Transport mechanism

Question Paper 4

Level	International A Level
Subject	Biology
Exam Board	CIE
Topic	Transport in plants
Sub Topic	Transport mechanism
Booklet	Theory
Paper Type	Question Paper 4

Time Allowed: 76 minutes

Score : /63

Percentage: /100

Grade Boundaries:

A*	А	В	С	D	Е	U
>85%	'77.5%	70%	62.5%	57.5%	45%	<45%

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1 When a leaf is first formed it is described as a sink for carbohydrate. As the leaf continues to grow, it starts to photosynthesise and becomes a source of carbohydrates and other assimilates.

Fig. 3.1 shows the changes that occur to the structure of plasmodesmata in the leaf as it grows.

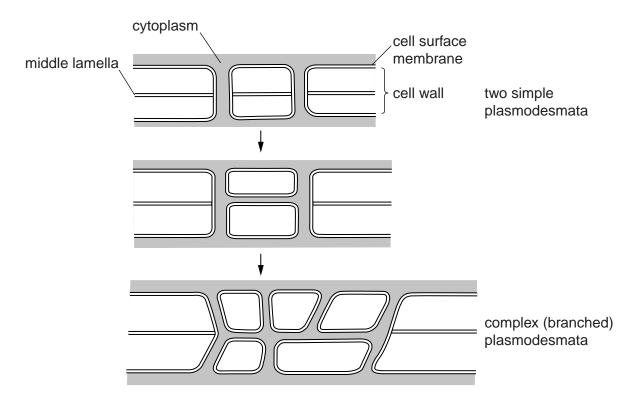
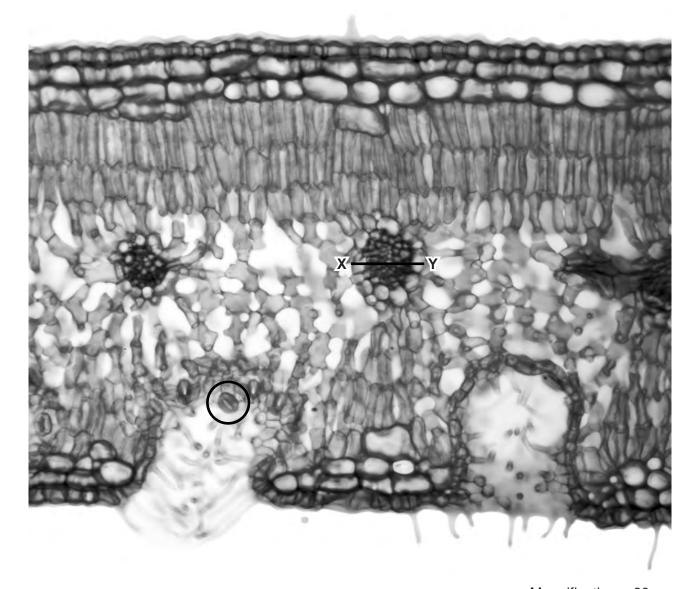


Fig. 3.1

(a)	Suggest the advantage of complex plasmodesmata between cells in leaves.
	[2

(b)	Assimilates are transported into phloem sieve tubes.
	Explain how assimilates in phloem sieve tubes move from the veins in a mature leaf to sinks, such as flowers and fruits, in the rest of the plant.
	[4]
	[Total: 6]

Fig. 4.1 is a light micrograph of a section through a leaf of the xerophytic plant *Nerium oleander*. An area containing one of the plant's stomata is circled.



Magnification × 60

Fig. 4.1

(a)	List three adaptations, visible in Fig. 4.1, which are characteristic of xerophytic plants.
	1
	2
	3

(b)	Calculate the diameter of the vascular bundle across the line X-Y.
	Show your working and give your answer to the nearest $100\mu\text{m}.$
	answerμm [2
(c)	Describe the process of transpiration in plants such as <i>N. oleander</i> .
	[4
	[Total: 9

3 Haemoglobinopathies are inherited conditions linked to the structure and function of haemoglobin. Sickle cell anaemia is one of these conditions in which the transport and delivery of oxygen to tissues is less than normal.

