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FORM TP 2011147

MAY/JUNE 2011

CARIBBEAN EXAMINATIONS COUNCIL

ADVANCED PROFICIENCY EXAMINATION

BIOLOGY

UNIT 2 – PAPER 02

2 hours 30 minutes

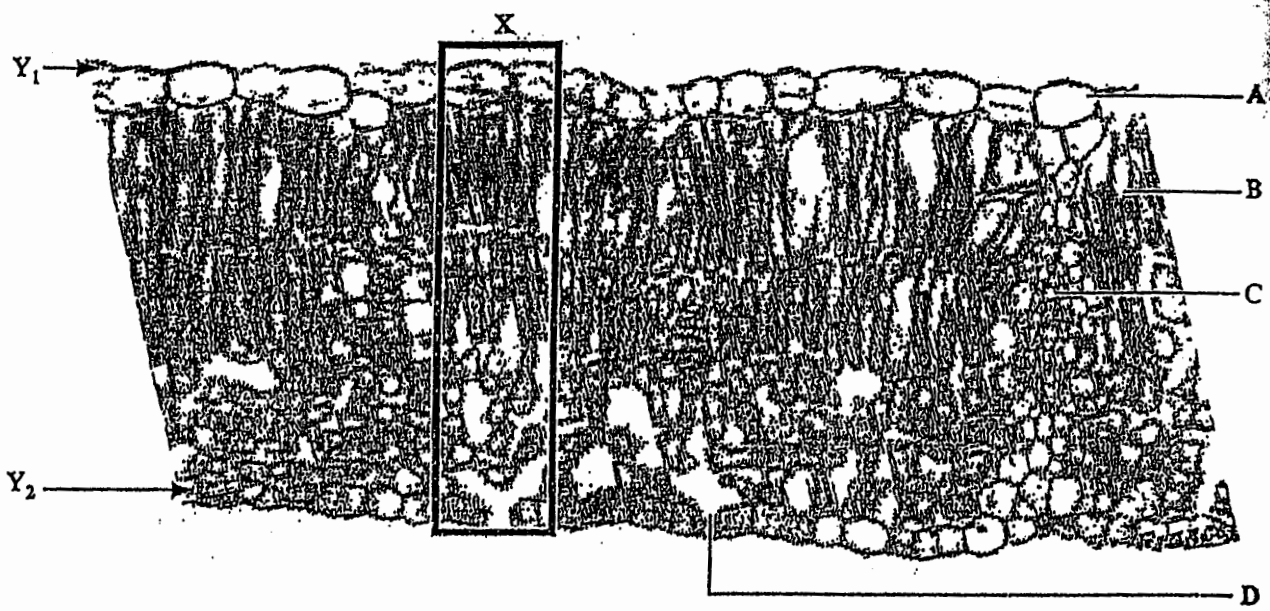
READ THE FOLLOWING INSTRUCTIONS CAREFULLY.

1. This paper consists of SIX questions in two sections. Answer ALL questions.
2. For Section A, write your answers in the spaces provided in this booklet.
3. For Section B, write your answers in the spaces provided at the end of each question in this booklet.
4. The use of silent non-programmable calculators is allowed.

SECTION A

Answer ALL questions in this section. Write your answers in the spaces provided in this booklet.

1. Figure 1 is a photomicrograph of a cross-section of a typical dicotyledonous leaf.



Source: www.2.puc.edu/Faculty/Gilbert_Muth/botglosl.htm

Figure 1. Cross-section of a typical dicotyledonous leaf

(a) (i) Identify the structures labelled A to D in Figure 1.

