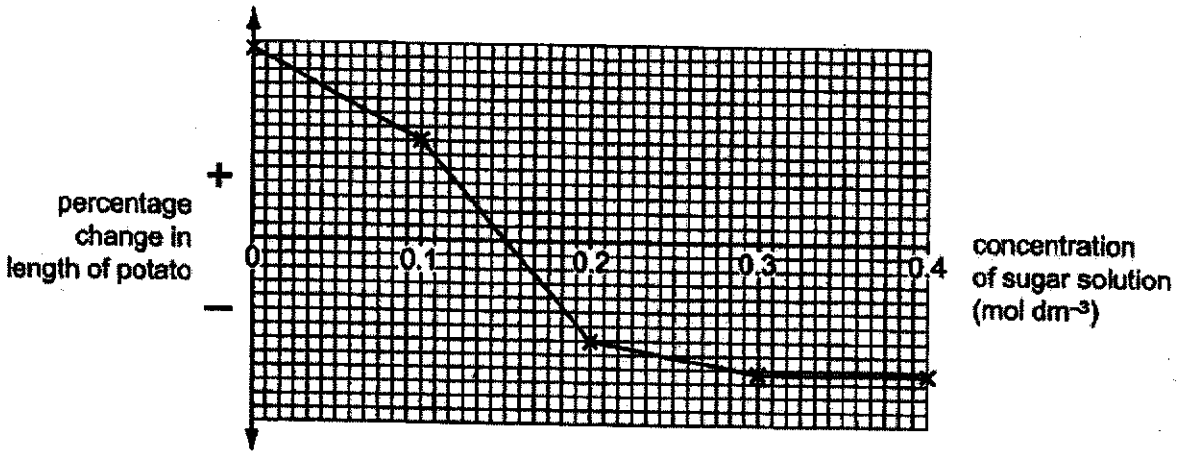
21 Five pieces are cut from a potato, all of equal size and shape. The pieces are then placed in sugar solutions of different concentrations. After four hours, the change in length of each potato piece is measured.

The results are shown in the graph.



Which concentration of sugar solution has approximately the same water concentration as the potato?

A 0.00 mol dm^{-3}

B 0.15 mol dm^{-3}

C 0.30 mol dm^{-3}

D 0.40 mol dm^{-3}

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22 The diagram shows an experiment to demonstrate the movement of molecules.

After one hour, the water in the beaker turned red. What is the most likely reason for this colour change?

A Molecules of red ink move through the membrane by diffusion.

B Molecules of red ink move through the membrane by osmosis.

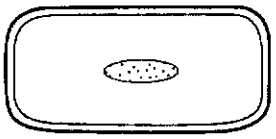
C Molecules of water move through the membrane by diffusion.

D Molecules of water move through the membrane by osmosis.

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23 Some plant and animal cells were placed in different solutions and the results are shown.



Which cells were placed in which solution?

	1.0 mol dm^{-3} sucrose	0.1 mol dm^{-3} salt solution
A	1 and 2	3 and 5
B	1 and 4	3 and 2
C	2 and 4	1 and 3
D	3 and 5	2 and 4

24 Which property of water is important for chemical reactions to take place inside cells?

A It acts as a solvent.

B It has high specific heat capacity.

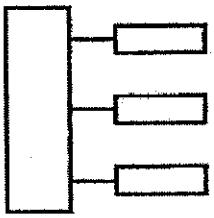
C It is transparent.

D There is cohesion between its molecules.

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25 The diagram represents a large molecule, synthesized by joining together smaller molecules of two types together.



Which line names the large molecule and its components?

	molecule	amino acid	fatty acid	glucose	glycerol
A	glycogen	√	x	√	x
B	lipid	x	√	x	√
C	polypeptide	√	x	x	√
D	starch	x	√	√	x

key

√ = component present

x= component absent

26 The table shows the results of tests carried out on a drink.

test	result
biuret	clear blue colour
Benedict's	orange colour
ethanol emulsion	white emulsion colour
iodine	yellow colour

What does the drink contain?

A fat and reducing sugar only

B fat, protein and reducing sugar only

C fat, protein, reducing sugar and starch

D protein and starch only

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27 Four statements about the active sites of a human enzyme are given.

1 The shape of the active site changes when the temperature falls to 10 °C and does not return to normal when the temperature returns to 37 °C.

2 The active site of the enzyme is the same shape as the substrate molecule.

3 The specificity of an enzyme depends on the shape of its active site.

4 The shape of the active site changes when the enzyme is heated to 80 °C and does not return to normal when the temperature returns to 37 °C.

Which statements are correct?

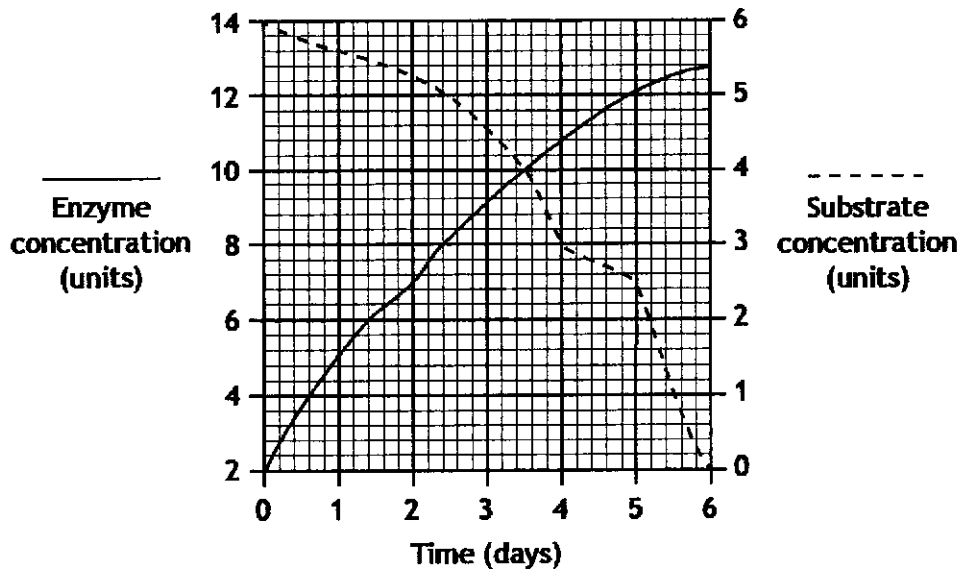
A 1, 2 and 3

B 1 and 4

C 2 and 3 only

D 3 and 4 only

28 The graph below shows changes in the enzyme and substrate concentrations in a seed over a period of time.

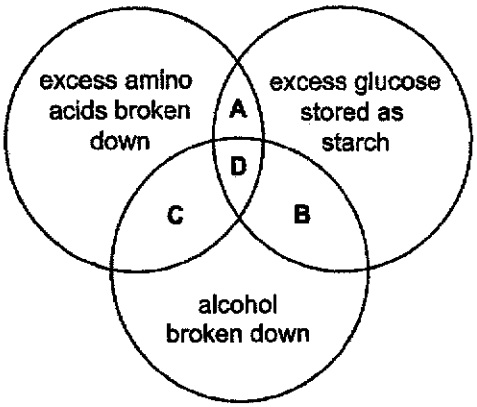


How many days does it take for the substrate concentration to decrease by 50%?