An investigation was carried out to discover the effect of sickle cell anaemia on the ability of blood to carry oxygen. Blood samples were taken from two people:

- person L without sickle cell anaemia
- person M with sickle cell anaemia.

The percentage saturation of haemoglobin with oxygen was determined over a range of partial pressures of oxygen.

Fig. 3.1 shows oxygen haemoglobin dissociation curves for the two blood samples.

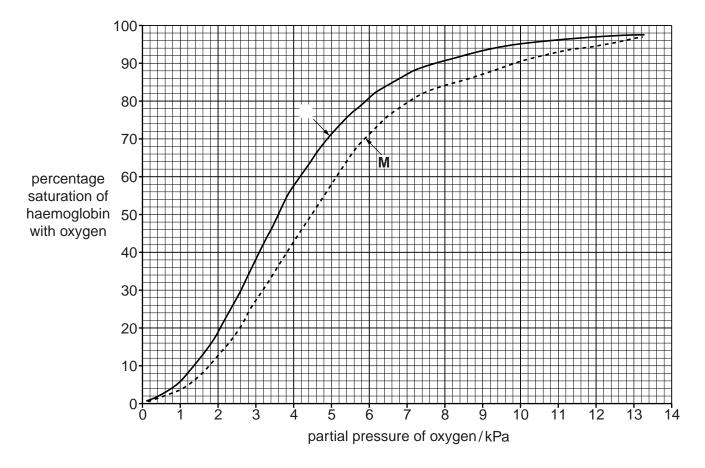


Fig. 3.1

- (a) P50 is the partial pressure of oxygen at which haemoglobin is 50% saturated with oxygen. It is taken as a measurement of the affinity of haemoglobin for oxygen.
 - (i) State the P50 for the two blood samples, L and M.

 L.....

M[1]

	(ii)	With reference to Fig. 3.1, describe how the dissociation curve for person ${\bf M}$ differs from the dissociation curve for person ${\bf L}$.
(b)		lain the advantage of the position of the dissociation curve for people with sickle cell emia.
		[3]
(c)		partial pressure of oxygen in the lungs at sea level is about 13.5 kPa. At an altitude 000 metres the partial pressure of oxygen in the lungs is about 7.5 kPa.
		en people move from sea level to high altitude they become adapted to the low ial pressure of oxygen.
		cribe and explain how humans become adapted to the low partial pressure of gen at high altitude.

(d)	Vaccination is used to control the spread of diseases, such as measles.
	Explain why vaccination cannot be used to prevent sickle cell anaemia.
	[2]
	[Total: 13]

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4 (a) Table 2.1 shows eight ions that are biologically important.

Table 2.1

ammonium (NH ₄ +)	Α
hydrogen (H ⁺)	В
hydrogen carbonate (HCO ₃ ⁻)	С
iron (Fe ²⁺)	D
magnesium (Mg ²⁺)	E
nitrate (NO ₃ ⁻)	F
phosphate (PO ₄ ³⁻)	G
sulfate (SO ₄ ²⁻)	Н

Choose one ion to match each of the following statements. In each case write **one** letter from Table 2.1. You may use each letter (**A** to **H**) once, more than once or not at all.

(i)	A component of polynucleotides.	
	[1]
(ii)	Ion produced by enzyme activity inside red blood cells.	
	[1]
(iii)	Ion used in the production of all amino acids in chloroplasts.	
	[1]
(iv)	Ion that diffuses through carrier proteins with sucrose into companion cells i phloem tissue.	in
	[1]
(v)	Component of haem group in haemoglobin that binds oxygen.	-
	Ţ [,]	11

Nitrogenase catalyses the reaction:

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(b) The enzyme nitrogenase is found in free-living and symbiotic nitrogen-fixing bacteria.

