

OCR A-LEVEL BIOLOGY B • H422

BIOLOGY



EXAM QUESTION PACK

2.2.2 TRANSPORT SYSTEMS IN MAMMALS

SCORE

/42

PERCENTAGE

%

STEMUP

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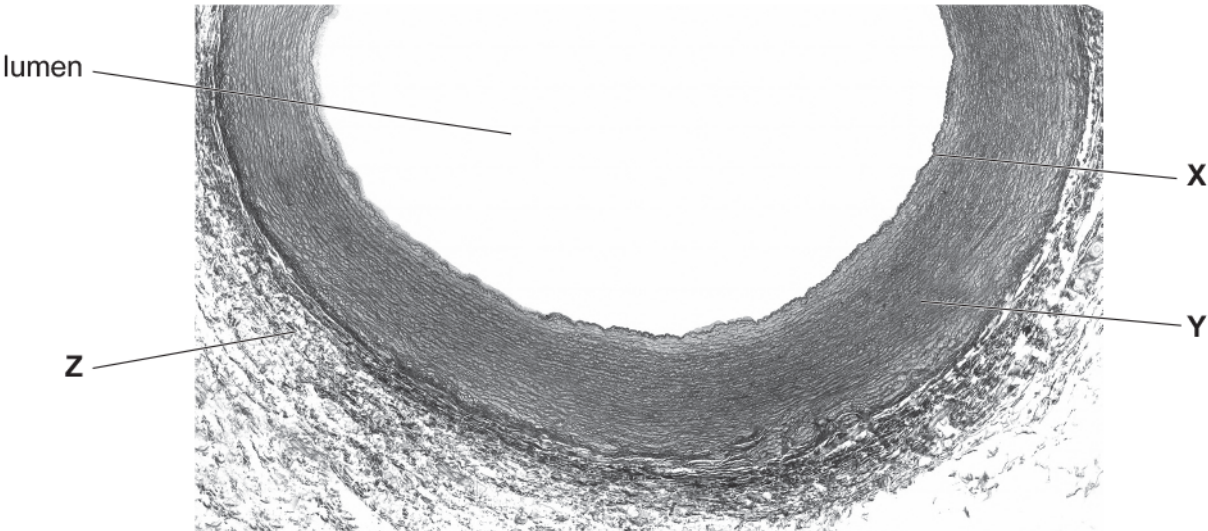
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1 The photomicrograph shows part of a transverse section through a mammalian aorta.



Which of the rows, A to D, correctly identifies some of the tissues that would be found in the areas labelled X, Y and Z in the photomicrograph?

	X	Y	Z
A	endothelium	collagen fibres and connective tissue	smooth muscle tissue
B	smooth muscle tissue	elastic tissue	endothelium
C	endothelium	smooth muscle tissue	collagen fibres and connective tissue
D	smooth muscle tissue	endothelium	elastic tissue

Your answer

[1]

2 Hypoalbuminaemia is a condition in which blood albumin levels are low. Albumin is a plasma protein.

Which of the options, **A** to **D**, is a correct explanation of why hypoalbuminaemia leads to accumulation of tissue fluid?

- A** decrease in blood pressure
- B** decrease in oncotic pressure
- C** increase in blood pressure
- D** increase in oncotic pressure

Your answer

[1]

3(a) Mammalian circulatory systems contain blood vessels, such as arteries and veins.

State **two** advantages of having blood vessels in a circulatory system.

1 _____

2 _____

[2]

(b)

