



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

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

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.

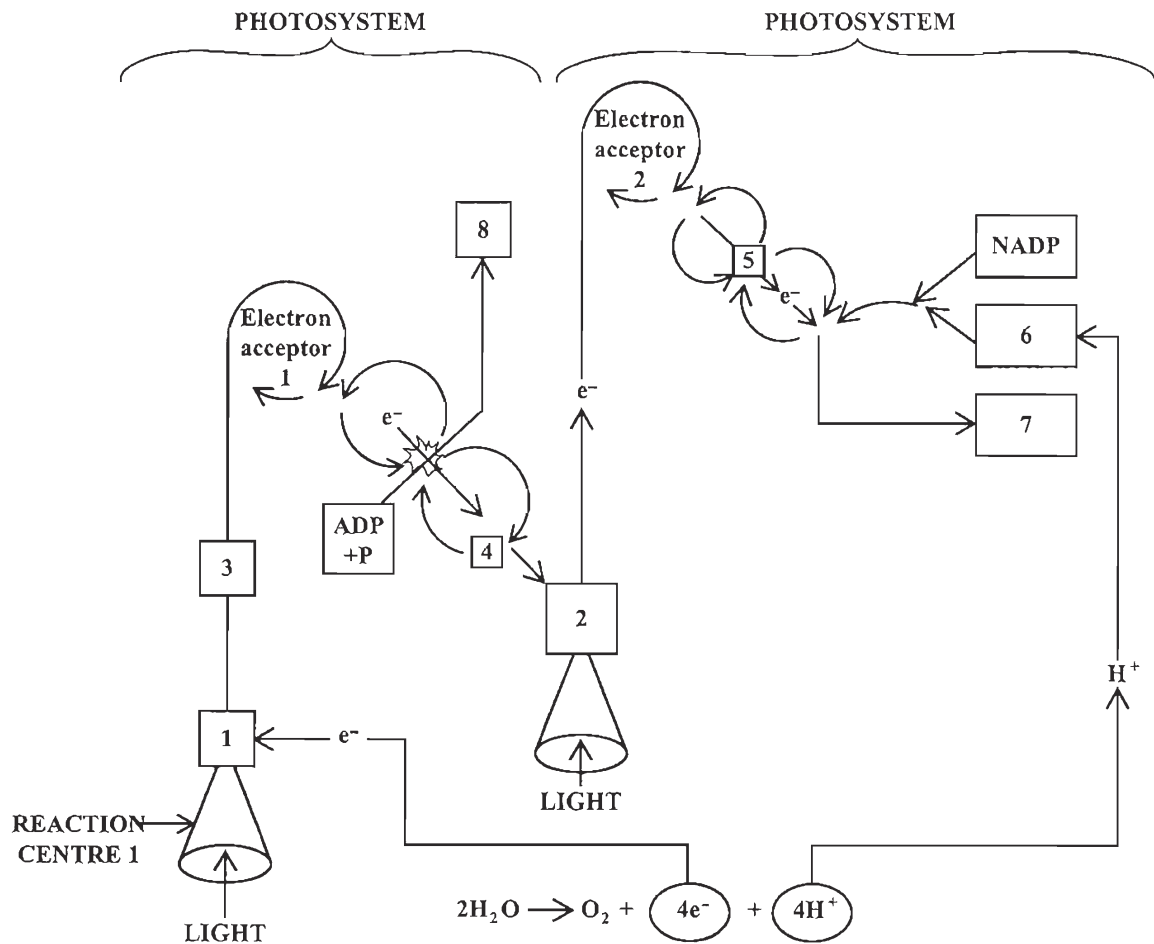


Figure 1. Light-dependent stages of photosynthesis

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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.

