Q1.

Use

5 Haemoglobin is a globular protein with quaternary structure.

Fig. 5.1 is a diagram of the haemoglobin molecule.

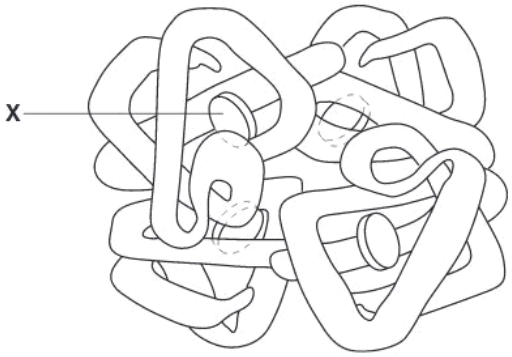


Fig. 5.1

(a) With reference to Fig. 5.1,

(i) name **X** and state its function;

.....

.....[2]

(ii) explain why haemoglobin is described as a *globular protein* with *quaternary structure*.

.....

.....

.....[2]

(b) Explain why people who have a deficiency of iron in their diet are often lacking in energy and feel tired.

.....

.....

.....

.....[3]

www.youtube.com/megalecture
MEGA LECTURE
www.megalecture.com

Online Classes : Megalecture@gmail.com
www.youtube.com/megalecture
www.megalecture.com

Examiner's Use

Fig. 5.2 shows the oxygen dissociation curves for myoglobin, **M**, and haemoglobin, **H**.

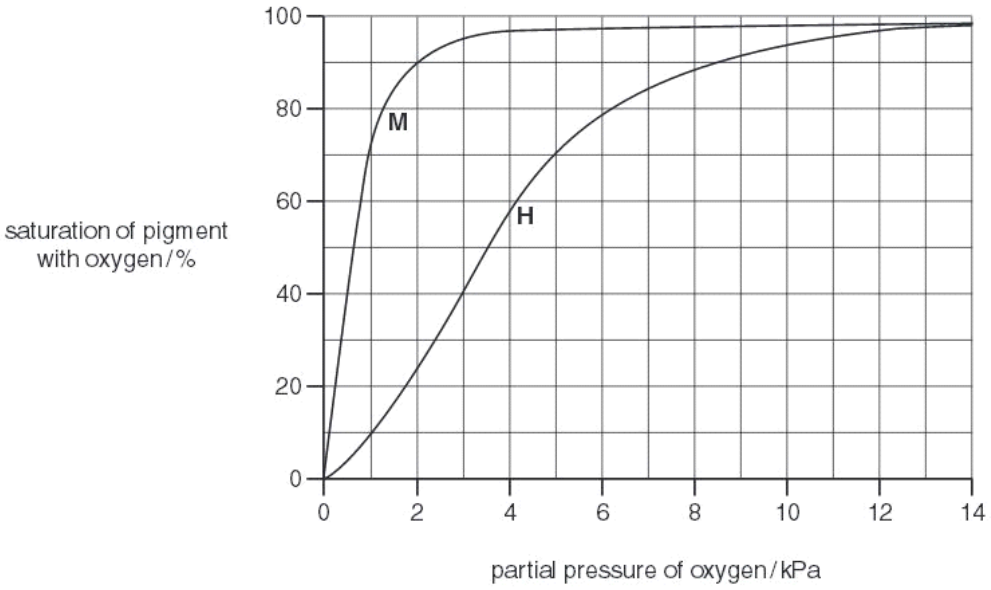


Fig. 5.2

(c) State the tissue where myoglobin is found.

.....[1]

(d) With reference to Fig. 5.2,

(i) state the percentage saturation of myoglobin and haemoglobin when the partial pressure of oxygen is 2 kPa;

myoglobin .....

haemoglobin .....[1]

(ii) explain the significance of the difference in percentage saturation that you have shown in **(i)**.

.....

.....

.....

.....

.....[3]

www.youtube.com/megalecture
MEGA LECTURE
www.megalecture.com

(e) When a person exercises vigorously, the partial pressure of carbon dioxide in the blood increases.