A _____

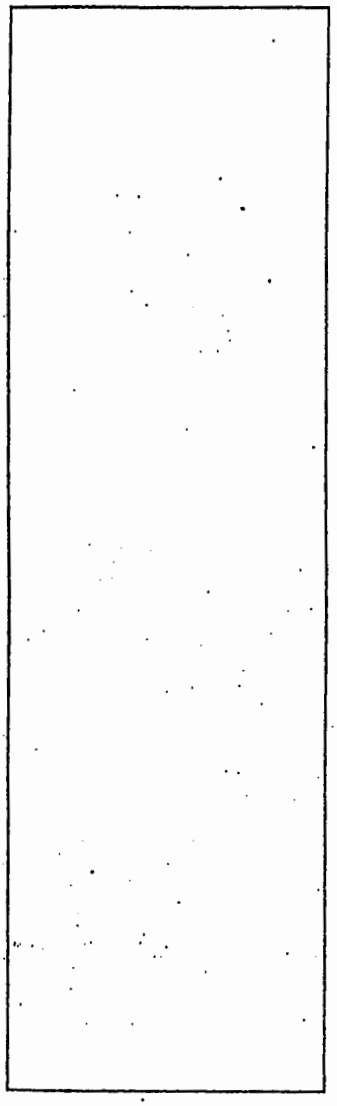
B _____

C _____

D _____

[4 marks]

(ii) In the space provided below make a detailed drawing to show the cellular organization of the region highlighted by **Box X** in **Figure 1**. Make your drawing TWO times the actual size of Box X. (No labels required.)



[5 marks]

(iii) If the photomicrograph in Figure 1 has been magnified 150 times, what is the actual width of the specimen from Y_1 to Y_2?

Actual width from Y_1 to Y_2: _____

[1 mark]

(b) Figure 2 shows a biological pyramid.

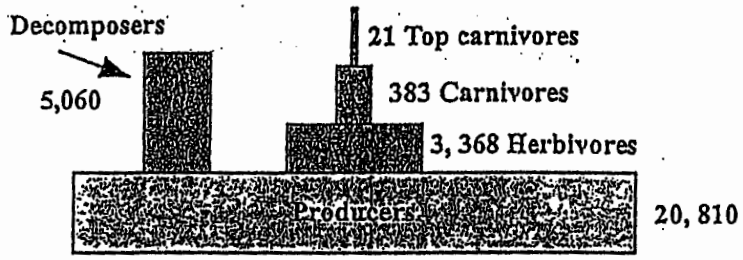


Figure 2. Biological pyramid

(i) Define the term 'biological pyramid'.

_____

_____

[2 marks]

(ii) Identify the type of biological pyramid shown in Figure 2.

_____

[1 mark]

(iii) Briefly explain the significance of the numerical values given in Figure 2.

_____

_____

_____

[2 marks]

Total 15 marks

2. (a) The apparatus in Figure 3 is used to investigate the effect of environmental factors on the rate of transpiration.