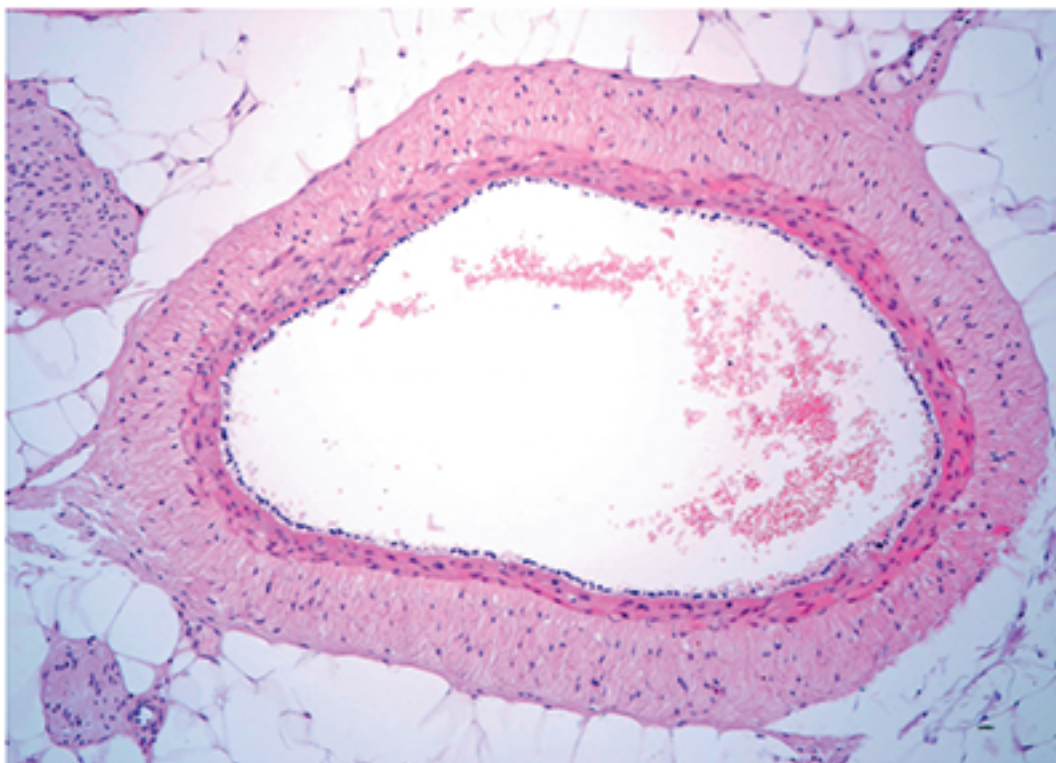


Fig 24.1, above and on the Insert, is a light micrograph of a transverse section through a mammalian vein.

(i) Complete the labelled plan diagram below of the vein in Fig. 24.1.

The fibrous outer layer (tunica externa) has been drawn and labelled for you.