A 2 **B** 3 **C** 4 **D** 5

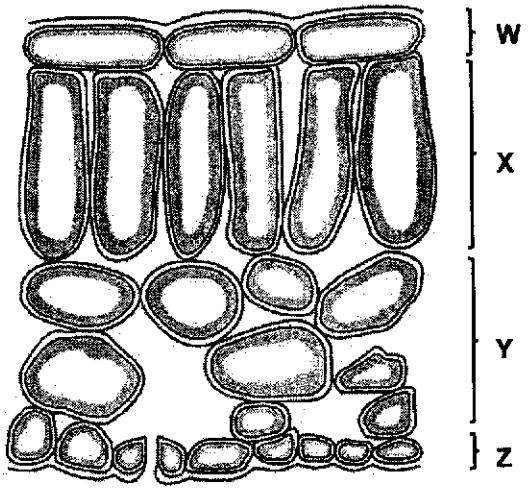
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29 Which section of the diagram represents the functions carried out by the liver?



30 The diagram shows the tissues in a cross-section of a leaf.

The four layers are labelled **W**, **X**, **Y** and **Z**.



Starting with the layer containing the highest number of chloroplasts first and ending with the layer containing no chloroplasts, which sequence of letters shows the distribution of chloroplasts in a leaf?

A **X → Y → W → Z**

B **X → Y → Z → W**

C **Y → X → W → Z**

D **Z → Y → X → W**

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31 What uses the stomata as its route into the leaf?

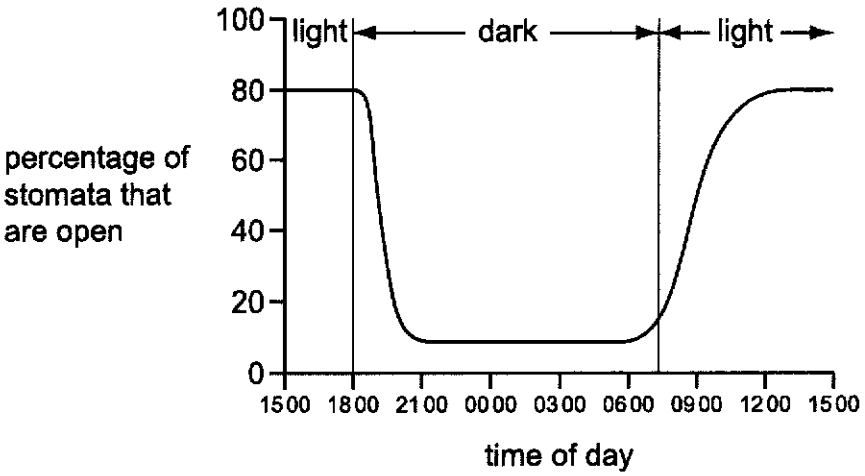
A carbon dioxide

B ions

C sunlight

D water

32 The graph shows stomatal opening and closing in the leaves of a species of Pelargonium, during a 24 hour period.



What can be concluded?

A Gas exchange occurs when stomata are open.

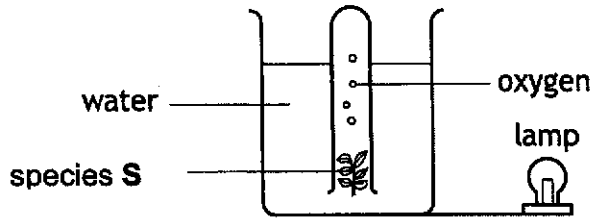
B Stomata open as light intensity increases.

C Stomata open as temperature increases.

D Transpiration does not occur in the dark.

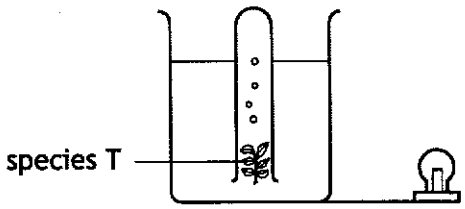
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33 An investigation was carried out to compare the rate of oxygen gas production by two different species of water plant, **S** and **T**.

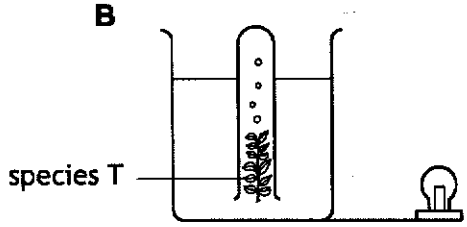


Which diagram below shows the set-up for species **T**, that would allow a valid comparison in the rate of oxygen production of the two species?

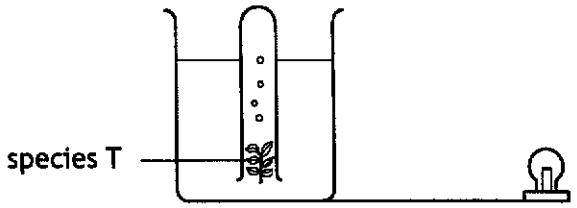
A



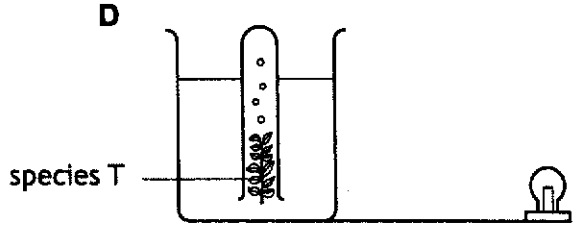
B



C



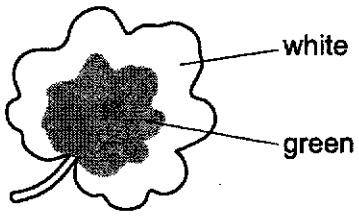
D



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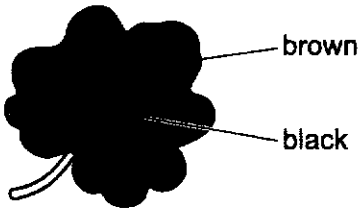
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34 A leaf was picked from a plant that had been in sunlight for eight hours.

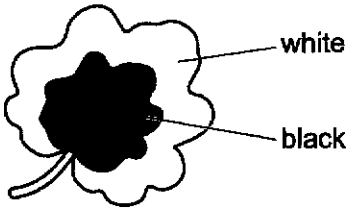


What does this leaf look like after it is tested with iodine solution?

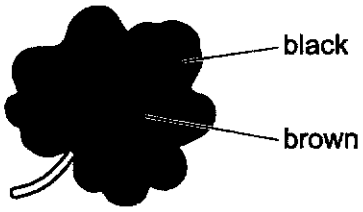
A



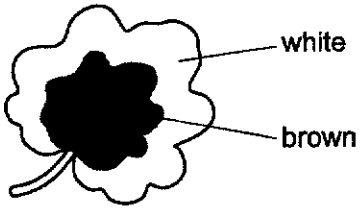
B



C

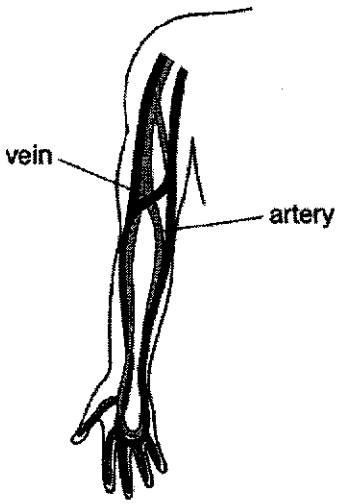


D



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35 The diagram shows arteries and veins in the human forearm.