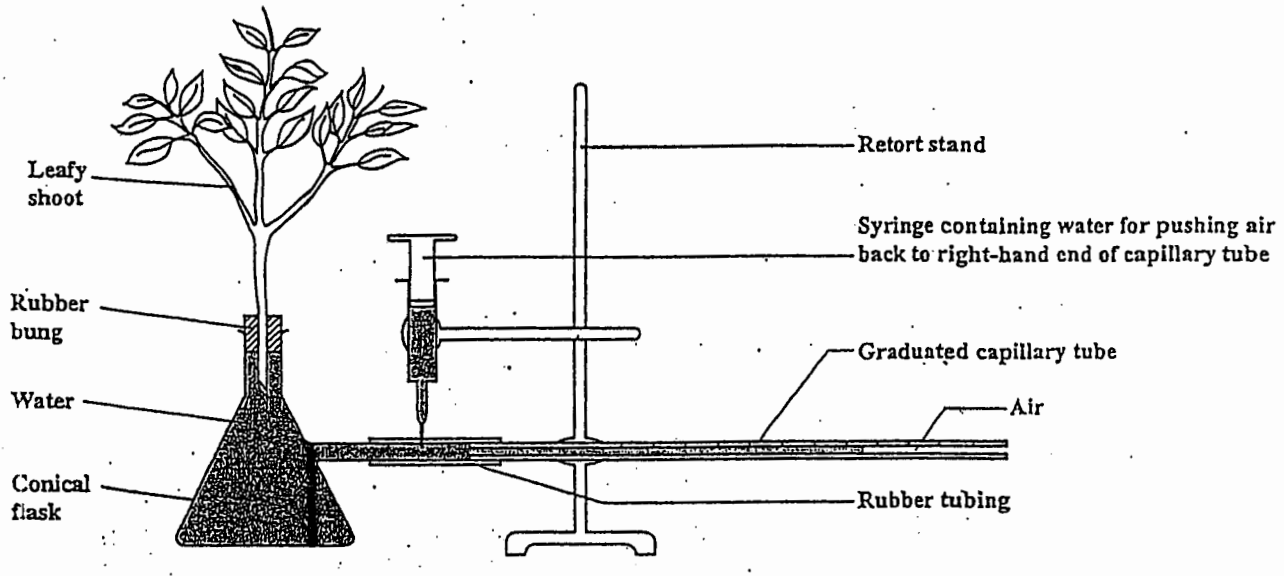


Figure 3. Apparatus for investigating the effect of environmental factors on transpiration rate

(i) What is the role of the syringe?

_____

_____

[1 mark]

(ii) State TWO precautions that must be taken when setting up the apparatus in Figure 3.

_____

_____

_____

[2 marks]

(iii) State TWO measurements that must be recorded to calculate the rate of transpiration.

_____

[1 mark]

(iv) State what should be done to ensure reliability of the results.

_____

_____

[1 mark]

(v) Describe how this apparatus could be used to investigate the effect of sunlight on transpiration. Suggest a possible control for the experiment.

_____

_____

Control: _____

_____

[2 marks]

(b) A nephron is a tubule which is divided into distinct regions, each of which serves a specific function. Figure 4 is a diagrammatic representation of the loop of Henlé of a nephron.

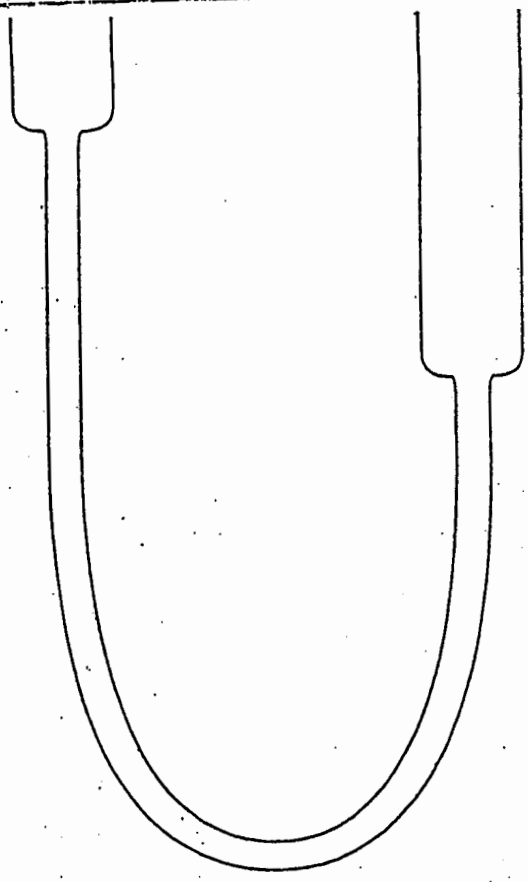


Figure 4. Diagrammatic representation of the loop of Henlé

(i) Using arrows labelled A, B, and C, indicate on Figure 4 where

a) A – water leaves the loop of Henlé by osmosis

b) B – sodium ions and chloride ions leave the loop of Henlé by diffusion

c) C – sodium ions and chloride ions leave the loop of Henlé by active transport.