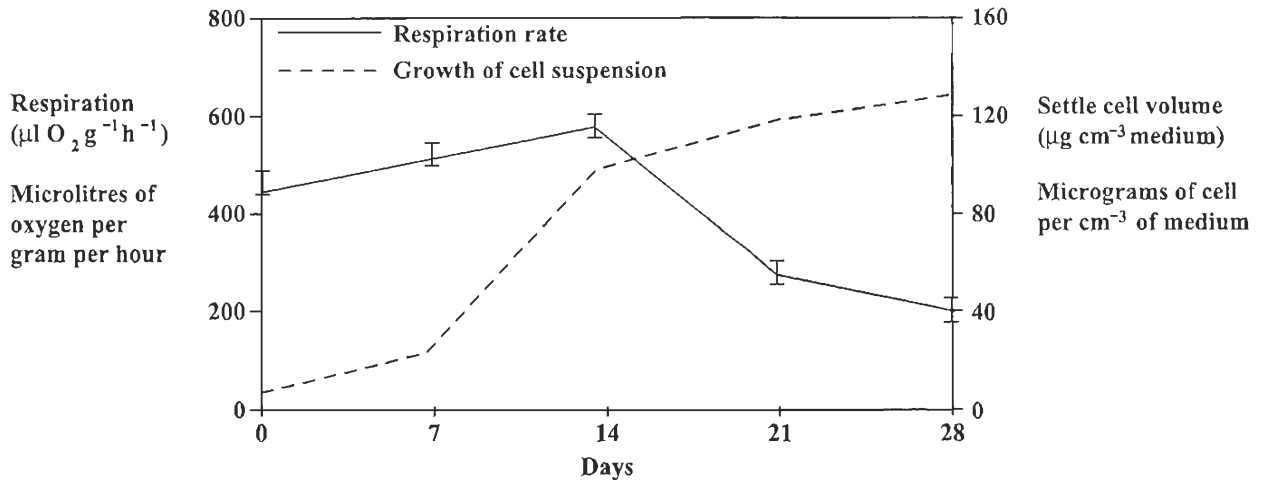
Which substance, e^- or H^+ , is stored in the thylakoid space?

[1 mark]

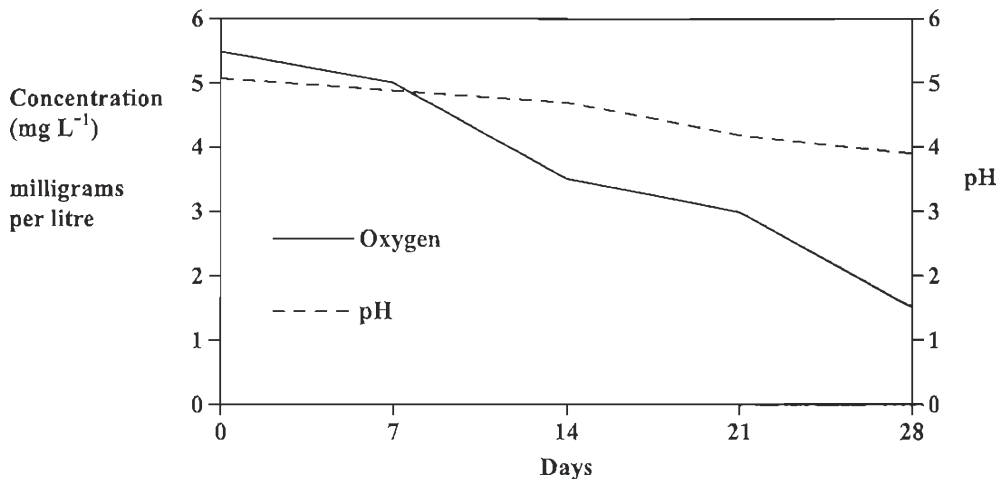
Total 10 marks

NOTHING HAS BEEN OMITTED.