Draw on Fig. 5.2 a dissociation curve for haemoglobin when the partial pressure of carbon dioxide has increased. [1]

[Total : 13]

Q2.

1 Fig. 1.1 is a vertical section of the heart to show the regions concerned with initiating and conducting impulses.

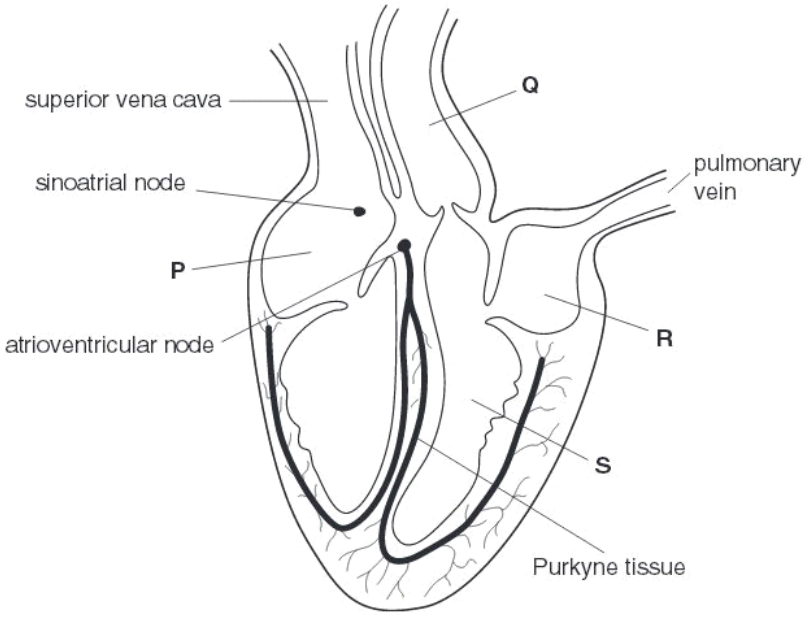


Fig. 1.1

www.youtube.com/megalecture
MEGA LECTURE
www.megalecture.com

(a) Name chamber **P** and blood vessel **Q**.

P .....

Q .....[2]

(b) Explain why the wall of chamber **S** is much thicker than the wall of chamber **R**.

.....

.....

.....

.....

.....[2]

(c) Describe how the following three structures shown on Fig. 1.1 initiate and coordinate the contraction of the heart:

- sinoatrial node (SAN)
- atrioventricular node (AVN)
- Purkyne tissue.

.....

.....

.....

.....

.....

.....

.....

.....[4]

www.youtube.com/megalecture
MEGA LECTURE
www.megalecture.com

(d) Outline the effects of atherosclerosis in coronary arteries on the blood flow through these coronary arteries and the resulting effects on the heart itself.

.....

.....

.....

.....

.....

.....

.....

.....[4]

[Total: 12]

Q3.

(c) State three ways in which the **structure** of a red blood cell differs from the structure of the cell shown in Fig. 4.1.

1 .....

2 .....

3 .....

[3]

Table 4.1 shows the red blood cell counts for two people from Peru – one who lived at sea level and the other who lived at 5 000 metres above sea level.

Table 4.1

	red blood cell count / cells mm^{-3}
sea level	5.0×10^6
5 000 metres above sea level	6.3×10^6

www.youtube.com/megalecture
MEGA LECTURE
www.megalecture.com

(d) Explain why the red blood cell count is much higher in the person who lived at high altitude.

.....

.....

.....

.....

.....[2]

[Total:11]

Q4.

3 **(a)** As blood passes through the capillaries in the lungs it becomes oxygenated.

Explain how the structure of haemoglobin aids the uptake of oxygen in the lungs.

.....

.....

.....

.....

.....