[3 marks]

(ii) Account for the large number of mitochondria in the cells in the region of the loop of Henlé that is labelled C.

_____

_____

[1 mark]

(iii) How does the concentration of the urine of small mammals inhabiting a desert diffe from that of small mammals inhabiting a moist tropical forest? Suggest ONE structura modification of the loop of Henlé that may be responsible for this difference.

[2 marks]

(iv) Protein and glucose were found to be present in a sample of human urine. Identify the regions of the nephron which may NOT have been functioning as they should, therefore resulting in the presence of these substances in the urine.

[2 marks]

Total 15 mark

3. (a) Table 1 summarizes the incidence of dengue fever in Argentina, Costa Rica, the Dominican Republic and Mexico for a period of seven years.

TABLE 1: INCIDENCE (rate per 100,000 inhabitants) OF DENGUE FEVER IN FOUR COUNTRIES

Country	2000	2001	2002	2003	2004	2005	2006
Argentina	4.6	0.03	0.6	0.4	8.7	0.1	0.5
Costa Rica	434.6	818.2	314.5	606.3	290.0	1165.2	345.1
Dominican Republic	40.7	42.3	37.6	72.5	27.6	33.7	72.3
Mexico	21.9	6.2	9.8	5.0	8.2	16.8	27.2

(i) Explain what is meant by the term 'incidence rate' as applied to diseases.

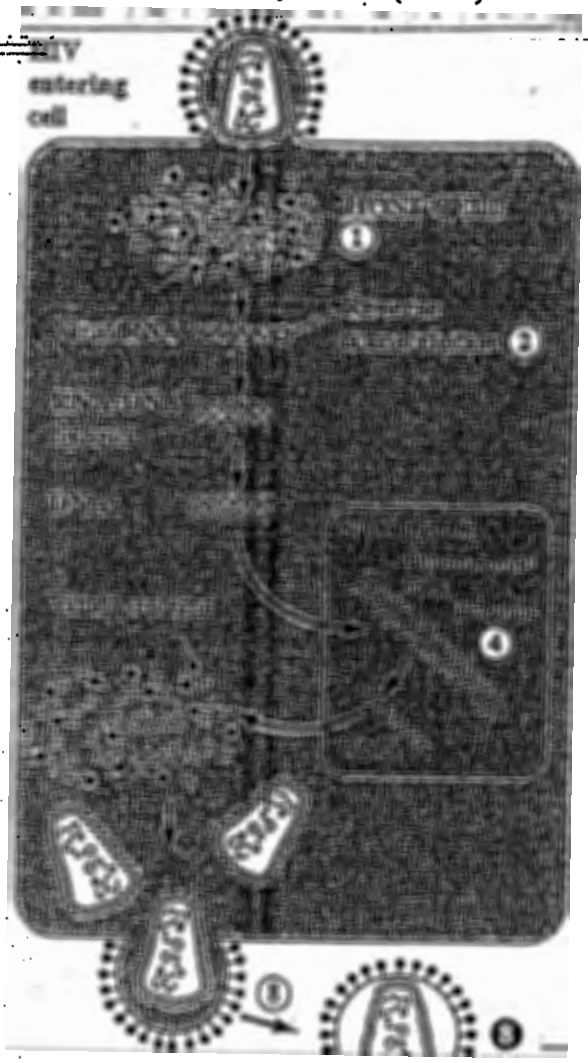
[2 marks]

(ii) On the grid provided on page 11 draw a bar graph of the data in Table 1 for the Dominican Republic and Mexico. [5 marks]

(iii) Compare the trend in incidence rates for Costa Rica with that of Argentina and state TWO major differences observed.

[2 marks]

(b) Figure 5 is a diagrammatic representation of the replication cycle of the Human Immunodeficiency Virus (HIV), the causative organism of Acquired Immune Deficiency Syndrome (AIDS).