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]

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- (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

3. Figure 3 is a diagram of the nitrogen cycle.

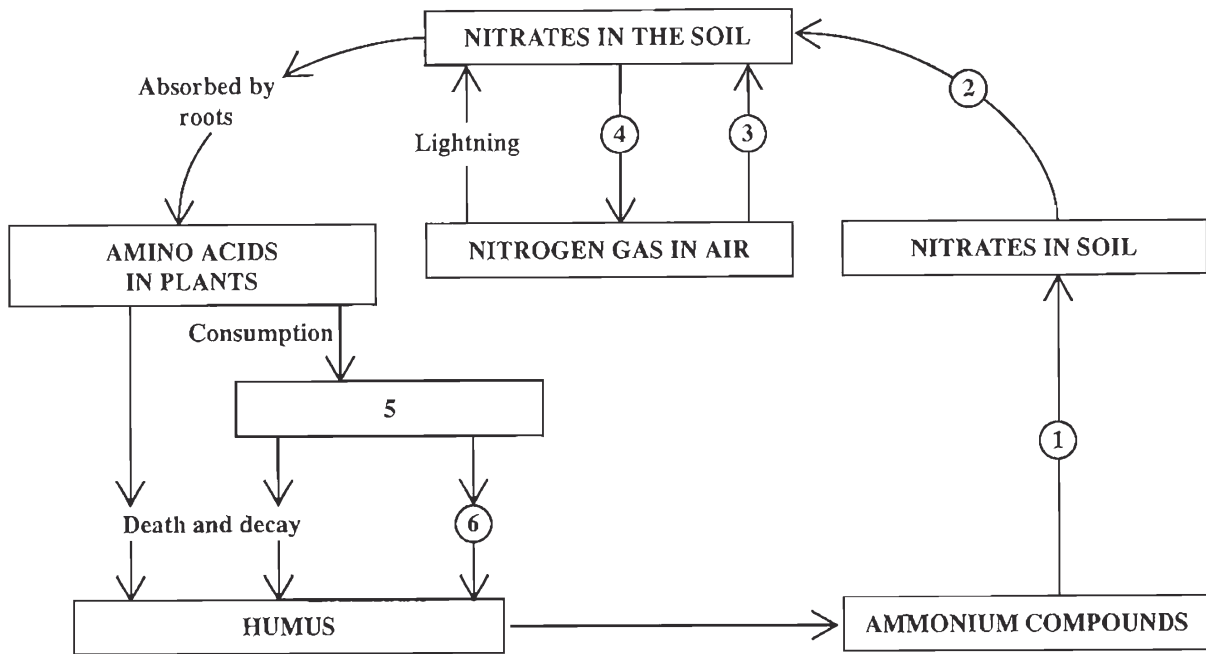


Figure 2. The nitrogen cycle

(a) (i) Identify the stages or organisms represented by the numbers 1 – 6 in Figure 3.

- 1 _____
- 2 _____
- 3 _____
- 4 _____
- 5 _____
- 6 _____

[3 marks]

(ii) Label ③ in Figure 3 represents a mutualistic relationship. Define the term 'mutualism'.

[1 mark]

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- (iii) Logging of trees for timber in tropical forests has ecological consequences for the ecosystem.

Briefly describe TWO prominent biological effects of logging.

Effect 1: _____

Effect 2: _____

[2 marks]

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

Benefit 1: _____

Benefit 2: _____

[2 marks]

- (c) Giving ONE example, suggest the effect that flooding of farm fields would have on the nitrogen cycle.

[1 mark]

- (d) Although nitrogen is cycled, some of the stages of the cycle contain greater reserves of the element. State, with support, which is the LARGEST reserve.

[1 mark]