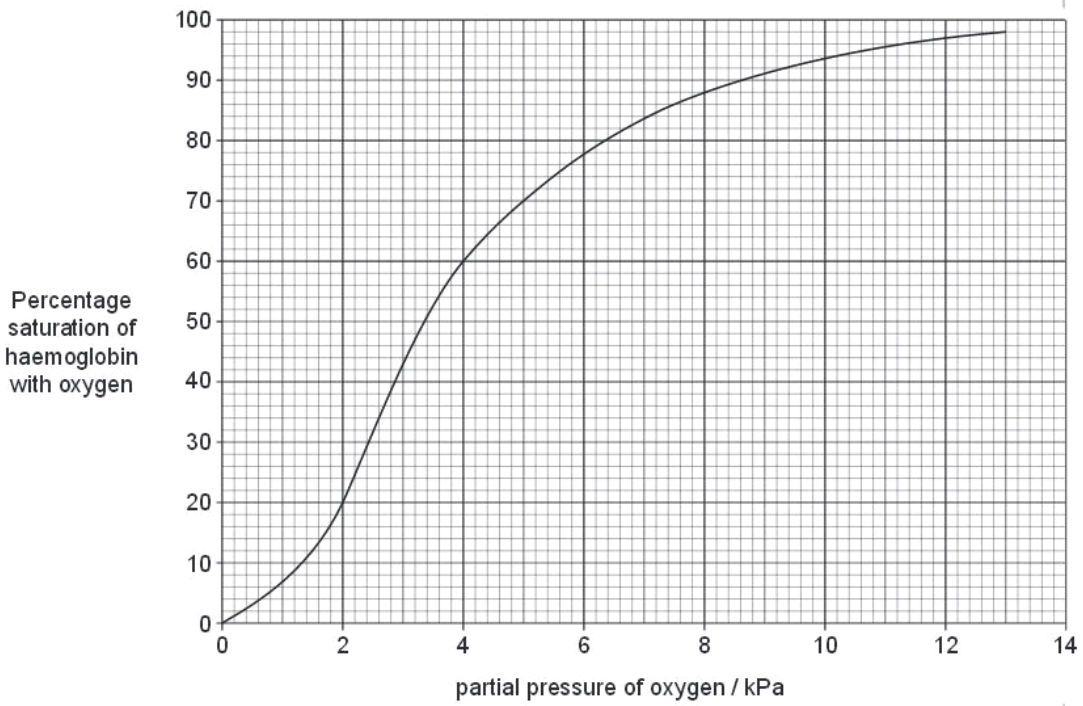
.....

.....

..... **[4]**

www.youtube.com/megalecture
MEGA LECTURE
www.megalecture.com

Fig. 3.1 shows the dissociation curve of adult haemoglobin.



(b) Use the information given in Fig. 3.1 to complete the table below.

part of the circulation	partial pressure of oxygen / kPa	percentage saturation of haemoglobin
capillaries in the lungs		98
capillaries in muscle tissue at rest		70
capillaries in muscle tissue during strenuous exercise	2.0	

[3]

www.youtube.com/megalecture
MEGA LECTURE
www.megalecture.com

(c) During exercise the concentration of carbon dioxide in muscle tissue increases. This stimulates an increase in the release of oxygen from the blood.

Explain how carbon dioxide stimulates the release of oxygen from the blood.

.....

.....

.....

.....

.....

..... [3]

[Total: 10]

Q5.

