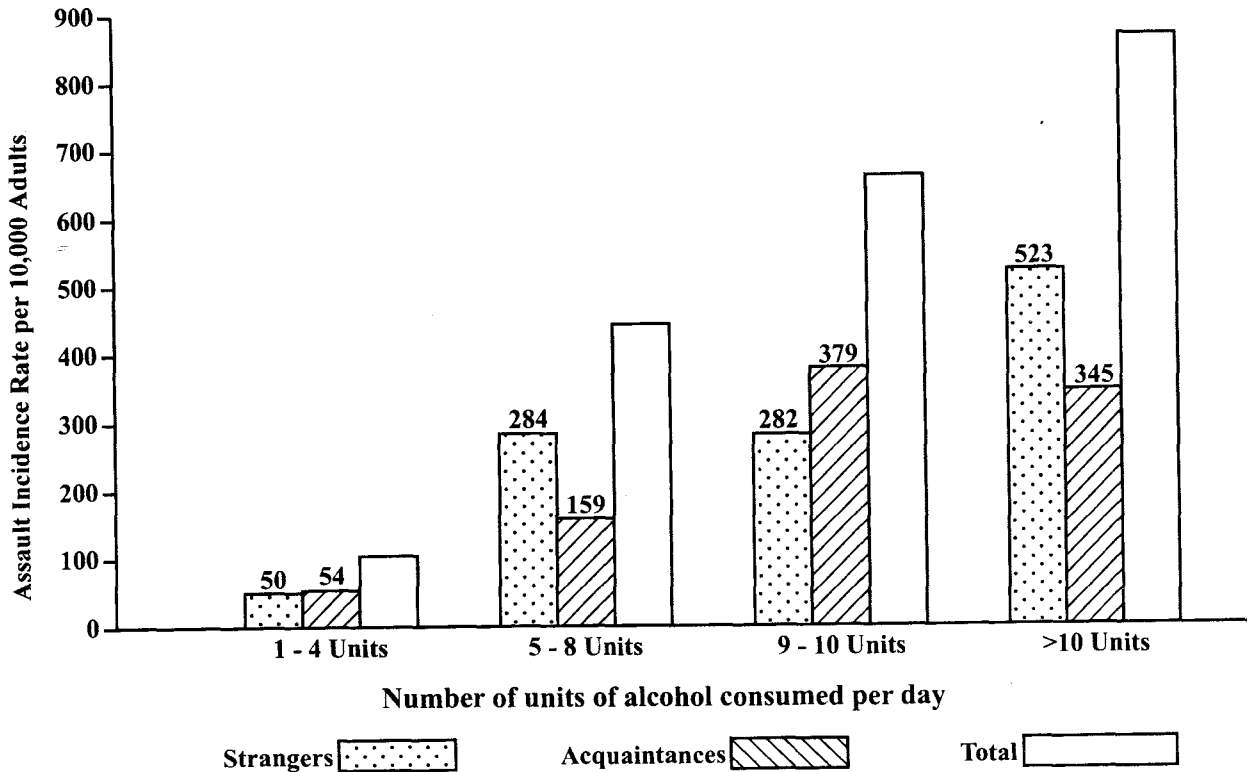


Figure 6. Incidence rate of alcohol-related assault in 1999, by unit consumption

*Adapted from T. Budd, "Alcohol-related assault: findings from the British Crime Survey".
Home Office Online Report 35/3, 2003, p. 25.*

(ii) With **reference** to the data in Figure 6, comment on the relationship between alcohol consumption in units per day and total assault rate.

[1 mark]

(c) What is the accepted 'safe limit' of alcohol consumption in units per day for the average person?

[1 mark]

Total 10 marks

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Cigarette smoking can cause the healthy coronary artery, cross-section shown in Figure 7.1.A. below, to become the unhealthy artery, cross section shown in Figure 7.1.B.

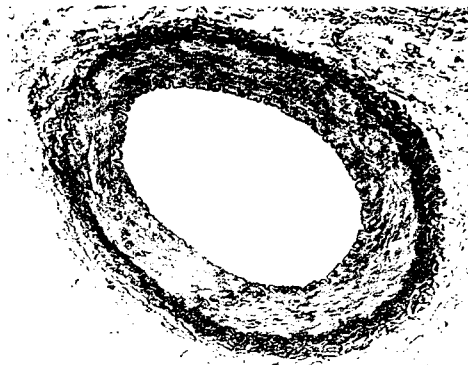


Figure 7.1.A

W. K. Parves et al. Life: Science of Biology, 6th Edition, W. H. Freeman and Company, 2001, p 878.

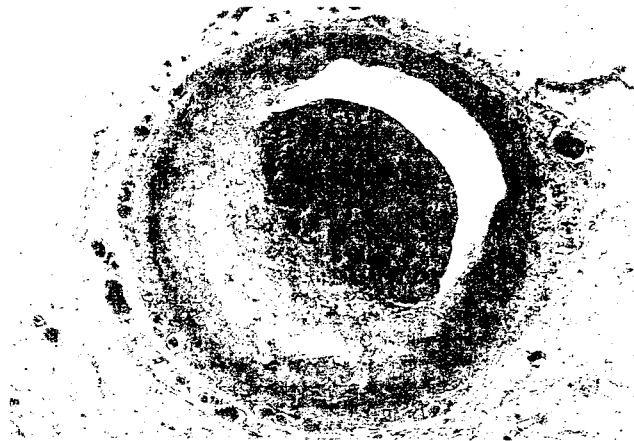


Figure 7.1.B

Chemistry in Britain. Royal Society of Chemistry. Thomas Graham House, Vol 38, #9, p. 35.