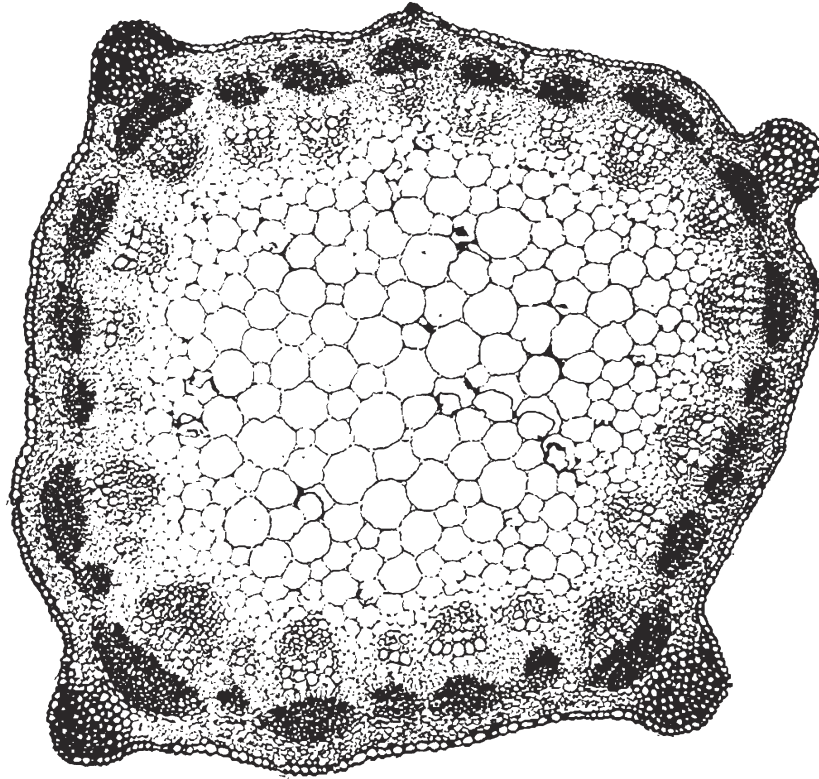
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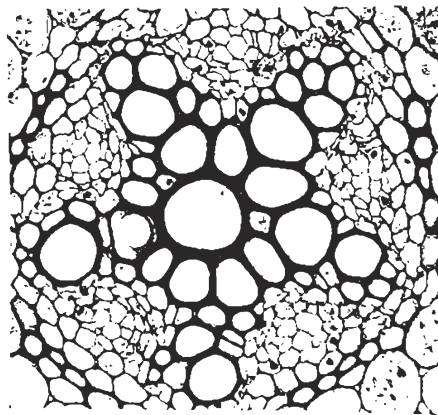
NOTHING HAS BEEN OMITTED.

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

- (a) (i) On the micrograph of EACH organ, label ONLY the **phloem**. [2 marks]
(ii) Identify 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.