1 Fig. 1.1 is a drawing made from an electron micrograph of a longitudinal section of a capillary in muscle tissue.

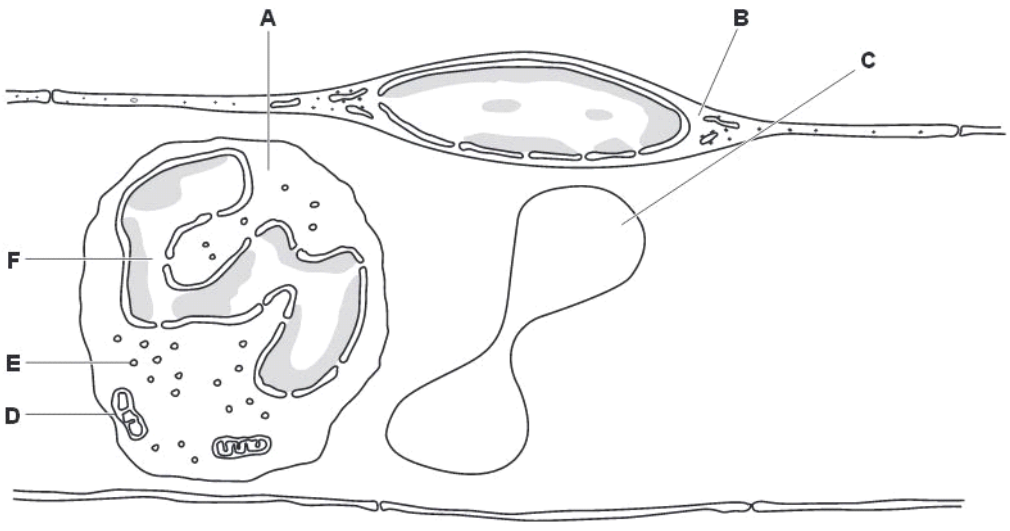


Fig. 1.1

www.youtube.com/megalecture
MEGA LECTURE
www.megalecture.com

(a) Complete the table below using the information in Fig. 1.1 to help you.

	cell **A**	cell **B**	cell **C**
name of cell			red blood cell
function of cell	ingest bacteria	permit exchange of gases	
diameter / µm		20	7

[4]

(b) Name the organelles **D**, **E** and **F**.

D .....

E .....

F .....[3]

(c) Explain how oxygen and glucose move from the blood inside the capillary to the tissue fluid in the muscle.

oxygen .....

.....

.....

glucose .....

.....

.....[3]

(d) Describe how the **structure** of the **wall** of a vein differs from that of a capillary.

.....

.....

.....

.....

.....

.....[3]

[Total: 13]

www.youtube.com/megalecture
MEGA LECTURE
www.megalecture.com

Q6.

1 Fig. 1.1 shows the heart and associated blood vessels.

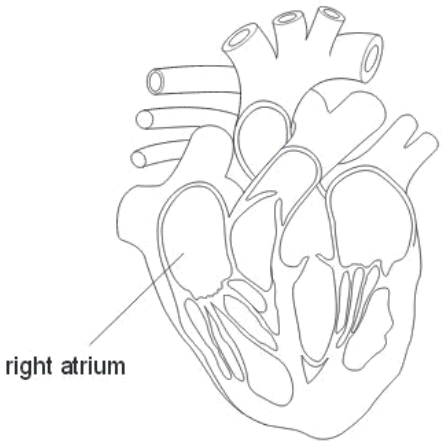


Fig. 1.1

(a) On Fig. 1.1, draw label lines and use the letters **P**, **Q** and **R** to indicate the following structures:

P a blood vessel that carries deoxygenated blood

Q a structure that prevents backflow into a ventricle

R a blood vessel that carries blood at high pressure [3]

(b) The changes in blood pressure in the right atrium are the same as those in the left atrium. The changes in blood pressure in the right ventricle are different from those in the left ventricle.

Explain why this is so.

.....

.....

.....

.....

.....

.....

.....

..... [4]

www.youtube.com/megalecture
MEGA LECTURE
www.megalecture.com

(c) Some components of tobacco smoke are absorbed into the blood stream and affect the cardiovascular system.

Describe the effects of nicotine and carbon monoxide on the cardiovascular system.

nicotine .....

.....

.....

.....

carbon monoxide .....

.....

.....

..... [4]

[Total: 11]

Q7.

3 **(a)** Fig. 3.1 shows a cross-section of the heart at the level of the valves.