Which statements apply to a vein in the human forearm?

	carries oxygenated blood	has valves	blood is returning to the heart
A	√	√	x
B	√	x	x
C	x	√	√
D	x	x	√

key

√ = yes

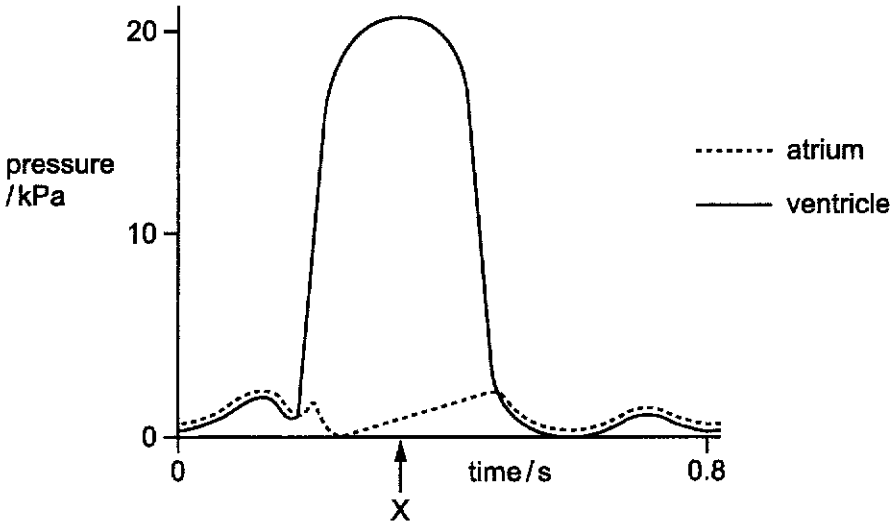
x = no

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36 The graph shows pressure changes in the left atrium and in the left ventricle during one heartbeat.

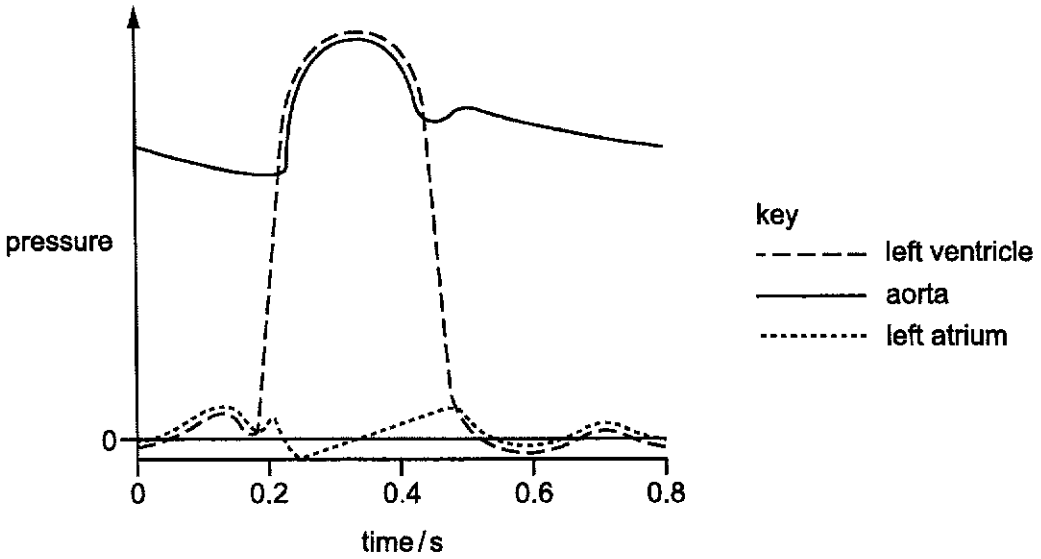


What is the state of the valves in the heart at time X?

	left atrio-ventricular valve (bicuspid)	semi-lunar valve (in aorta)
A	closed	closed
B	closed	open
C	open	closed
D	open	open

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37 The graph shows the changes in pressure that occur in the left side of the heart during one cardiac cycle.

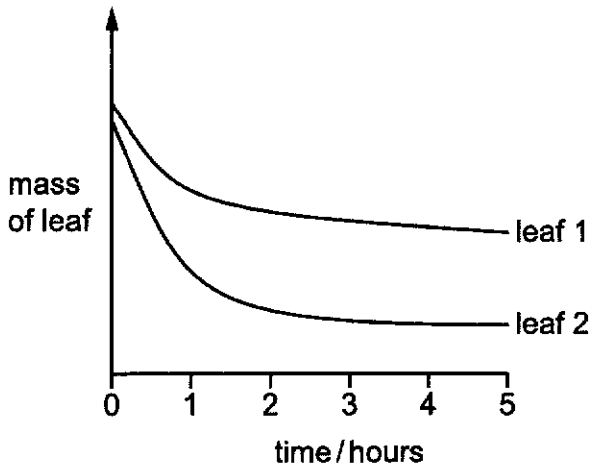


What is the heart rate in beats per minute?

A 75 **B** 80 **C** 120 **D** 150

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38 The diagram shows the results of an experiment using leaves with the same surface area from two different species. Each leaf was left on a balance in daylight in a closed room and their mass recorded at 1 hour intervals.



What could explain these results?

A Leaf 1 has a thicker cuticle than leaf 2.

B Leaf 1 is thinner than leaf 2.

C Leaf 2 has stomata protected by hairs and leaf 1 does not.

D Leaf 2 has sunken stomata and leaf 1 does not.

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39 Diagram **1** shows part of a plant stem in longitudinal section.

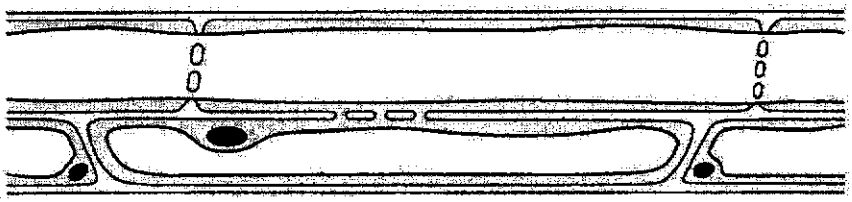


Diagram 1

Diagram **2** shows a transverse section of a plant stem.

Which part of diagram **2** contains the components shown in diagram **1**?