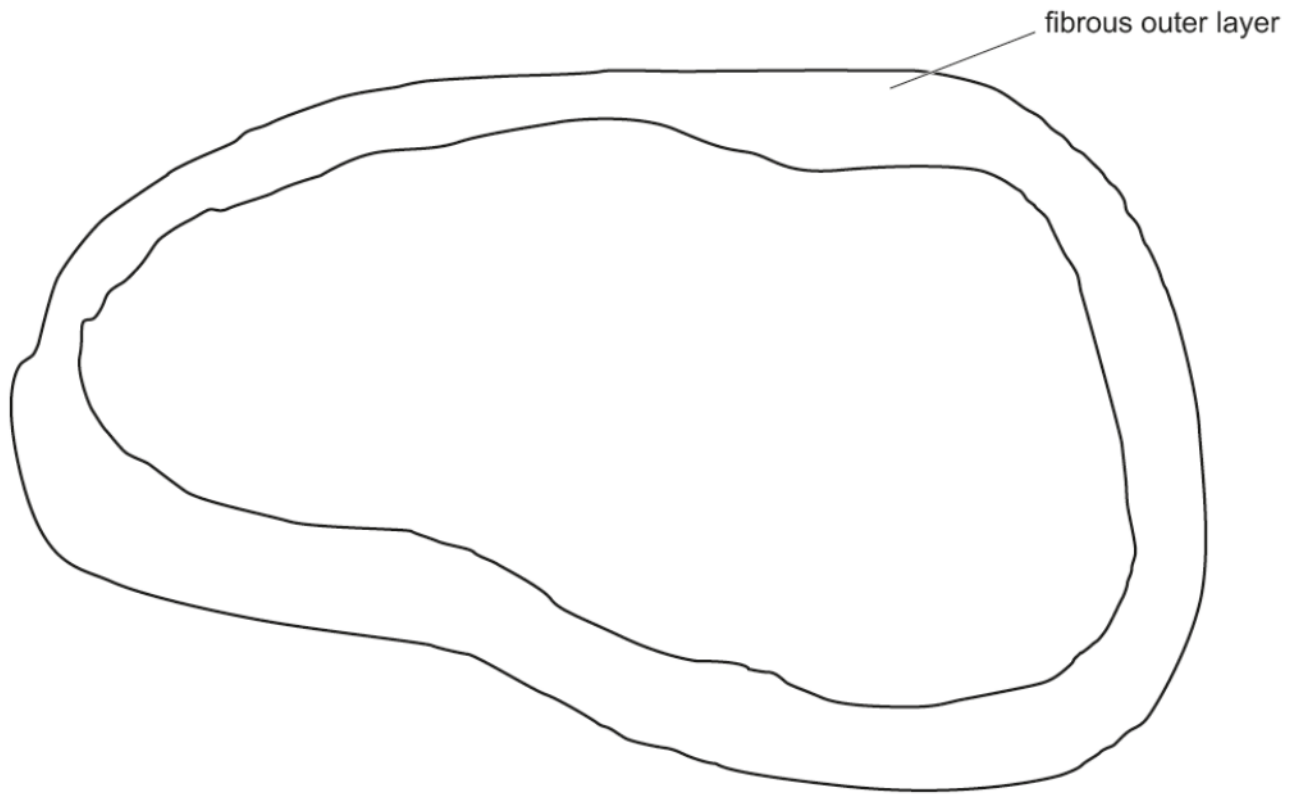


Fig 24.1

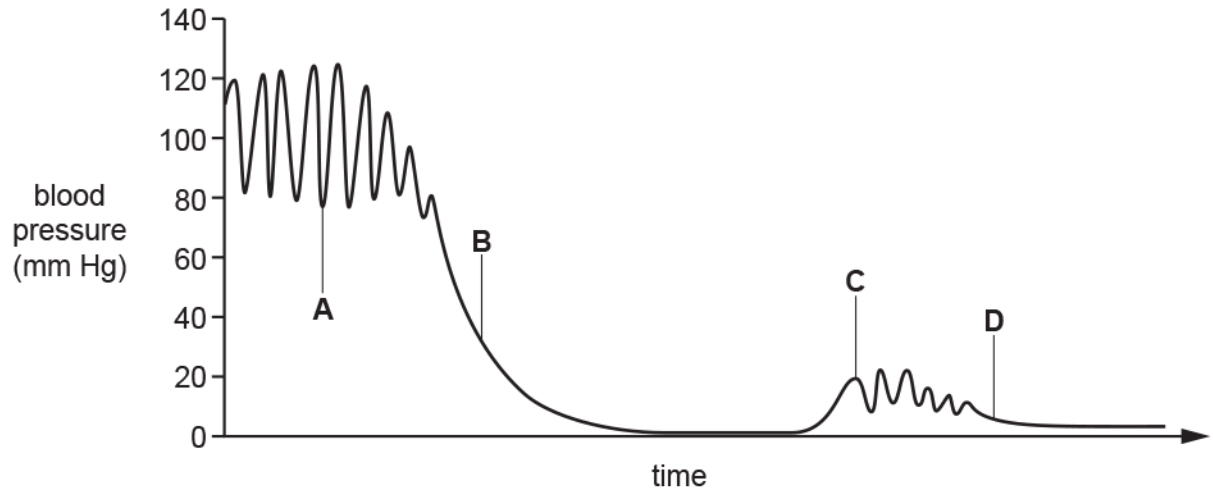
[3]

(ii) Describe **one** function of the fibrous outer layer labelled in the drawing above.

----- [1]

(iii) Compare the structure of the vein in Fig. 24.1 with that of a similar sized artery.

- 4 The graph below shows the normal variation in blood pressure across different regions of the human circulatory system. Four regions are labelled A to D.



Which of the regions on the graph, A to D, is the region in which blood becomes oxygenated?

Your answer

[1]

- 5 A student was learning about the heart and circulatory system. The student dissected a heart and made a drawing of their dissection as shown in Fig. 1.1.

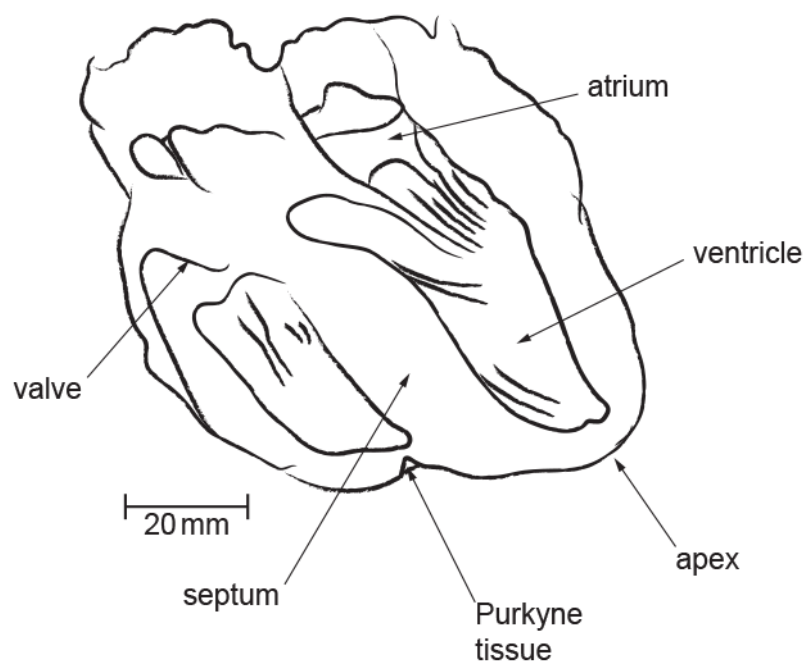
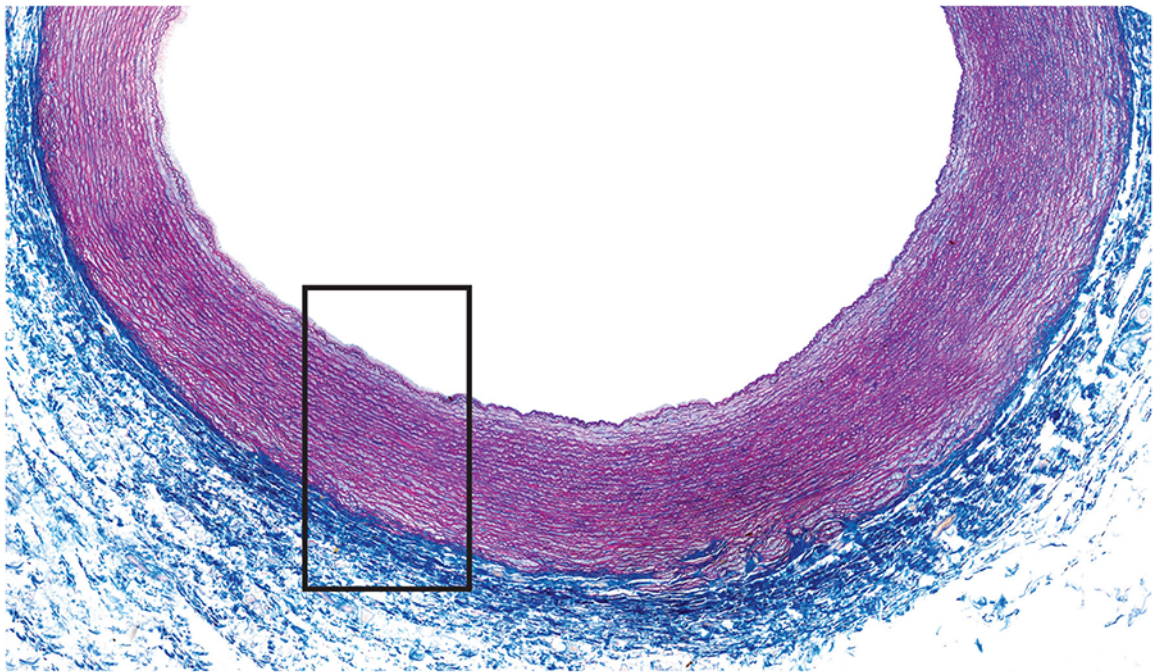


Fig. 1.1

The student was given a microscope slide of a large artery. The image seen is shown in Fig. 1.2, below and on the Insert for H422/03, June 2019.