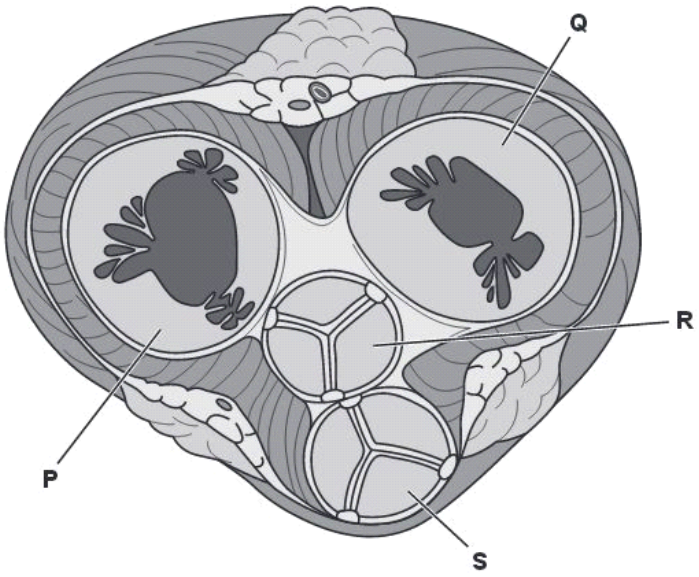
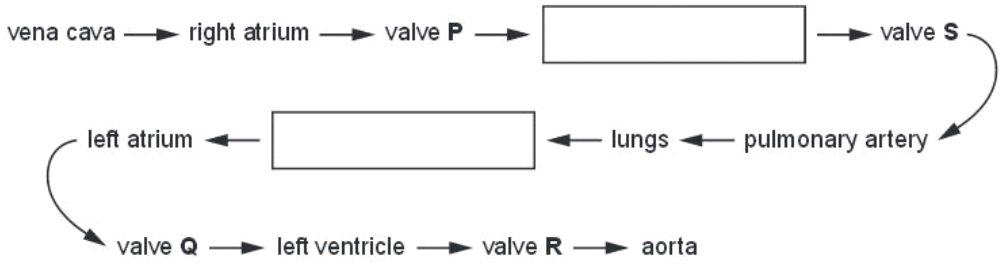


Fig. 3.1

www.youtube.com/megalecture
MEGA LECTURE
www.megalecture.com

(i) Complete the following flow chart to show the pathway of blood through the heart.



[2]

(ii) Explain how the valves **P** and **Q** ensure one-way flow of blood through the heart.

.....

.....

.....

.....[2]

(b) The cardiac cycle describes the events that occur during one heart beat.

Fig. 3.2 shows the changes in blood pressure that occur within the left atrium, left ventricle and aorta during one heart beat.