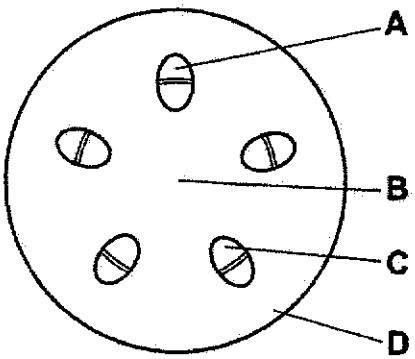
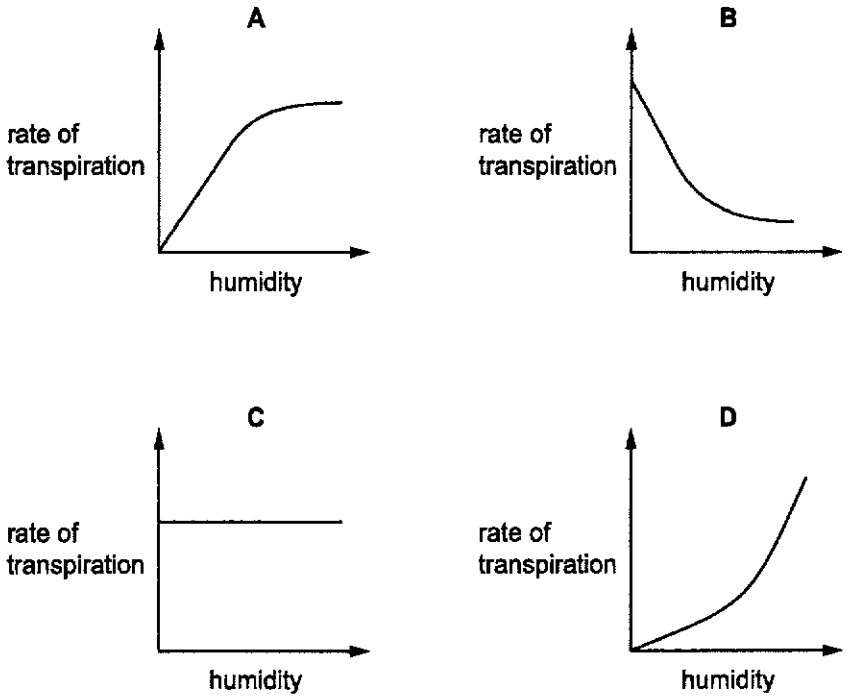


Diagram 2

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40 Which graph shows most clearly what will happen to the rate of transpiration as humidity increases?



END OF PAPER 1

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Section A [45 marks]

Answer **all** questions in the spaces provided.

1 Fig. 1.1 shows three types of cells, **not** drawn to scale.

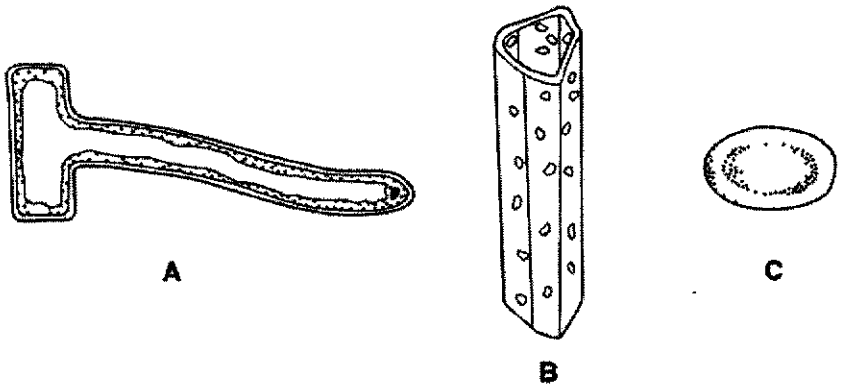


Fig. 1.1

(a) What is the name of cell **A**?

.....[1]

(b) **(i)** **B** is a xylem vessel. State **one** function that this vessel performs in a plant.

.....[1]

(ii) The cells forming the xylem vessel have no chloroplasts or vacuoles. In what other way is this type of cell different from a typical plant cell?

.....

.....[1]

(iii) Explain how this difference helps this type of cell to perform its function.

.....

.....

.....[1]

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(c) **C** is a component of blood.

(i) What is the name of this type of cell?

.....[1]

(ii) This cell has no nucleus.

Explain how this helps the cell perform its function in the body.

.....

.....

.....

.....

.....

.....[2]

[Total: 7]

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2 Enzymes are used commercially to extract juice from apples.

Fig. 2.1 shows two containers of apple juice. One contains juice extracted using an enzyme and the other without an enzyme.

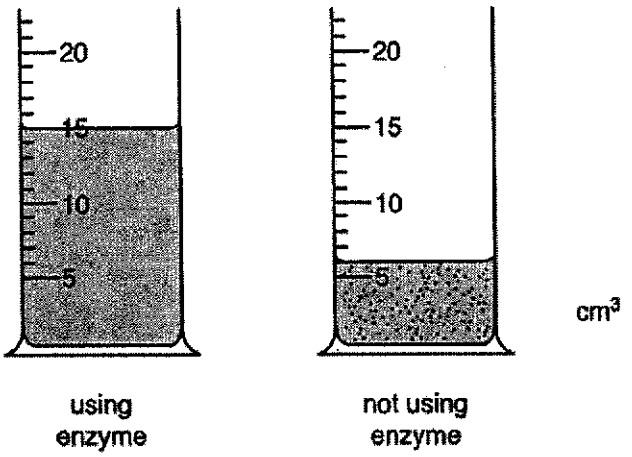


Fig. 2.1

(a) With reference to Fig. 2.1, compare the volume and appearance of the two juices extracted.

.....

.....

.....

.....

.....[2]

Some students investigated the effect of pH on the production of apple juice using the same enzyme.

- The apples were chopped up and formed into a smooth pulp.
- The pulp was divided into samples. Each sample was adjusted to a different pH.
- Enzyme was stirred into each sample of pulp and left to stand for 10 minutes for the enzyme to react.
- The mixtures of pulp and enzyme were then filtered for 20 minutes to collect the juice. The volumes of apple juice collected, are shown in Table 2.1.

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Table 2.1

pH	volume of apple juice collected /cm^3
3	40
4	56
5	95
6	60
7	30

(b) **(i)** Construct a graph using the grid in Fig. 2.2 to show the effect of pH on the production of apple juice using this enzyme. [4]