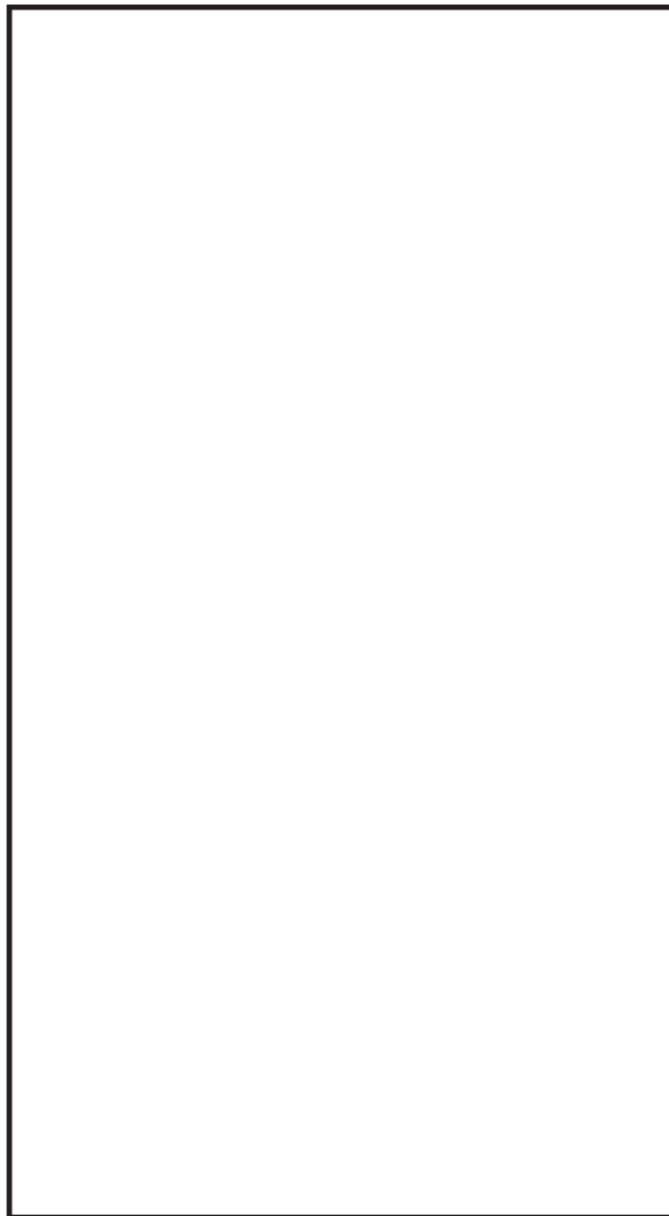
A small part of the image in Fig. 1.2 has been enclosed in a rectangle.



Magnification $\times 27$

Fig. 1.2

Using the space below, draw an annotated low power plan of the part of the artery shown within the rectangle in Fig. 1.2.



[4]

6 A doctor takes a blood pressure measurement from a patient using a manual sphygmomanometer.

The result is $\frac{160}{100}$ mm Hg.

Here are three statements about the doctor's examination:

- 1 The patient has hypertension that requires medical treatment.
- 2 The greatest pressure exerted on the patient's arterial walls during the cardiac cycle is 260 mm Hg.
- 3 At cuff pressures below 100 mm Hg, blood flow can be heard using a stethoscope.

Which of the statements is/are correct?

- A 1, 2 and 3 are correct
- B Only 1 and 2 are correct
- C Only 2 and 3 are correct
- D Only 1 is correct

Your answer

[1]

7(a) Fig. 3.1, below and on the insert for H422/03, June 2018, shows a light photomicrograph of a cross-section of a healthy artery.