❶ _____

_____

❷ _____

_____

❹ _____

_____

_____

_____

Figure 5. The replication cycle of HIV

(i) On Figure 5 describe, using annotations, the events occurring at Stages 1, 2, 4 and 8. Write your answers on the lines next to the number of the stages in Figure 5.

[4 marks]

(ii) Other than by exchange of body fluids during sexual intercourse, state TWO distinct routes by which HIV can be transmitted to human beings.

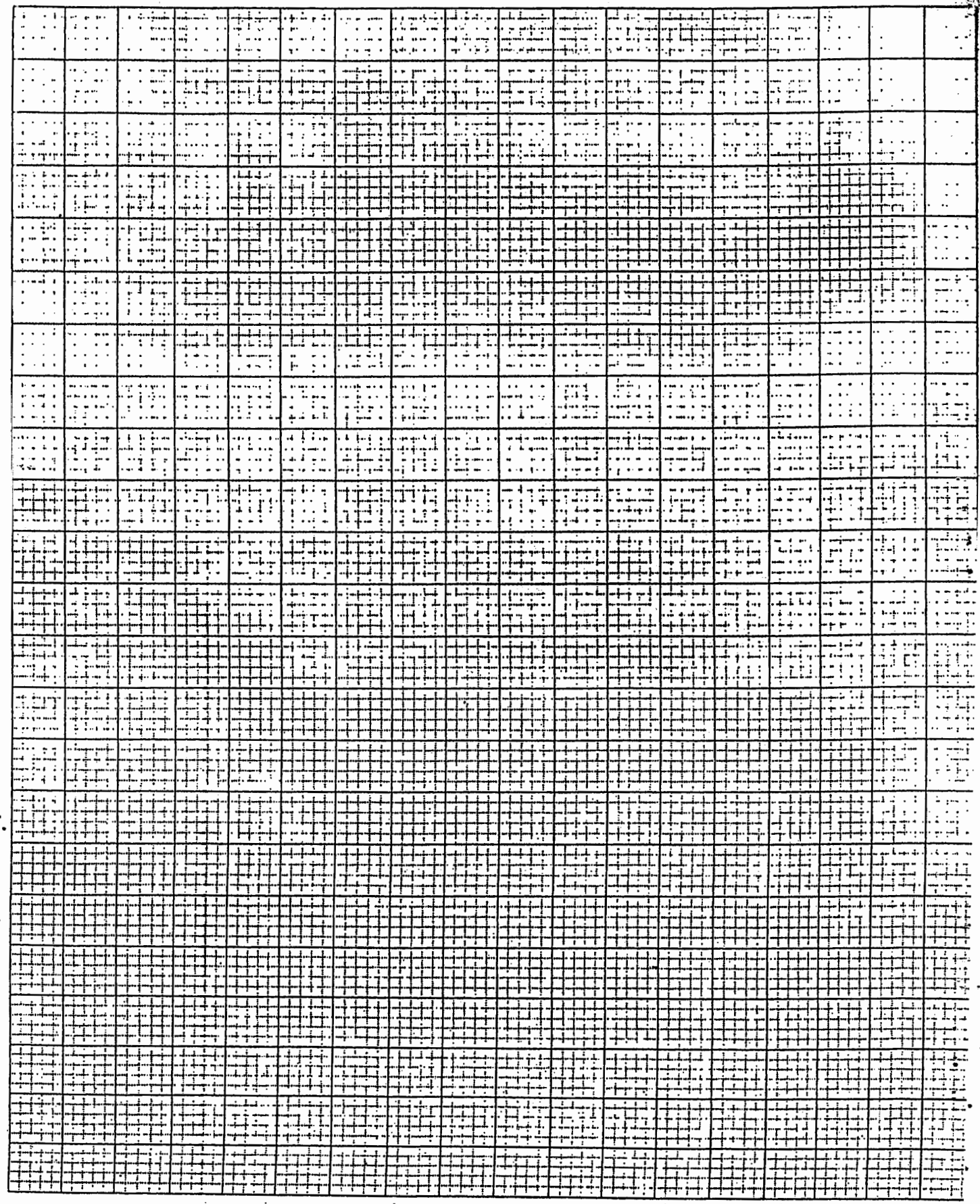
_____

_____

_____

[2 marks]

Total 15 ma



SECTION B

Answer ALL questions in this section.