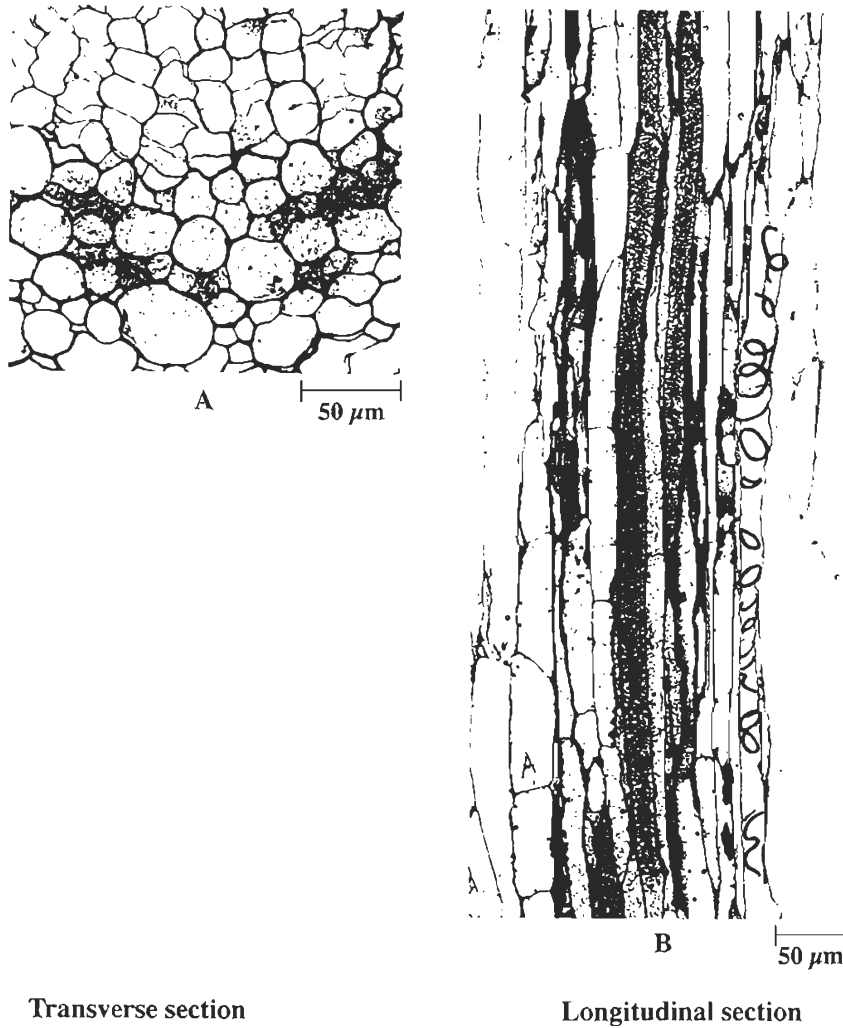


Figure 4.2. Sections of vascular bundles of *Vicia faba*

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.

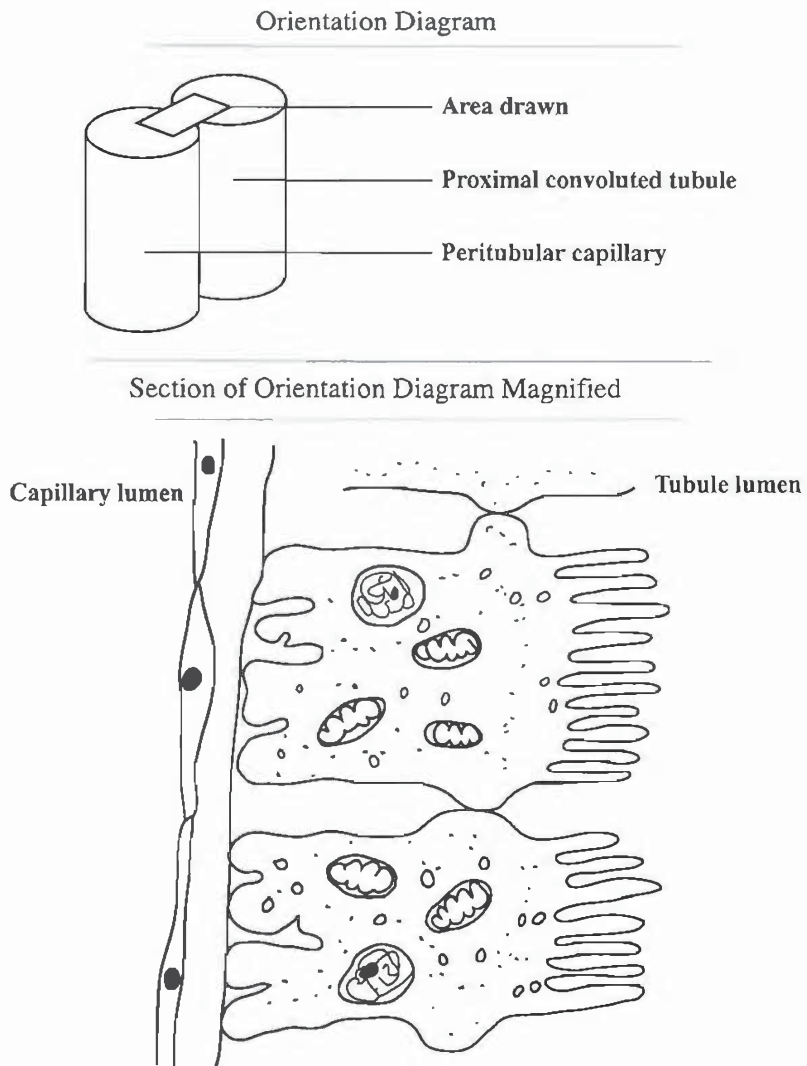


Figure 5.1. Proximal convoluted tubule and peritubular capillary

- (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]