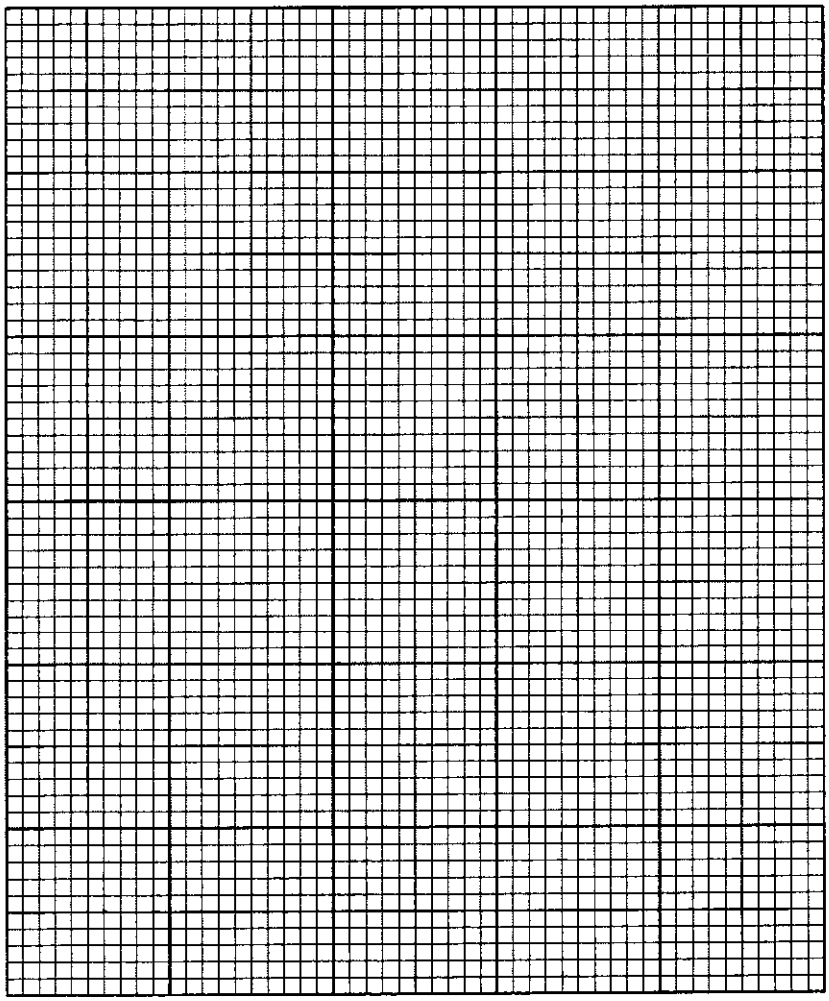


Fig. 2.2

(ii) State the optimum pH for the action of this enzyme.

.....[1]

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(iii) Describe and explain the effect of pH on the production of apple juice, using this enzyme.

.....

.....

.....

.....

.....

.....

.....[2]

(c) Suggest **two** factors that need to be controlled in this investigation.

.....

.....

.....

.....[2]

[Total: 11]

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3 Fig. 3.1 shows part of the human digestive system.

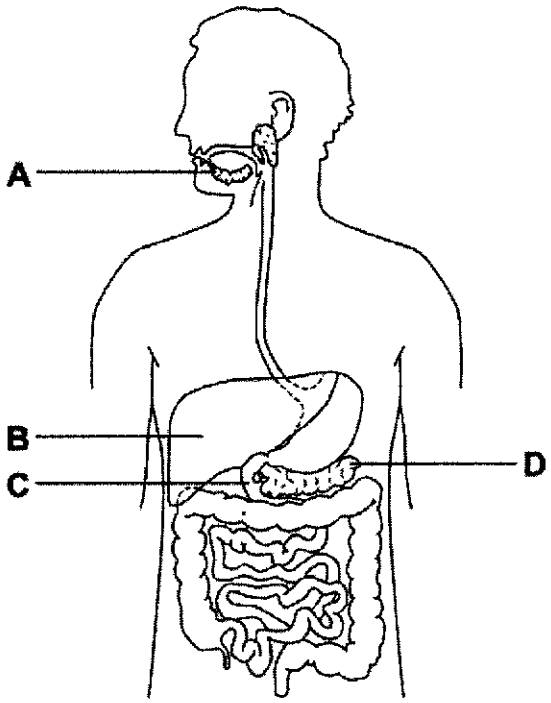


Fig. 3.1

(a) Name the parts of the digestive system and its associated organs **A**, **B**, **C** and **D**.

A.....

B .....

C .....

D ..... [2]

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(b) **(i)** A student has eaten a steak for dinner. The steak contains protein and fat.

Describe how the **protein** is digested.

.....

.....

.....

.....

.....

.....

.....[3]

(ii) Explain **two** ways in which bile helps the body to digest **fat.**

.....

.....

.....

.....

.....

.....

.....[4]

[Total: 9]

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4 Fig. 4.1 shows a graph drawn by a student of the rate of photosynthesis in a plant exposed to the same concentration of carbon dioxide at two different temperatures.

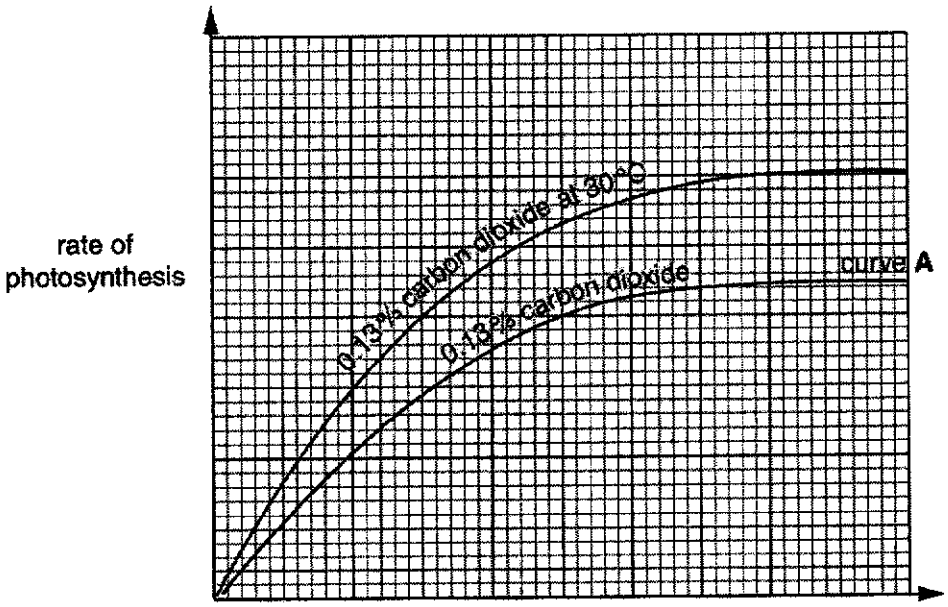


Fig. 4.1

(a) (i) Name **one** limiting factor, other than carbon dioxide and temperature, that affects the rate of photosynthesis.

.....[1]

(ii) Suggest a likely temperature for curve **A**. Give an explanation for your answer.

likely temperature .....

explanation .....

.....

.....

.....[3]

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(b) The student failed to label the horizontal (x) axis of the graph. Suggest a suitable label for this axis and explain your suggestion.

label for x axis.....

explanation .....

.....

.....

.....[4]

[Total: 8]

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5 Heart surgeons may stop the heart beating during operations. While this happens blood is pumped through a heart-lung machine that oxygenates the blood.

Fig. 5.1 shows a heart-lung machine in use.