Transfer of phosphate group to organic compound

4. (a) Define the term 'phosphorylation' and distinguish between photophosphorylation and oxidative phosphorylation. [3 marks]

(b) Discuss TWO similarities and TWO differences between the chemical reactions which occur during photophosphorylation and oxidative phosphorylation. [4 marks]

(c) (i) Distinguish among the following terms as they relate to the nitrogen cycle: nitrification, denitrification and nitrogen fixation. [5 marks]

(ii) A farmer who is experiencing difficulty getting his grass to grow was advised to plant the legume, alfalfa, along with the grass. He was also advised to plough the legume into the soil after reaping the grass. Suggest THREE ways in which this practice enables him to have a better crop of grass. [3 marks]

Total 15 marks

Write your answer to Question 4 here.

5. (a) (i) Explain why haemoglobin functions as an efficient carrier of oxygen in blood. [4 marks]

(ii) Using haemoglobin as an example, and with the aid of a diagram, describe an oxygen dissociation curve. [4 marks]

(b) (i) Briefly explain the term 'translocation' as applied to plants. [2 marks]

(ii) Of the many mechanisms of translocation which have been proposed the mass (pressure) flow hypothesis has gained some support from experimental work.

Outline the principle of mass flow and discuss, using TWO examples, experimental evidence in support of mass flow as a possible mechanism of translocation. [5 marks]

Total 15 marks

Write your answer to Question 5 here.

Space for diagram

5. (a) (i) Explain what is meant by the term 'synaptic transmission'. **[2 marks]**

(ii) Outline the MAIN steps in the chemical transmission of an action potential across a synapse. (No diagrams required.) **[5 marks]**

(b) (i) Outline the TWO MAJOR functions of the human kidney. **[2 marks]**

(ii) The kidney accomplishes its functions by three separate but related processes: ultrafiltration, selective re-absorption and secretion. Discuss the significance of EACH of these processes in relation to the functions stated in (b) (i) above. **[6 marks]**

Total 15 marks

Write the answer to Question 5 here.

6. (a) When the human body is invaded by a foreign organism it responds by identifying and destroying the foreign organism in a manner that involves both a cell-mediated and humoral response.

(i) Distinguish between 'cell-mediated' and 'humoral immune' responses. [4 marks]

(ii) When Kayla was eight years old she was infected with measles. Ten years later while volunteering at an orphanage, she is required to take care of a baby with measles. Explain the immunological process which is responsible for Kayla not becoming ill. [4 marks]

(b) (i) Distinguish between physical and psychological dependence on drugs. [4 marks]

(ii) John is 40 years old and has consumed half of a litre of rum almost every day for the past 12 years. Explain THREE possible effects of this level of long-term consumption of rum on the nervous system. [3 marks]

Total 15 marks

Write your answer to Question 6 here.

6. (a) (i) Explain the term 'complement', and outline its role in the body's response to invasion by foreign organisms. [6 marks]

(ii) Entry of foreign organisms into the body, for example, when there is a break in the skin, is often followed by redness, warmth and swelling at the site of entry.

Discuss why EACH of these responses is an indication that the body is attempting to eliminate the foreign organisms. [3 marks]

(b) Discuss THREE ways in which smoking cigarettes consistently over a prolonged period may result in breathlessness or difficulty in breathing. Refer to emphysema and bronchitis in your answer. [6 marks]

Total 15 marks

Write the answer to Question 6 here.