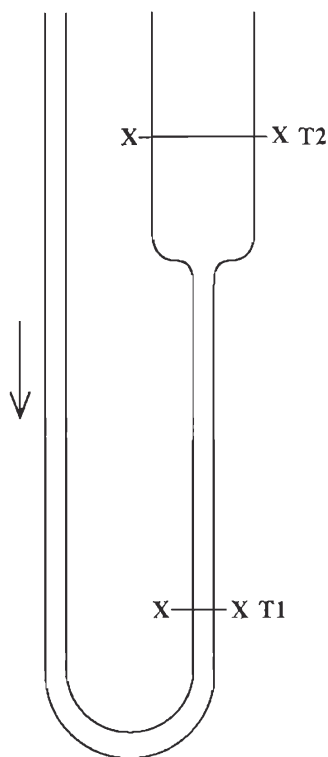
- (iii) Give **TWO** reasons why substances which accumulate at the intercellular space between the tubule and capillary move into the capillary and do **NOT** return to the tubule lumen.

[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) State what actions of the heart are controlled by the

(i) sino-atrial node (SAN)

[1 mark]

(ii) atrio-ventricular node (AVN)

[1 mark]

(iii) Purkinje tissue.

[1 mark]

(b) Give brief explanatory answers to the following:

(i) Why is there a 0.15 second delay between the effect of the SAN and the AVN?

[1 mark]

(ii) What is the benefit of stimulating the contraction of the ventricles to begin at their base, further away from the AVN, and not their apex, next to the AVN?

[1 mark]

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- (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	338
	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]