www.youtube.com/megalecture
MEGA LECTURE
www.megalecture.com

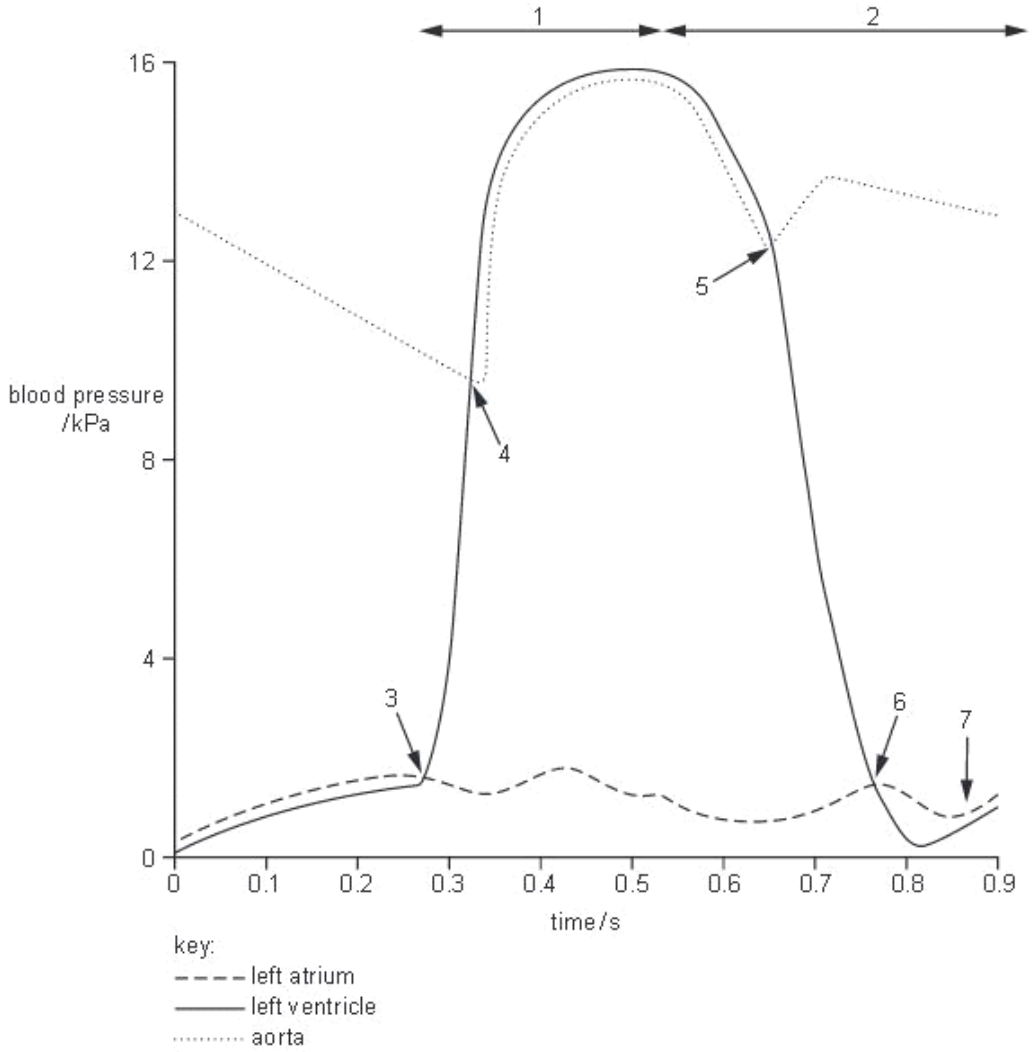


Fig. 3.2

www.youtube.com/megalecture
MEGA LECTURE
www.megalecture.com

In the table below, match up each event during the cardiac cycle with an appropriate number **1** to **7** on Fig. 3.2.

For Examiner Use

You should put only one number in each box. You may use each number once, more than once or not at all.

The first answer has been completed for you.

event during the cardiac cycle	number
atrioventricular (bicuspid) valve opens	**6**
ventricular systole	
semilunar (aortic) valve closes	
left ventricle and left atrium both relaxing	
semilunar (aortic) valve opens	

[4]

(c) Explain the roles of the sinoatrial node (SAN), atrioventricular node (AVN) and the Purkyne tissue during one heart beat.

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....[5]

[Total: 13]

Q8.

www.youtube.com/megalecture
MEGA LECTURE
www.megalecture.com

2 Fig. 2.1 is a diagram of a vertical section through a healthy mammalian heart.

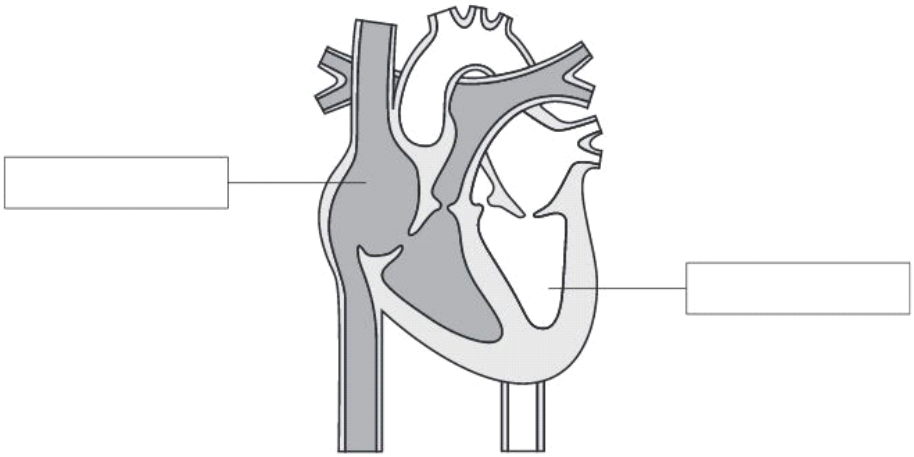


Fig. 2.1

(a) (i) Label the **two** chambers of the heart by writing in the boxes provided on Fig. 2.1. [1]

(ii) State two ways in which the **composition** of blood entering the right atrium is different to blood entering the left atrium.

1. .....

.....

2. .....

.....[2]

www.youtube.com/megalecture
MEGA LECTURE
www.megalecture.com

Some people are born with structural defects of the heart and its associated blood vessels. This is known as congenital heart disease. The dotted circles labelled **A** to **G** on Fig. 2.2 show some areas that are affected by different types of congenital heart disease.

