The circulatory system

Question Paper 1

Level	International A Level
Subject	Biology
Exam Board	CIE
Topic	Transport in mammals
Sub Topic	The circulatory system
Booklet	Theory
Paper Type	Question Paper 1

Time Allowed: 63 minutes

Score : /52

Percentage: /100

Grade Boundaries:

A*	Α	В	С	D	E	U
>85%	′77.5%	70%	62.5%	57.5%	45%	<45%

1	Eac	ch of statements A to E describe a structure associated with the mammalian heart.
	For	each statement, identify the structure that is being described.
	Α	The chamber that pumps blood into the pulmonary artery.
	В	A blood vessel that transports deoxygenated blood into the right atrium.
	С	The specialised tissue responsible for delaying the conduction of impulses from the atria to the ventricles.
	D	The blood vessels that supply cardiac muscle with oxygenated blood.
	E	The valve that prevents the backflow of blood from the ventricle that contains oxygenated blood.
		[5]

[Total: 5]

2 Outside the body, red blood cells can be maintained in an intact state by keeping the cells in a 0.9% solution of sodium chloride. This is known as a normal saline solution.

Fig. 3.1 shows intact red blood cells.

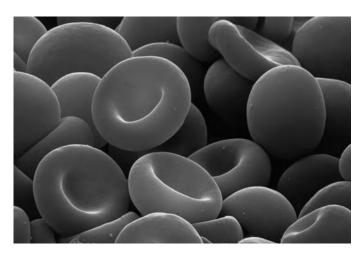


Fig. 3.1

(a)	Explain why red blood cells can be maintained in an intact state by keeping them in a normal saline solution.
	[2]
(b)	In the blood, red blood cells are suspended in plasma. The main component of blood plasma is water.
	Suggest one other component of blood plasma that could enter red blood cells and describe how it would cross the cell surface membrane.
	component
	description
	accompliant
	[3]

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Fig. 3.2 shows red blood cells within a capillary. The capillary shown in Fig. 3.2 allows the rapid exchange of substances between the blood, tissue fluid and body cells.

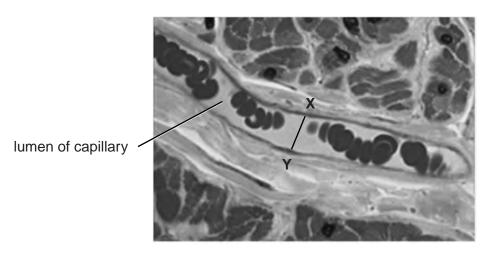


Fig. 3.2

(c) The actual diameter of the lumen of the capillary at the point X–Y in Fig. 3.2 is 9.5 μm.
Calculate the magnification of the image shown in Fig. 3.2. Show your working.

	magnification ×[2]
(d)	With reference to Fig. 3.2, explain one feature that enables the surrounding body cells to receive an adequate supply of oxygen from the blood supplied by the capillary.
	[2]
(e)	Some areas of the brain, known as blood-brain barriers, have a type of capillary that is relatively impermeable to substances.
	Suggest one way in which the structure of a capillary in the blood-brain barrier differs from the structure of the capillary shown in Fig. 3.2.
	[1]

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3 Fig. 4.1 shows how blood pressure changes in the human systemic circulation.

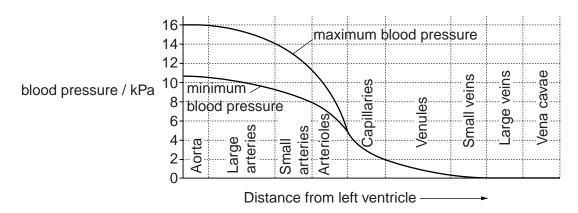


Fig. 4.1

(a)	(i)	Describe the changes in blood pressure shown in Fig. 4.1.	
		[3]	
((ii)	Explain how the structure of veins is related to their function in returning blood to the heart.	
		[2]	

(b)		produced in the body to raise blood pressure. me (ACE) catalyses the final step in angiotensin production.
	10 amino acid polypeptide:	Asp-Arg-Val-Tyr-Ile-His-Pro-Phe-His-Leu
	angiotensin:	ACE His-Leu Asp-Arg-Val-Tyr-Ile-His-Pro-Phe
		Fig. 4.2
	Describe the eten shows in [-
	Describe the step shown in F	1g. 4.2.
		[3]
(c)	People with high blood press angiotensin in the blood.	ure can be treated with a drug which lowers the concentration of
	This drug is a competitive inl	nibitor of ACE.
	Explain how this drug acts as	s a competitive inhibitor.

[Total: 11]

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4	oxy	en haemoglobin in red blood cells travels through the capillaries of the lungs it binds with gen to form oxyhaemoglobin. When oxyhaemoglobin reaches respiring tissues, it dissociates elease oxygen.
	(a)	Explain what causes oxyhaemoglobin to dissociate readily in actively respiring tissues.
		[3]
	(b)	When people move to high altitudes there is an increased production of red blood cells. Explain why more red blood cells are produced when people move to higher altitudes.

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(c) Some people who move to live at high altitudes can develop chronic mountain sickness. One feature of this condition makes it difficult for the heart to pump blood around the body owing to the increased production of red blood cells.

The *EPAS1* gene codes for a type of protein called a transcription factor, which helps to regulate the transcription of genes involved in red blood cell production. Some people have a mutated version of this gene that prevents the over-production of red blood cells.

(i)	Explain what is meant by transcription.
	[3]
(ii)	Describe how a mutated version of the <i>EPAS</i> 1 gene can cause a change in the transcription factor protein produced.
	[3]
(iii)	Some transcription factors may prevent transcription.
	Suggest two ways in which they may do this.
	1
	2

5	Nan	ne as precisely as you can the structure described in each of the following statements.
	(a)	The blood vessel that transports deoxygenated blood from the heart.
		[1]
	(b)	The cell that ingests and digests cell debris and bacteria in the lungs.
		[1]
	(c)	The cell that secretes antibodies.
		[1]
	(d)	The epithelial cell that secretes mucus in the trachea.
		[1]
	(e)	The tissue that prevents the collapse of the trachea during inhalation.
		[1]
		[Total: 5

Fig. 1.1 is an electron micrograph of a cross section through a blood vessel.

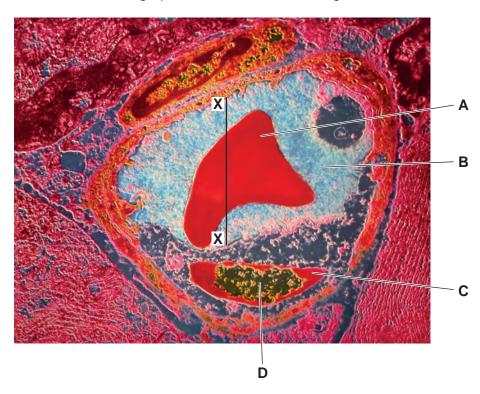


Fig. 1.1

(a)		haracteristic of this type of vessel.	nicn
	type	e of vessel	
	cha	racteristic feature	
			[2]
(b)	Nar	me:	
	(i)	structure A	
	(ii)	the main component of substance B .	[2]
	(iii)	Cell C in Fig. 1.1 is an endothelial cell.	ر کے
	()	Name structure D .	
			[1]

(c)	The magnification of Fig. 1.1 is × 6000.
	Calculate the diameter of the lumen along the line X – X .
	Show your working and give your answer in micrometres (μm) to the nearest whole number.
	answer μm [2
	[Total: 7