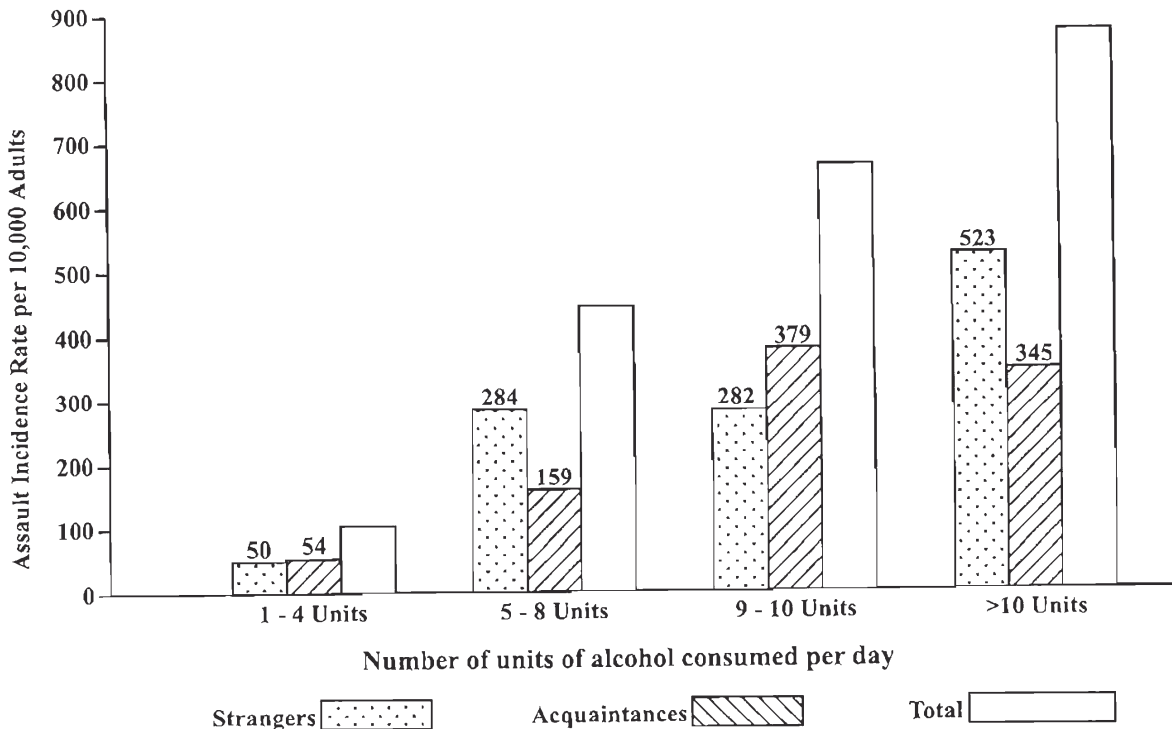


Figure 6. Incidence rate of alcohol-related assault in 1999, by unit consumption

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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8. 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.

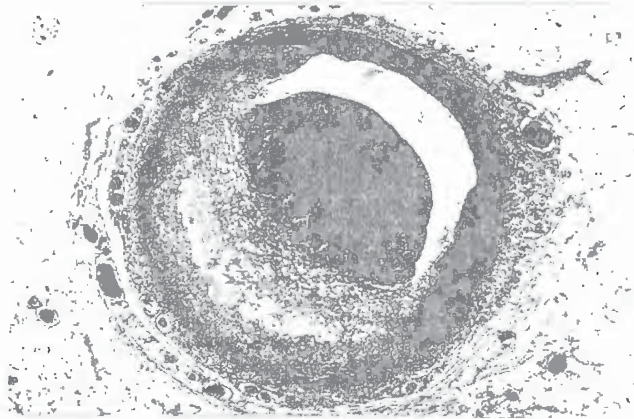


Figure 7.1.B

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.

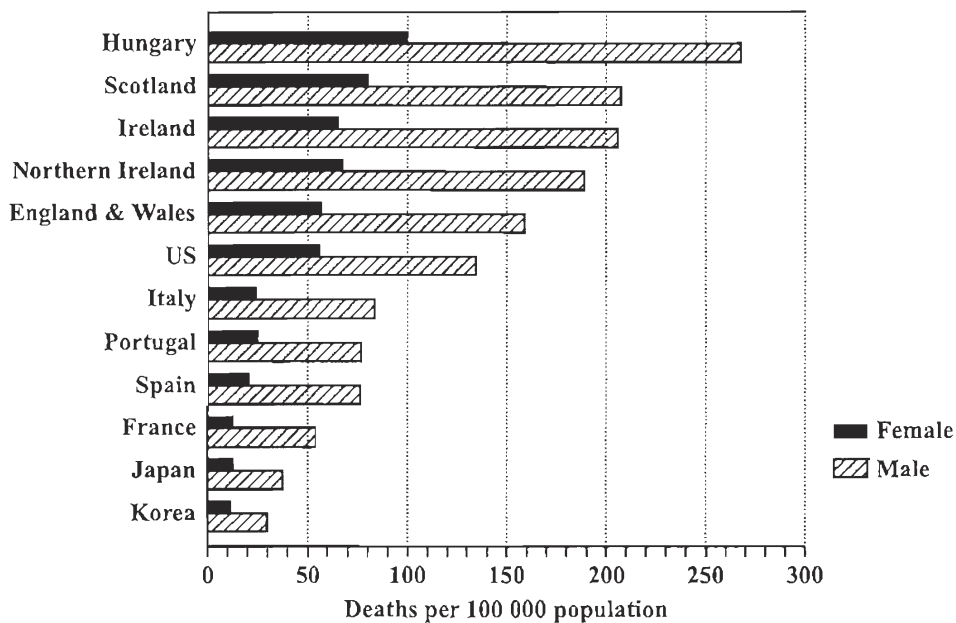


Figure 7.2. Age standardised mortality rates from CHD, men and women aged under 75, in 1998

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

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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