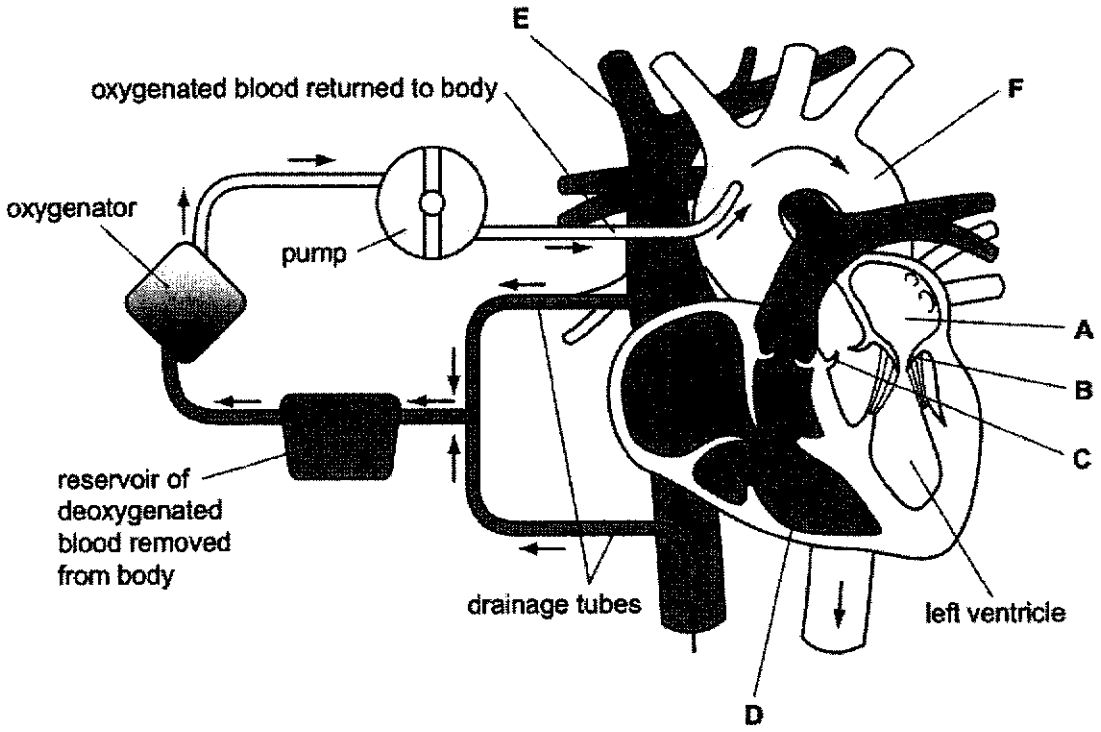


Fig. 5.1

(a) Name the structures labelled **A** to **D**.

A .....

B .....

C .....

D ..... [2]

(b) Name the blood vessels **E** and **F**.

E .....

F ..... [1]

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(c) The heart-lung machine is used so that surgeons can operate on the arteries supplying heart muscle. These arteries may be diseased.

Name these arteries and explain how they may become diseased.

name of arteries .....

explanation .....

.....

.....

.....

.....[3]

(d) Suggest why a patient is put on a heart-lung machine during such an operation.

.....

.....

.....

.....[1]

Humans have a double circulation system. There is a low pressure circulation and a high pressure circulation.

(e) Explain how the structure of the heart enables it to pump blood into two circulations at different pressures.

.....

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.....

.....

.....

.....

.....[3]

[Total: 10]

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Section B [20 marks]

Answer any **two** questions in this section.

Write your answers in the spaces provided.

6 **(a)** With reference to a suitable example, define the term *tissue*.

.....

.....

.....

.....

.....

.....[3]

(b) Identify parts **A**, **B**, **C** and **D** shown on Fig. 6.1 and describe their main features and functions.

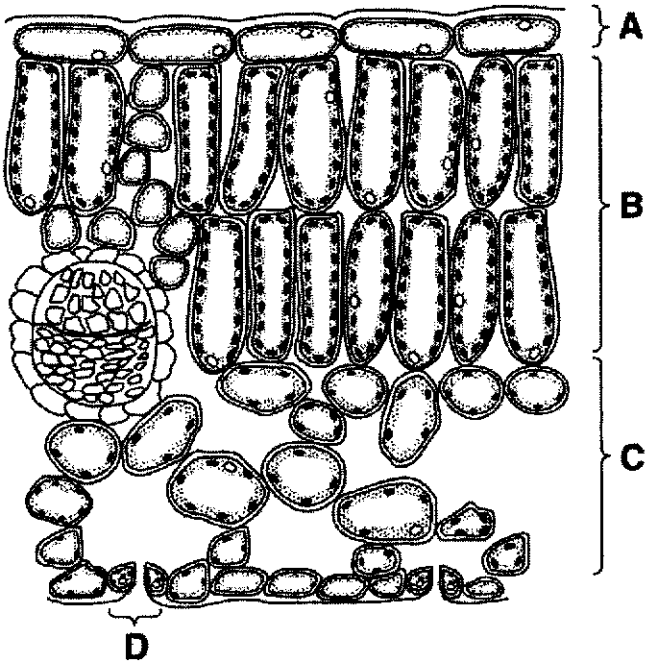


Fig. 6.1

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.....

..... [7]

[Total: 10]

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7 **(a)** State **two** ways in which the structure of arteries differs from the structure of veins.

1.....

.....

2.....

.....[2]

(b) Fig. 7.1 shows the speed of blood flow as it passes through the arteries, capillaries and veins.

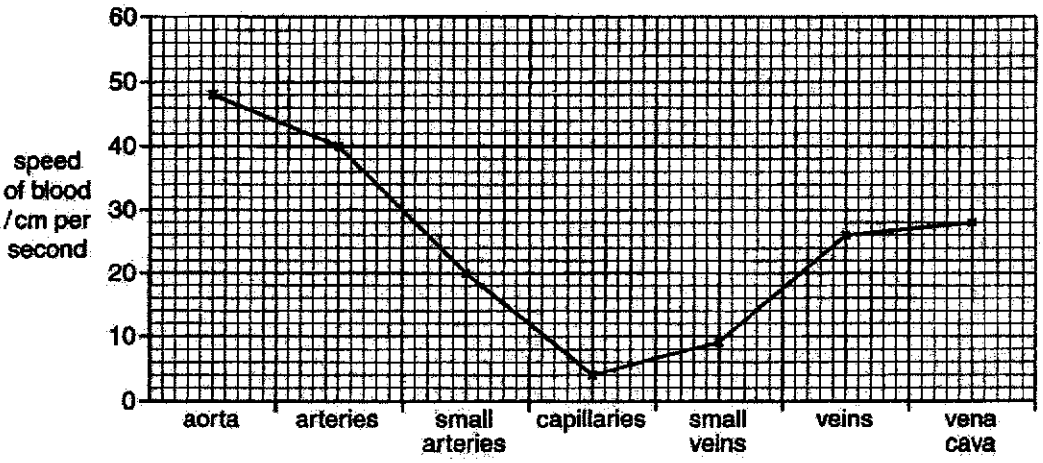


Fig. 7.1

(i) With reference to Fig. 7.1, describe the changes in the speed of the blood as it passes from the aorta to the vena cava.

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.....[3]

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(ii) Table 7.1 shows the changes in blood pressure as blood passes from the aorta to the vena cava.