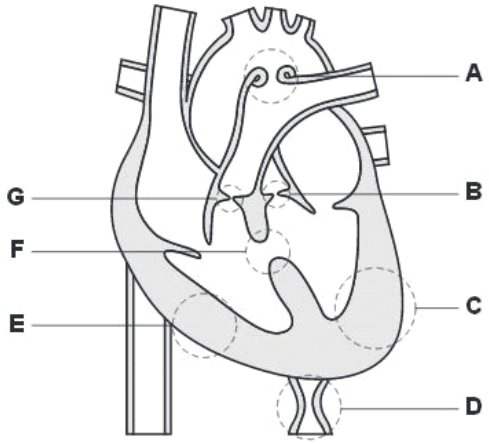


Fig. 2.2

The structural defects causing four types of congenital heart disease are described below:

- **patent ductus arteriosus** – a link between the pulmonary artery and aorta fails to close after birth
- **pulmonary stenosis** – a narrowing of the semilunar valve of the pulmonary artery
- **coarctation of the aorta** – a localised narrowing of the aorta
- **ventricular septal defect** – a hole in the septum between the ventricles.

(b) Match the **one** correct area from **A** to **G** on Fig. 2.2 with each of the congenital heart diseases.

The first one has been completed for you.

patent ductus arteriosus ..... **A** .....

pulmonary stenosis .....

coarctation of the aorta .....

ventricular septal defect ..... [3]

www.youtube.com/megalecture
MEGA LECTURE
www.megalecture.com

(c) Suggest and explain how the flow of blood in a person with patent ductus arteriosus differs from that of a person with a healthy heart.

.....

.....

.....

.....

.....

.....[3]

[Total: 9]

Q9.

2 Fig. 2.1 shows a diagram of a section through a human heart.

For Examiner Use

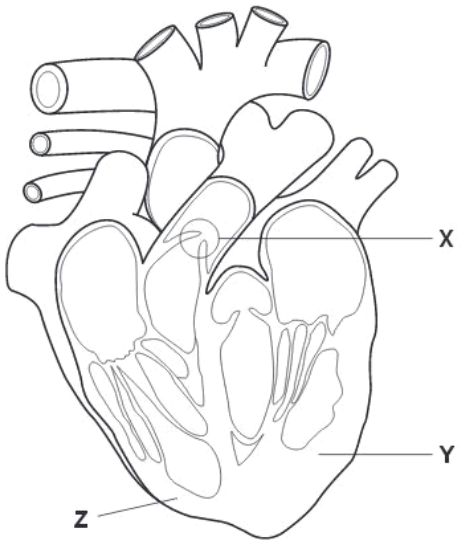


Fig. 2.1

www.youtube.com/megalecture
MEGA LECTURE
www.megalecture.com

(a) State the name and function of the circled structure labelled **X**.

name .....

function .....

.....

.....[3]

(b) Explain why the region labelled **Y** is thicker than the region labelled **Z**.

.....

.....

.....

.....

.....

.....[3]

(c) Cardiac muscle is described as myogenic as it naturally contracts and relaxes. With reference to the structures and tissues within the heart, describe how the cardiac cycle is initiated and coordinated.

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....[5]

[Total: 11]

Q10.

www.youtube.com/megalecture
MEGA LECTURE
www.megalecture.com

2 **(a)** Carbon dioxide is transported in the blood in various forms.

Describe how carbon dioxide molecules reach red blood cells from respiring cells. [5]

.....

.....

.....

.....[2]

Fig. 2.1 shows part of a capillary network and some cells of the surrounding tissue.

