

# The circulatory system

## Question Paper 1

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

**Time Allowed :** 63 minutes

**Score :** / 52

**Percentage :** /100

**Grade Boundaries:**

A*	A	B	C	D	E	U
>85%	'77.5%	70%	62.5%	57.5%	45%	<45%

**1** Each of statements **A to E** describe a structure associated with the mammalian heart.

For each statement, identify the structure that is being described.

**A** The chamber that pumps blood into the pulmonary artery.

.....

**B** A blood vessel that transports deoxygenated blood into the right atrium.

.....

**C** 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.

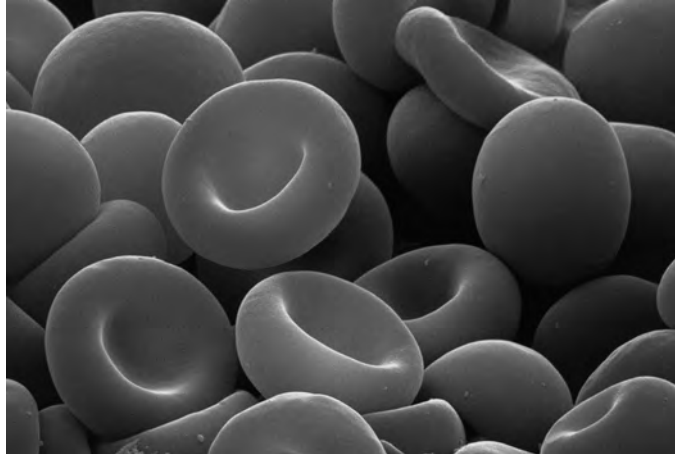


Fig. 3.1

- (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* .....

.....  
.....  
.....  
.....  
.....[3]

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.

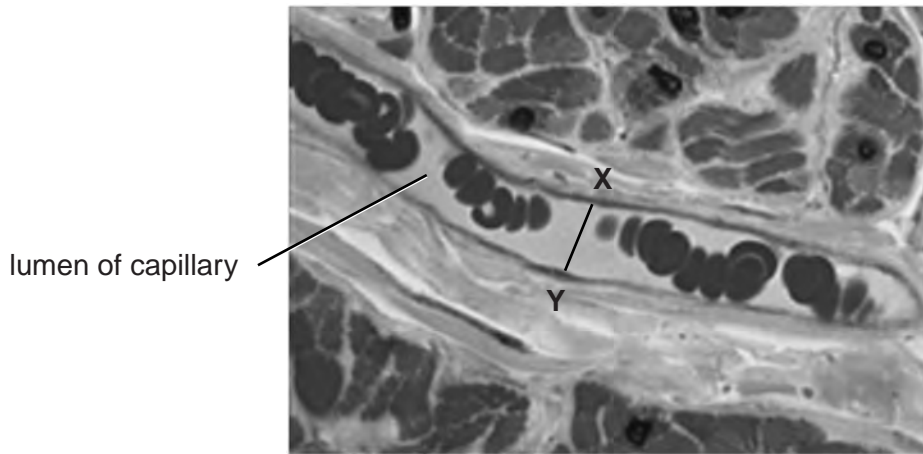


Fig. 3.2

(c) The actual diameter of the lumen of the capillary at the point X–Y in Fig. 3.2 is  $9.5\ \mu\text{m}$ .

Calculate the magnification of the image shown in Fig. 3.2. Show your working.

magnification  $\times$  ..... [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]







- (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 *EPAS1* 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. ....  
.....

[2]



**5** Name 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]

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

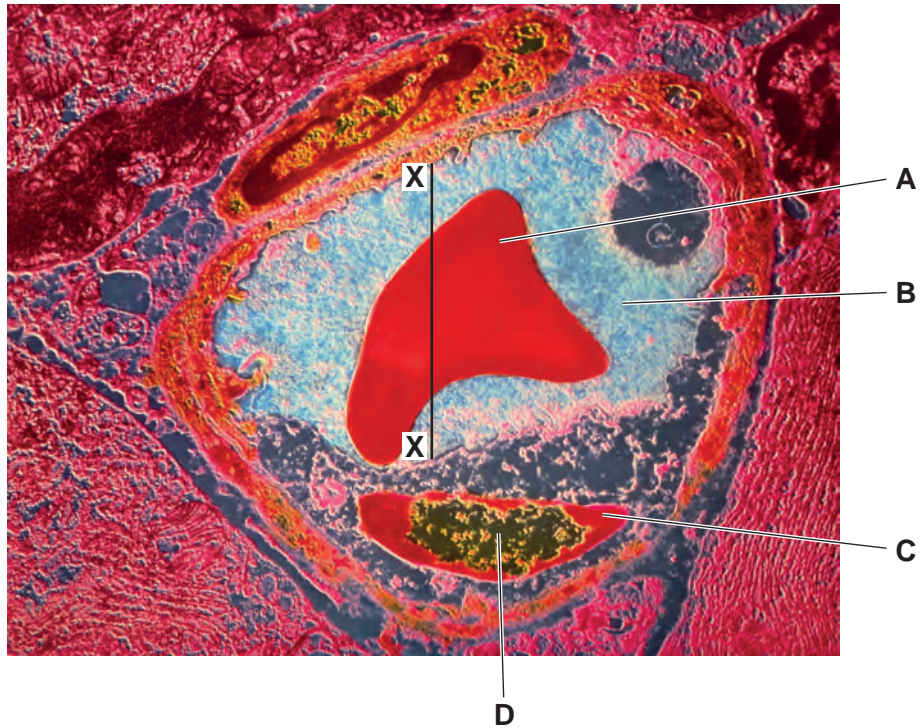


Fig. 1.1

(a) Name the type of blood vessel shown in Fig. 1.1 and describe one **visible** feature which is characteristic of this type of vessel.

*type of vessel*.....  
*characteristic feature* .....  
..... [2]

(b) Name:

(i) structure **A** .....  
(ii) the main component of substance **B**. ..... [2]

(iii) Cell **C** in Fig. 1.1 is an endothelial cell.

Name structure **D**.

..... [1]

**(c)** The magnification of Fig. 1.1 is  $\times 6000$ .

Calculate the diameter of the lumen along the line **X–X**.

Show your working and give your answer in micrometres ( $\mu\text{m}$ ) to the nearest whole number.

answer .....  $\mu\text{m}$  [2]

[Total: 7]