Table 7.1

blood vessel	mean blood pressure /mm mercury
aorta	104
arteries	88
small arteries	32
capillaries	18
small veins	12
veins	6
vena cava	4

Plot the data from Table 7.1 onto the grid in Fig. 7.2 [4]

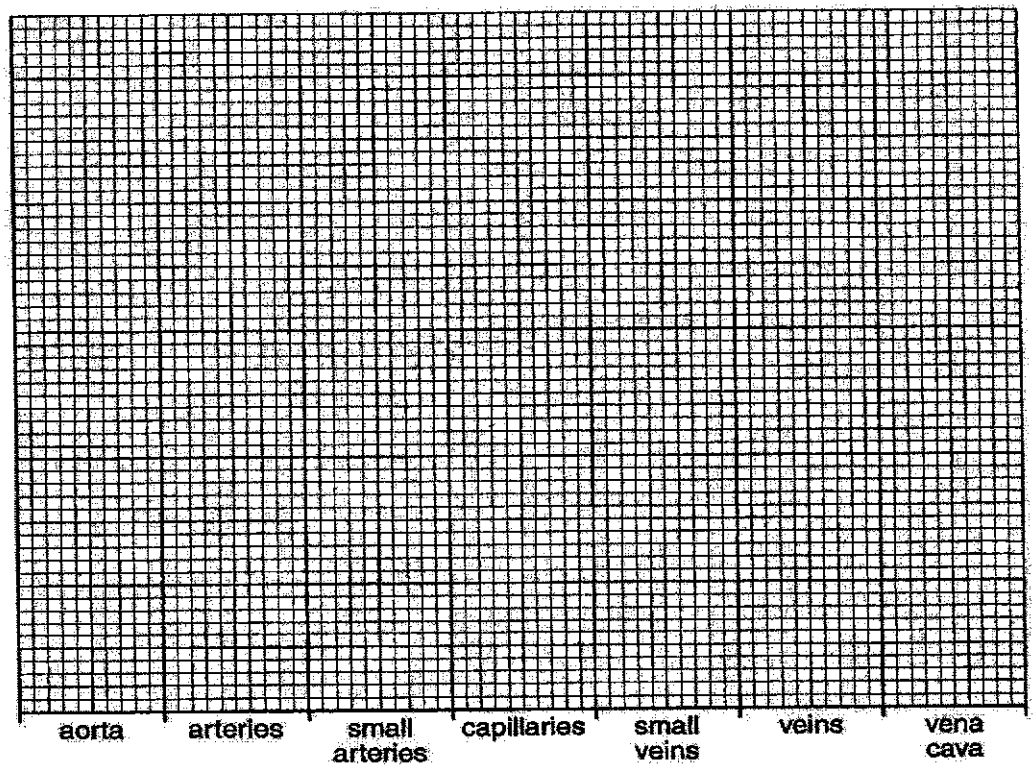


Fig. 7.2

(iii) Describe the process that generates the pressure in the aorta.

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.....[1]

[Total: 10]

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8 (a) Describe the similarities and differences in the function of xylem tissue and phloem tissue.

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(b) Explain how environmental factors affect transpiration.

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.....[5]

[Total: 10]

END OF PAPER 4

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ST ANTHONY'S CANOSSIAN SECONDARY SCHOOL

3E End-of-Year Examination 2019
Marking Scheme

[Science (Biology) 3E /5077/5078]

Paper 1 : MCQ [20 marks]

21	B	31	A
22	A	32	B
23	D	33	A
24	A	34	A
25	B	35	C
26	A	36	B
27	D	37	A
28	C	38	A
29	C	39	A
30	B	40	B

Qn No.			Paper 4 [65 marks]	Marks per part Qn	Total marks per Qn
			Section A		
1	a		root hair cell;	1	
	b	i	transports water and mineral salts; OR provide support/keep plant upright;	1	
		ii	absence of protoplasm; OR absence of cross walls; OR deposition of lignin;	1	
		iii	(hollow lumen), no obstruction to/allows rapid flow of water (and minerals salts); OR enhance tensile strength for support;	1	
	c	i	red blood cell;	1	
		ii	gives cell a circular, biconcave shape; increases surface area to volume ratio; allows fast diffusion of oxygen; OR more space/contains more haemoglobin; able to transport more oxygen; OR able to change shape/more flexible; enables it to squeeze through narrow blood vessels/capillaries;	1 1 1 1 1 1 1	7

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Qn No.			Paper 4 [65 marks]	Marks per part Qn	Total marks per Qn
				Max:2	
2	a		more with enzyme / less without enzyme / **AW** ; 15 (cm^3) + 6 (cm^3) ; clear v cloudy / **AW** ; [3] **Must be comparative** **A** calculated difference **A** idea of more pulp / apple residue when not using enzyme **Must be comparative**	1 1 1 Max:2	
	b	i	1. axes correctly orientated pH on x, volume on y + fully labelled; 2. scale on y axis such that graph fills at least half printed grid and both scales linear, increasing from the origin ; 3. all plots clear and correct ; 4. smooth curve cleanly drawn through most plots or plots neatly joined by ruled lines ; 2. if scales start from zero, look for scale breaks if non-linear 4. **R** if extrapolated to zero at either end.	1 1 1 1	
		ii	5; **A** correct reading from graph drawn	1	
		iii	More/less juice /enzyme activity increases/decreases to / from optimum / pH5 / **AW**; correct ref. to enzyme denaturing / active site shape changing; Need a description and an explanation for both marks.	1 1	
	c		type of apple used ; volume of apple pulp ; volume of enzyme ; concentration of enzyme ; temperature ; length of time (collection or resting); **AVP** e.g. consistency of pulp / ripeness of apple; **A** 'amount' for 'volume' **A** pH only if refer to buffers / **AW**; max 1 **AVP**.	1 1 1 1 1 1 1 Max:2	**11**

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Qn No.			Paper 4 [65 marks]	Marks per part Qn	Total marks per Qn
3	a		**A** - saliva(ry) gland **B** - liver **C** - duodenum ignore small intestine **D** - pancreas 1 mark for every 2 correct answers	2	
	b	i	any **three** from: • chewing / muscle contraction / mechanical digestion; **allow** churning • protease enzymes; **allow** pepsin / trypsin / erepsin / peptidases • in stomach / small intestine / duodenum / from pancreas; • (break down protein) into amino acids; **allow** (poly)peptides	1 1 1 1 Max:3	
		ii	neutralises acid pH / makes conditions alkaline; so lipase can work; emulsifies fat; to give large(r) surface area to volume ratio for faster lipase / enzyme action;	1 1 1 1	**9**
4	a	i	light/chlorophyll/water;	1	
		ii	any temperature with units between 15 °C and 29 °C; any 2 from: ref. to enzymes; work slower at lower temps / below optimum ; ref to less kinetic energy / collisions **AW**; **A** reduces the rate plant has slower (metabolic) rate **AW**; **A** slower rate of photosynthesis **Max: 2 marks for explanation**	1 1 1 1 1	
	b		light intensity **AW**; stomata open / allow CO_2 to enter; supplies light energy for photosynthesis; plants do not photosynthesise in the dark; increase in light increases photosynthesis (rate); **Max: 3 marks for explanation**	1 1 1 1 1	**8**