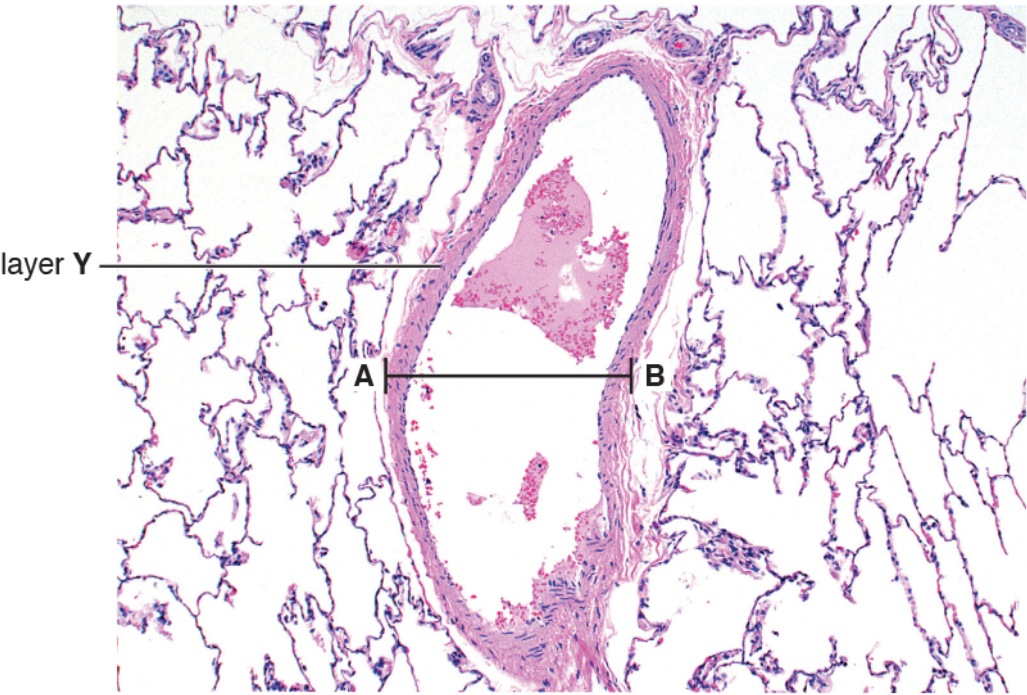


Fig. 3.1

(i) Identify layer Y.

-----[1]

(ii) Describe the importance of layer Y in the normal functioning of an artery.

-----[1]

(b)

- (i) The artery in Fig. 3.1 has a diameter of 0.40 mm measured between A and B.

Calculate the magnification of this image.

Show your working.

Answer = ... [2]

- (ii) Fig. 3.2, below and on the insert for H422/03, June 2018, shows a light photomicrograph of a cross-section of a diseased artery. The diseased artery has a diameter 14.3% greater than the healthy artery in Fig. 3.1. The diameter of the healthy artery is 0.40 mm.

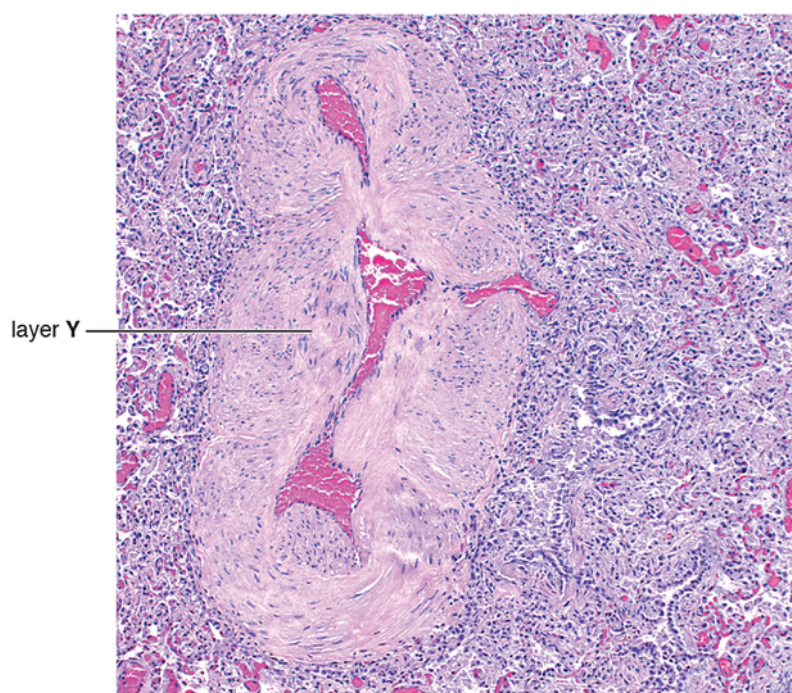


Fig. 3.2

Calculate the actual diameter of the diseased artery. Give your answer to 2 significant figures.

Show your working.

Diameter = ... mm [2]

(c) Suggest why layer Y is much thicker in this diseased artery than in the healthy artery shown in Fig. 3.1.

----- [2]

(d)

- (i) Capillaries do not have a layer Y.

Explain why the absence of layer Y is important in the formation of tissue fluid.

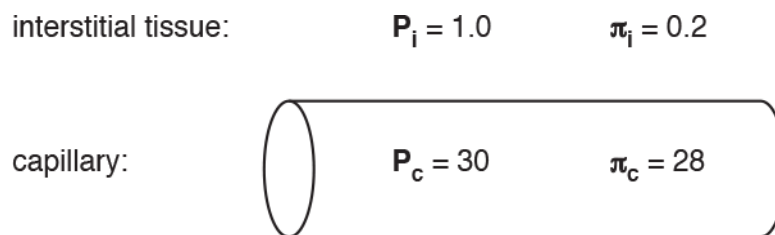
----- [1]

- (ii) Complete this passage about the formation of tissue fluid using the most appropriate words.

Tissue fluid is formed at the end of capillaries due to the high
..... pressure. The high concentration in
capillaries produces a high pressure. This enables fluid to diffuse back
into the capillaries.

[4]

- 8 The diagram below represents a capillary (c) surrounded by interstitial tissue (i). Hydrostatic pressures (P) and oncotic pressures (π) are shown.



The net movement of fluid between the capillary and interstitial tissue is determined by the net driving force (NDF):

$$\text{NDF} = (P_c - P_i) - (\pi_c - \pi_i)$$

When $\text{NDF} > 0$, fluid leaves the capillary.