$N_{2 (g)} + 6 e^- + 8H^+_{(aq)} \longrightarrow 2NH_4^+_{(aq)}$
Some nitrogenase enzymes have vanadium ions in their active sites; others have molybdenum ions.
Explain how the enzyme nitrogenase functions in the fixation of nitrogen.

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(c) Some pea plants were grown with their roots in a solution of mineral ions. The solution was kept aerated for three days.

The concentrations of five ions in the solution and in the root tissue were determined after the three days. The results are shown in Table 2.2.

Table 2.2

	concentration / mmol dm ⁻³			
ion	surrounding solution	root tissue		
potassium (K+)	1.0	75.0		
magnesium (Mg ²⁺)	0.3	3.5		
calcium (Ca ²⁺)	1.0	2.0		
phosphate (PO ₄ ³⁻)	1.0	21.1		
sulfate (SO ₄ ²⁻)	0.3	19.7		

		of root cells are the surrounding
 	 	 [5]

[Total: 14]

5 Fig. 4.1 is an electron micrograph of a transverse section through a plant stem. The xylem vessels are clearly visible.

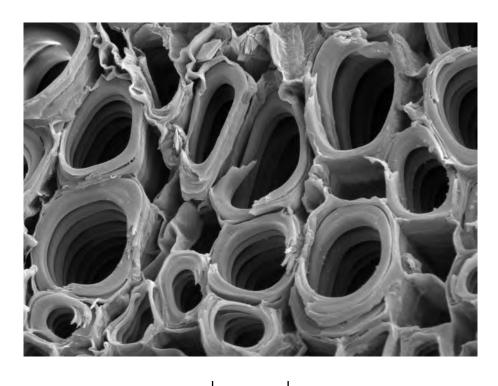


Fig. 4.1

 $50\,\mu m$

(a) Calculate the magnification of the electron micrograph in Fig. 4.1.

Show your working and give your answer to the nearest 100.

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answei	 _	ı

Describe how the structure of xylem vessels is adapted to their function.
Describe and explain how water moves from the xylem vessels in the leaves to the atmosphere surrounding the leaves of the plant.
[5]

[Total: 10]

6 Fig. 1.1 is a drawing made from an electron micrograph. It shows a longitudinal section through a sieve tube element and a companion cell in the phloem of a flowering plant.

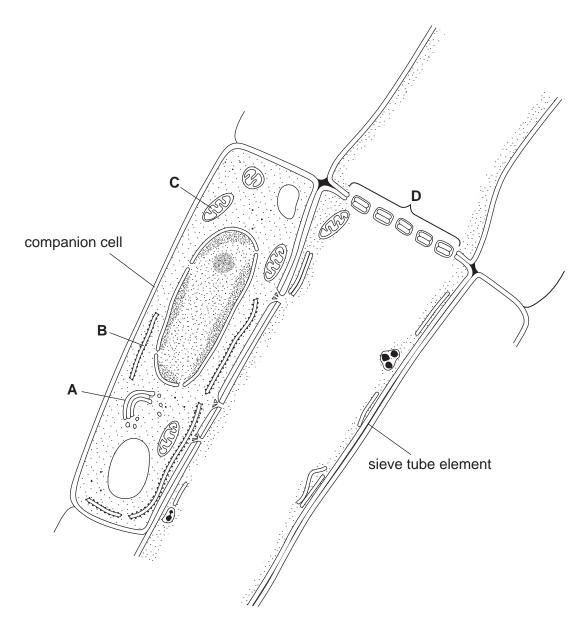


Fig. 1.1

(a) F	Refer	to F	ıg. ´	1.1	١.
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(i)	Name structures A to C.
	A
	В
	C[3]

	(ii)	State the name given to the region labelled ${\bf D}$ that separates the two sieve tube elements.
		[1]
	(iii)	Name one assimilate that is transported in the phloem.
		[1]
(b)		plain how the structure of sieve tube elements helps the translocation of substances ne phloem.
		[3]
(c)	Des	scribe the role of companion cells in translocation in the phloem.
		[2]

[Total : 10]