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Qn No.			Paper 4 [65 marks]	Marks per part Qn	Total marks per Qn
5	a		**A** left atrium **B** mitral / bicuspid / atrioventricular, valve **C** semi-lunar valve / pocket valve / aortic valve **D** right ventricle 1 Mark for every 2 correct answers	2	
	b		**E** (superior / anterior) vena cava , **F** aorta ;	1	
	c		coronary; **R** cardiac explanation: 1 fatty deposit in (wall of) artery; **A** atheroma / plaque **A** cholesterol / LDL / fatty acids **A** arteriosclerosis / described 2 blocks, artery / restricts, blood flow ; **A** 'narrows' artery 3 restricts, oxygen / nutrient, supply ; **R** if 'to body' ignore high blood pressure 4 blood clotting occurs ; **Max: 2 for explanation**	1 1 1 1 1	
	d		heart not pumping blood / keeps blood circulating ; **A** blood not pumped to the lungs blood is oxygenated ; **A** exchange of oxygen and carbon dioxide carbon dioxide is removed from blood ; **ignore** 'to keep patient alive' / 'supply heart with blood'	1 1 1 Max:1	
	e		1 ref. to (cardiac) muscle ; 2 ref. to myogenic / heart has own pacemaker ; 3 septum (divides heart into two) ; 4 two (separate) ventricles / **AW** ; 5 ventricle(s), contract / pump ; **R** 'push' 6 increase blood pressure ; 7 right ventricle has thin(er) wall / left ventricle has thick(er) wall ; **A** bigger , **R** tougher **A** muscle 8 so low(er) pressure / higher pressure ; (in context)	1 1 1 1 1 1 1 1	**10**

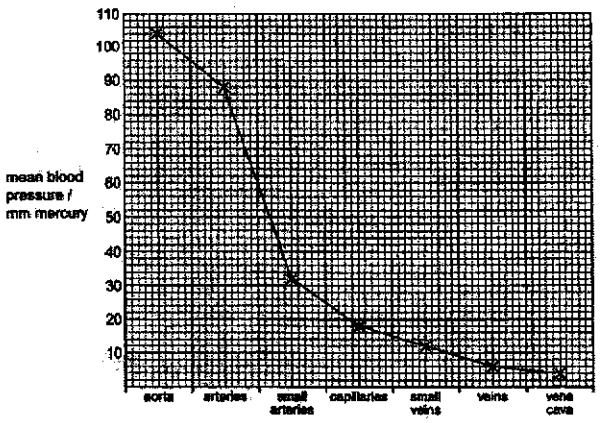
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Qn No.			Paper 4 [65 marks]	Marks per part Qn	Total marks per Qn
			9 to lungs / to rest of body ; (in context) **A** 'to whole body' for left ventricle if blood to lungs described	1 Max:3	
			Section B		
6	**a**		**MAX. 2 WITHOUT NAMED EXAMPLE**		
			named tissue;	1	
			made up of a group of cells;	1	
			of the same type;	1	
			performing the same function;	1	
				Max: 3	
	b		**MAX. TWO IF PART IS NOT NAMED**		
			i **A** = upper epidermis;	1	
			ii ref. to a single layer of cells;	1	
			iii produces/secretes wax/cuticle;	1	
			iv to make leaf waterproof/decreases transpiration; (linked to iii)	1	
			v ref. to transparent nature of + cells/cuticle; **A** ref. to lack of chloroplasts	1	
			vi to allow light to pass through; (linked to v.)	1	
			vii ref. to acting as a barrier against + bacteria/fungi **AW**;	1	
				Max: 3	
			viii **B** = palisade mesophyll;	1	
			ix cells are very long/columnar **AW**;	1	
			x cells contain many chloroplasts/much chlorophyll; **AWARD ONCE**	1	
			xi ref. to photosynthesis; **AWARD ONCE**	1	
				Max: 3	
			xii **C** = spongy mesophyll;	1	
			xiii cells are rounded;	1	
			xiv ref. to presence of air spaces (between cells)/cells loosely packed;	1	
			xv cells contain + chloroplasts/chlorophyll; **AWARD ONCE**	1	
			xvi ref. to photosynthesis; **AWARD ONCE**	1	
			xvii ref. to gaseous exchange **AW**; Award for description	1	
				Max: 3	

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Qn No.			Paper 4 [65 marks]	Marks per part Qn	Total marks per Qn
			xviii **D** = guard cells/stoma(ta); xix ref. to presence of guard cells in pairs; xx guard cells surround a + pore/hole/stoma; xxi and control its opening or closing; xxii ref. to gaseous exchange **AW**; xxiii ref. to control of transpiration; xxiv cells contain + chloroplasts/chlorophyll; **AWARD ONCE** xxv ref. to shape of guard cells/irregular thickness of cell wall; xxvi correct ref. to role of turgor in cells; (can award for **A**, **B**, **C** or **D**)	1 1 1 1 1 1 1 1 1 1 Max: 3 **Max: 7 in total for (b)**	
7	**a**		Any **two** of the following comparisons: 1. arteries narrow lumen, veins large lumen; 2. arteries thicker muscle wall, veins thinner muscle wall; 3. arteries thicker elastic fibres, veins thinner elastic fibres; 4. arteries usually no valves, veins usually have valves;	2	
	b	**i**	the speed of blood decreases as it travels along the aorta till it enters the arteries where the rate of decrease is greater; the decrease in speed continues uniformly through the small arteries and into the capillaries; data quote, e.g: From aorta to capillaries, 48 to 12 cm/s, decrease by 36 cm/s; as the blood enters the small veins, its speed increases and further increases as it enters the veins; as blood then enters the vena cava, it continues to increase but at a slower rate; data quote, e.g: from capillaries to vena cava, 6 to 28 cm/s, increase by 22 cm/s;	1 1 1 1 1 1 Max: 3	

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Qn No.			Paper 4 [65 marks]	Marks per part Qn	Total marks per Qn
		ii	 suitable scale for Y-axis; Y-axis labelled with units (mean blood pressure/ mm mercury); Plots correctly done; Line graph drawn, with plots joined point to point with a straight line; (graph should occupy most of the grids given)	4	10
		iii	Thick muscle wall of left ventricle, high pressure created during ventricular contraction;	1	
8	a		both xylem and phloem serve to transport substances in solution in plants; xylem transports water and mineral salts; while phloem transports manufactured foods like sucrose and amino acids; the lignified cell walls of the xylem tissue also provide support to plants; while the cellulose cell walls of phloem tissue cannot serve the same function due to lack of lignification;	1 1 1 1 1	
	b		increasing temperatures increases the rate of evaporation of water, which increases transpiration rate; higher temperatures increase K.E of molecules, faster rate of diffusion of water vapour out of stomata of leaves; lower humidity increase the water vapour concentration gradient between the intercellular air spaces of leaves and the external environment, which increases rate of transpiration; Greater wind speed sweeps away water vapour outside the leaves, this increases water vapour concentration gradient between the intercellular air	1 1 1 1	10

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Qn No.			Paper 4 [65 marks]	Marks per part Qn	Total marks per Qn
			spaces of leaves and the external environment, thus increasing rate of transpiration; higher light intensity causes the guard cells to photosynthesise and thus stomata open wider, this increases the rate of transpiration;	1	

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