- (a) (i) Name the disease that is characterized by the state of the coronary artery in Figure 7.1.B.

_____ [1 mark]

- (ii) Briefly outline FOUR symptoms that a smoker with the coronary artery shown in Figure 7.1.B is LIKELY to experience.

[2 marks]

- (iii) Estimate the percentage obstruction occurring in the lumen of the coronary artery in Figure 7.1.B.

_____ [1 mark]

GO ON TO THE NEXT PAGE

- (b) Name TWO components of cigarette smoke and describe ONE effect of EACH component on the body.

Component 1: _____

Effect: _____

Component 2: _____

Effect: _____

[2 marks]

- (c) Figure 7.2 below shows age standardized mortality rates from coronary heart disease (CHD) in men and women under 75 years of age in 1998.

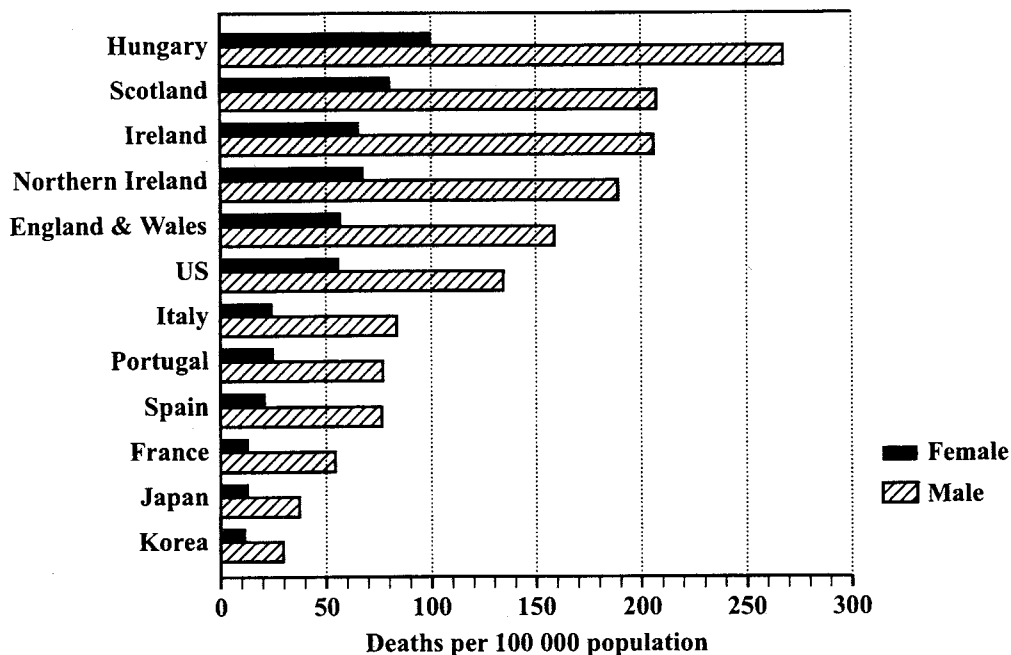


Figure 7.2. Age standardised mortality rates from CHD, men and women aged under 75, in 1998

Source: OHE and WHO in *Chemistry in Britain*.
Royal Society of Chemistry, Thomas Graham House, Vol 38, #9, p 36.

Using Figure 7.2, determine the number of male and female deaths per 100 000 population, that occurred in the USA and Japan in 1998.

USA: Female _____ Male _____

Japan: Female _____ Male _____

[2 marks]

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- (d) Japanese diet consists mainly of fresh fruit, vegetables, rice, fish and soybean curd. The American diet consists mainly of beef, pork, chicken, rice, potatoes, carbonated and alcoholic beverages.

Suggest how these differences in diet contribute to the CHD levels in EACH country.

[2 marks]

Total 10 marks

GO ON TO THE NEXT PAGE

9. (a) State FOUR methods that can be used to control mosquitoes.

[2 marks]

(b) An increase in the number of cases of mosquito-borne diseases is closely correlated with increases in rainfall.

Suggest why these trends are normally correlated.

[2 marks]

(c) On the island of Trinidad the mosquito, *Anopheles albimanus*, breeds in swamps. *Anopheles bellator*, another species of mosquito found in Trinidad, breeds in water trapped between the overlapping leaf bases of bromeliads growing on the trunks of trees of the rain forests.

In the 1940's officials in Trinidad sprayed with insecticide and drained numerous marshes and swamps. However, the incidence of malaria remained unchanged.

Suggest why this campaign failed to reduce the incidence of malaria in Trinidad.

[1 mark]

(d) For EITHER dengue OR malaria

(i) name the specific causative agent

_____ [1 mark]

(ii) briefly describe FOUR typical symptoms of the disease

_____ [2 marks]

(iii) use your knowledge of the habits of the mosquito that transmits the disease to suggest the part of the day when an individual is MOST likely to be bitten by the disease-transmitting mosquito.

_____ [1 mark]

(e) State TWO precautions that may be taken to reduce the chance of being bitten by a mosquito which is a vector for EITHER dengue OR malaria.

_____ [1 mark]

Total 10 marks

END OF TEST

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