When $\text{NDF} < 0$, fluid enters the capillary.

Which of the statements, A to D, is correct?

- A $\text{NDF} = -1.7$, favouring the production of tissue fluid
- B $\text{NDF} = -1.7$, favouring a loss of tissue fluid
- C $\text{NDF} = 1.2$, favouring the production of tissue fluid
- D $\text{NDF} = 1.2$, favouring a loss of tissue fluid

Your answer

[1]

9 High blood pressure is a major cause of chronic kidney disease (CKD).

Progression of the disease can be slowed by controlling blood pressure. Enalapril is a drug used for this purpose.

The blood pressure of a CKD patient during treatment with enalapril is shown in Fig. 33.2.

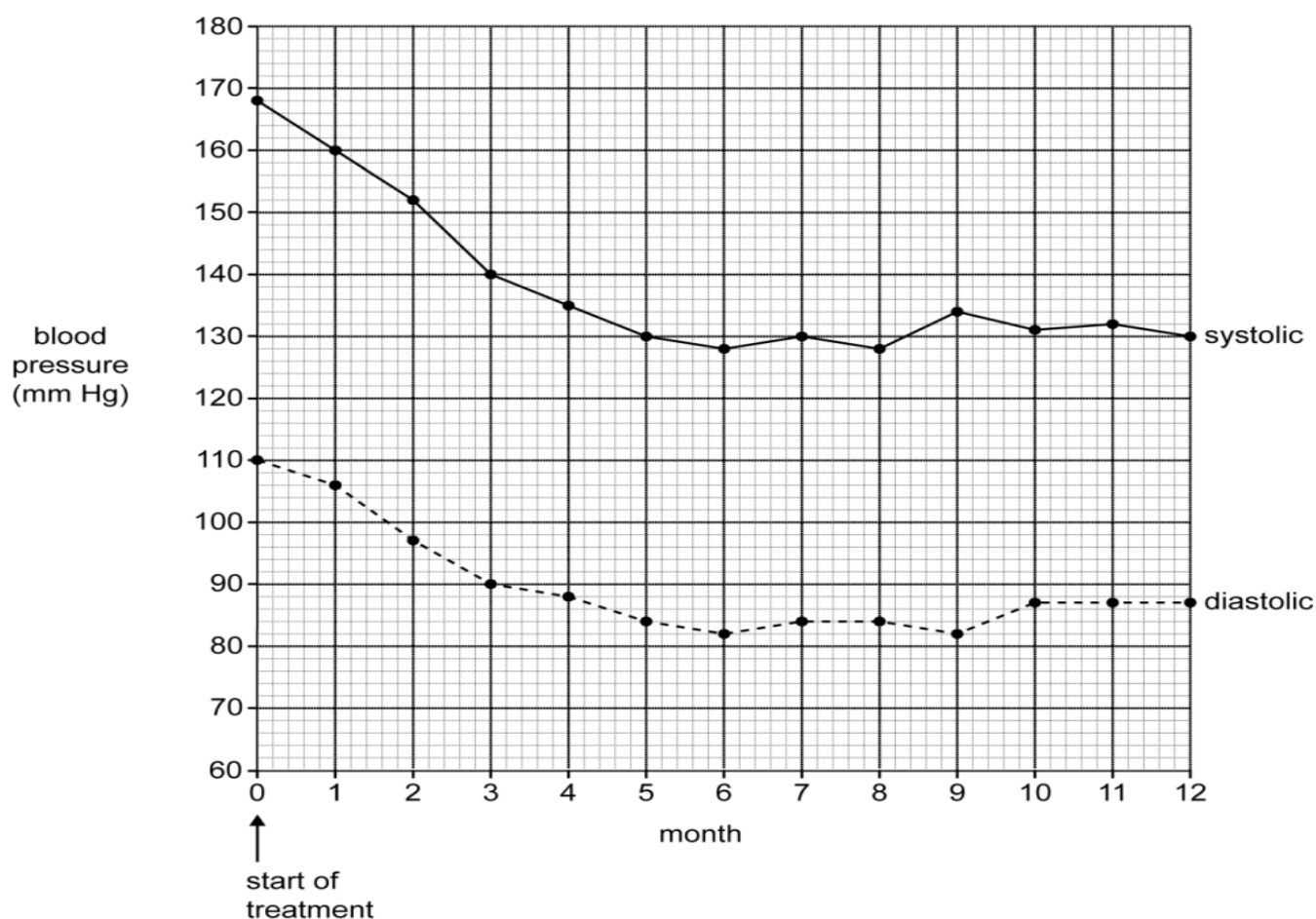


Fig. 33.2

- (i) Calculate the percentage decrease in **diastolic** blood pressure after the first **three** months of treatment. Show your working.

(ii) Outline how blood pressure can be measured manually.

[3]

10 Kwashiorkor is a disease that results from severe protein deficiency.

Which of the options, **A** to **D**, is a pressure decrease that causes an accumulation of tissue fluid in a person with kwashiorkor?

- A oncotic pressure of blood plasma
B oncotic pressure of interstitial fluid
C hydrostatic pressure of blood plasma
D hydrostatic pressure of interstitial fluid

Your answer

[1]

11 Cyclic **AMP** acts as an intracellular messenger molecule in many cells.

The sequence of cellular events which happens in a normal erection is described below:

- stimulation of tissue causes the release of a cell signalling molecule (nitrogen monoxide) from nerve endings
- nitrogen monoxide diffuses into neighbouring cells and causes the production of an intracellular messenger molecule, cyclic **GMP**
- cyclic GMP causes smooth muscle in cells in blood vessel walls to relax
- cyclic GMP is then broken down by an enzyme **PDE-5**.

(i) Comment on the properties of nitrogen monoxide as a cell signalling molecule.

----- [2]

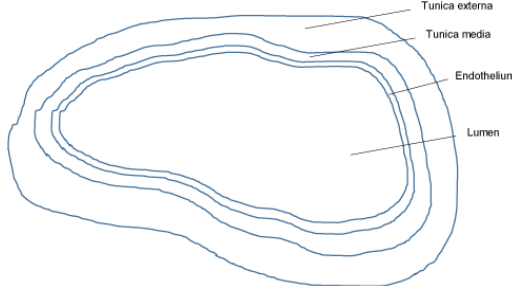
(ii) The chemical sildenafil citrate (Viagra®) binds to the active site of the enzyme **PDE-5**.

Suggest how the action of Viagra® makes it an effective treatment for erectile dysfunction.

----- [3]

END OF QUESTION PAPER

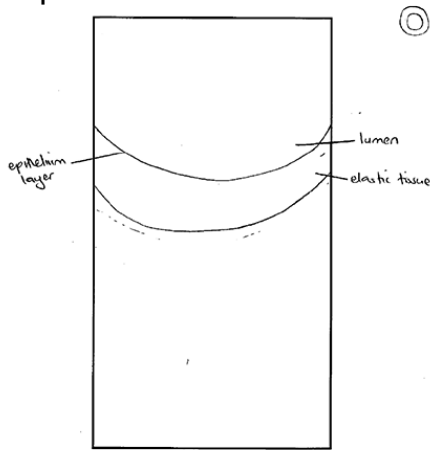
Mark Scheme

Question			Answer/Indicative content	Marks	Guidance
1			C	1(AO2.3)	
			Total	1	
2			B	1 AO2.5	
			Total	1	
3	a		(blood vessels) can maintain blood pressure in the body ✓ different vessels can vary blood pressure ✓ can vary blood, volume / supply, to, tissues / organs ✓ lower blood volume needed ✓	2 max(A O1.2)	
	b	i	another line drawn inside to form another layer AND layer labelled smooth muscle ✓ additional labelling e.g. tunica media / elastic fibres ✓ inner line or another thin layer formed AND labelled endothelium ✓ additional labelling e.g. tunica intima ✓ lumen labelled ✓	3 max(A O2.3)	
		ii	holds vein in position / anchors vein to connective tissue ✓ protection from damage ✓ prevents collapse ✓	1 max(A O2.3)	
		iii	<i>artery has</i> smaller lumen ✓ thicker wall ✓ more, smooth muscle / elastic, tissue ✓ both have endothelium ✓	3 max(A O1.2)	Must be comparative IGNORE valves (not present in Fig.24.2) MPs 1-3 ALLOW ORA for vein
			Total	9	

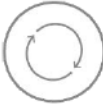
Mark Scheme

Question			Answer/Indicative content	Marks	Guidance
4			D	1 AO2.2	<u>Examiner's Comments</u> Few candidates were able interpret this graph correctly and possibly did not realise that it included both the pulmonary and systemic circulation. Those who answered correctly (option D) were able to recognise the two periods of variable pressure as blood leaving the main arteries of the heart. The smaller pressure in the pulmonary artery (option C) is immediately followed by the pulmonary capillaries where blood gets oxygenated.
			Total	1	

Mark Scheme

Question	Answer/Indicative content	Marks	Guidance
5	correct area of artery shown is drawn showing 'angular' section ✓ sharp pencil AND drawn to appropriate scale AND minimum of 3 pencil lines drawn (no arrowheads) AND <u>no</u> internal detail or structures drawn ✓ 2 correctly labelled AND annotated layers ✓✓	4 (AO 2.3) (AO 3.2)	<i>Annotation adds concise notes about the structures labelled on a biological drawing. It is often used to draw attention to features of particular biological interest, either structural (such as shape, size, colour) or functional.</i> Examples of labels AND annotations: • (<i>Top layer</i>) tunica intima / endothelial lining, thinner / smooth / pale purple • (<i>Middle layer</i>) tunica media is, thicker / dark(er) purple / contains smooth muscle / contains elastin fibres • (<i>Bottom layer</i>) tunica externa is, thinner / blue / contains elastin fibres / contains collagen fibres <u>Examiner's Comments</u> Candidates did not always follow their own advice from Q1(a) in terms of guidelines for biological drawings e.g. sharp pencil, ruled label lines. Some candidates did not draw the section that represented the area specified in the rectangle. Several candidates incorrectly labelled the areas in the low power plan and did not add suitable annotations. Some candidates merely drew two lines which did not allow them to identify the different areas of tissue within the section. Exemplar 1  [4]

Mark Scheme

Question			Answer/Indicative content	Marks	Guidance
					Exemplar 1 didn't score any marks. This was because the wrong section was drawn. This candidate has drawn an area which is outside of the rectangle. Although labels have been included, there are no annotations.  Afl When candidates are preparing biological drawings it is important to emphasise the difference between labels and annotations. Annotation adds concise notes about the structures labelled on a biological drawing. It is often used to draw attention to features of particular biological interest, either structural (such as shape, size and colour) or functional.  OCR support OCR Biological drawing booklet can be used to support drawings: https://www.ocr.org.uk/Images/251799-biology-drawing-skills-handbook.pdf
			Total	0	
6			D	1	
			Total	1	

Mark Scheme

Question			Answer/Indicative content	Marks	Guidance
7	a	i	<u>smooth</u> muscle / elastic fibres / tunica media ✓	1	Enter text here.
		ii	<i>Explanation should link to correct tissue if named in provided for (i)</i> (elastic fibres enable) recoil OR (muscle) <u>contracts</u> to, <u>reduce</u> the size of the lumen ✓	1	DO NOT ALLOW reference to elastic fibres 'relaxing/contracting' ALLOW regulates blood pressure by altering (width of lumen) IGNORE references to maintain blood pressure <u>Examiner's Comments</u> Candidates were not all confident in identifying layer Y. A common error in 3a ii was the use of incorrect terms for the tissue identified in e.g. smooth muscle stretching and recoiling or elastic fibres contracting.
	b	i	$\times 80$ ✓✓	2	If incorrect answer then award one mark maximum for either correct working i.e. $32/0.4$ OR '80' ALLOW one mark maximum for correct formula and correctly formatted answer if the candidate has measured incorrectly e.g. $32.5/0.4 = \times 81.125$ (accept a tolerance of ± 0.5 mm)

Mark Scheme

Question			Answer/Indicative content	Marks	Guidance
		ii	0.46 ✓✓	2	If answer is incorrect or missing: ALLOW one mark for correct working e.g. 1.143×0.4 or $(14.3 / 100 \times 0.4) + 0.4$ ALLOW one mark for correct answer to incorrect number of d.p. e.g. 0.4572 mm <u>Examiner's Comments</u> Some candidates did not give their answer to 2 significant figures and as such did not score full marks. Candidates should be encouraged to give their working in the space provided. Some candidates gave an incorrect answer, but with no working missed the opportunity to make one mark.
	c		hypertrophy/ hyperplasia (of smooth muscle cells) ✓ to withstand a higher blood pressure OR to enable greater, contraction (of the artery wall) ✓ more / thicker, elastic fibres ✓ to withstand a higher blood pressure OR for greater, recoil ✓ plaque formation/ atheroma / atherosclerosis / increased cholesterol <u>in</u> the artery wall ✓ cancer / uncontrolled cell division results in more cells ✓	2 max	IGNORE generic references to high blood pressure (as a sign of disease) ALLOW more / bigger, (smooth) muscle cells <u>Examiner's Comments</u> This question required candidates to consider possible reasons for the tunica media to thicken. It mainly assessed AO2. Able candidates gave 2 appropriate suggestions but other candidates gave one suggestion, which diverted away from the question, describing the causes of coronary heart disease. A common error was the deposition of fats/lipids <u>in</u> the lumen or <u>on</u> the wall (rather than in the artery wall).

Mark Scheme

Question			Answer/Indicative content	Marks	Guidance
	d	i	allows leakage of liquid through fenestrations ✓ reduces diffusion distance/ increases rate of diffusion, to meet the demand for nutrients / removal of waste products AW ✓	1	ALLOW 'gaps between cells' as alternative wording for fenestrations Examiner's Comments Able candidates related the role of fenestrations in the formation of tissue fluid. Some candidates used terms plasma and tissue fluid incorrectly and as such did not gain a mark. Several candidates appreciated the diffusion distance would be reduced but did not then link this to either meeting the demand for nutrients or removing waste products adequately. Exemplar 4 <i>The absence of muscle on the ^{five} allows ^{water} and other molecules to be forced out of the fenestrations into the capillary wall. [1]</i> ✓
		ii	arterial ✓ hydrostatic ✓ solute ✓ osmotic ✓	4	ACCEPT arteriole / artery ACCEPT protein ACCEPT oncotic (if protein is the given as mp3)
			Total	13	
8			C ✓	1	Examiner's Comments The majority of candidates were able to use their mathematical skills well to identify the correct response.
			Total	1	

Mark Scheme

Question			Answer/Indicative content	Marks	Guidance
9		i	$((110 - 90) \div 110) \times 100$ OR $(20 \div 110) / 100$ 18 / 18.2 % (1)(1)	2	ALLOW 1 mark for correct method of calculation ALLOW 18.18% DO NOT ALLOW more than 2 d.p.
		ii	any 3 from: cuff of sphygmomanometer cuts off blood flow (1) to brachial artery (of arm) (1) stethoscope used to listen to blood flow (1) cuff slowly relaxed / valve released (1) first sound indicates systolic pressure (1) disappearance of sound indicates diastolic pressure (1)	3	
			Total	5	
10			A	1	
			Total	1	
11		i	Any 2 from: <i>idea that</i> nitrogen monoxide must be, lipid soluble / hydrophobic (explanation) it diffuses / AW, through the cell surface membrane binds to, receptor / AW, inside the cell <i>idea that</i> second messenger is cyclic GMP rather than cyclic AMP	2	
		ii	Any 3 from: Viagra acts as a competitive inhibitor (of PDE-5) <i>idea that</i> cyclic GMP, is not broken down / lasts longer (in cells) <i>idea that</i> blood vessels dilate, more / for longer <i>idea that</i> erection maintained for longer	3	ALLOW 'Viagra forms an enzyme inhibitor complex' OR description 'prevents the formation of ESC'
			Total	5	