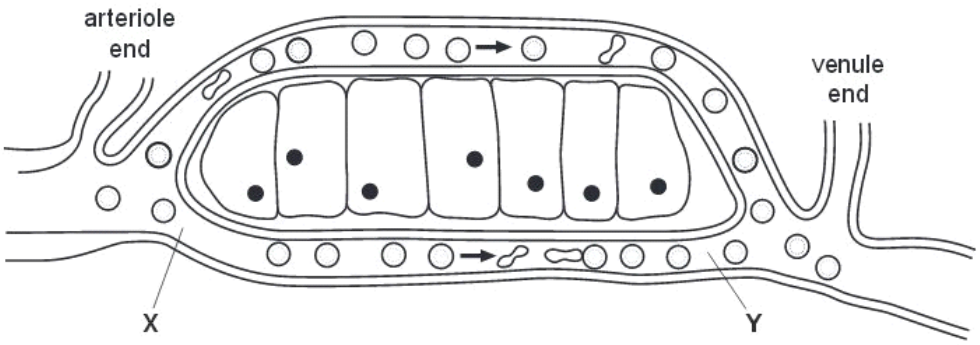


Fig. 2.1

(b) State three ways in which the blood at **Y** differs from the blood at **X** **other than** in the concentration of carbon dioxide.

1. .....

2. .....

3. .....[3]

www.youtube.com/megalecture
MEGA LECTURE
www.megalecture.com

An enzyme in red blood cells catalyses the reaction between carbon dioxide and water as blood flows through respiring tissues.

For Examiner Use

$$CO_2 + H_2O \xrightarrow{\text{enzyme}} H_2CO_3 \longrightarrow H^+ + HCO_3^-$$

(c) (i) Name the enzyme that catalyses this reaction.

.....[1]

(ii) Explain the significance of this reaction in the transport of carbon dioxide.

.....

.....

.....

.....

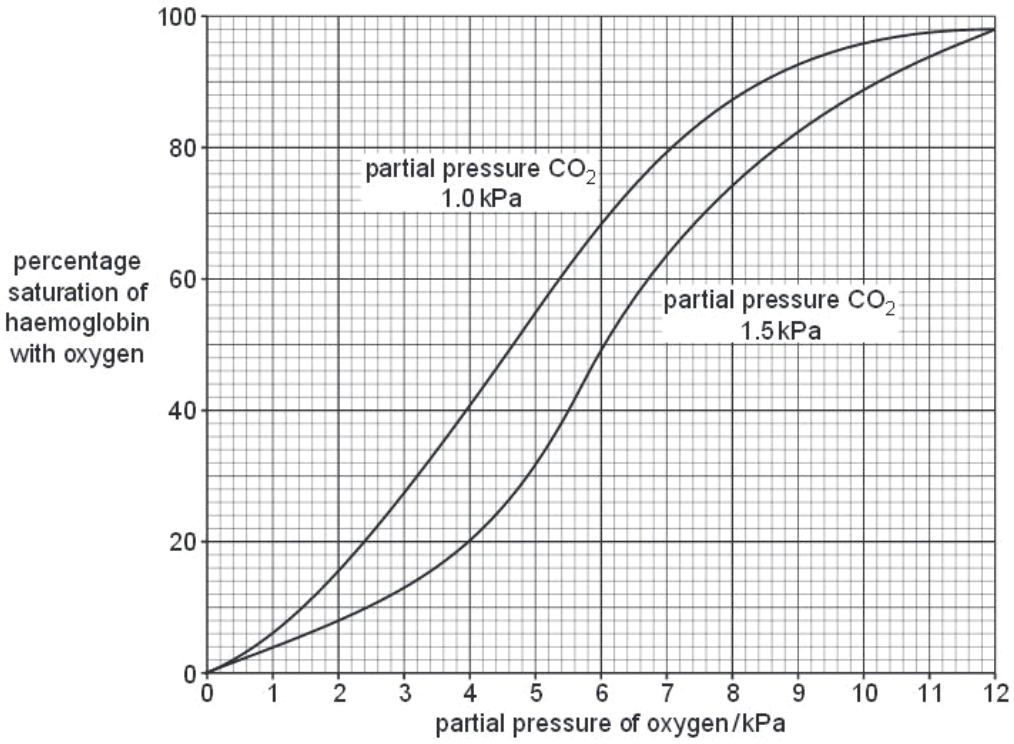
.....

.....

.....[3]

www.youtube.com/megalecture
MEGA LECTURE
www.megalecture.com

(d) Fig. 2.2 shows the effect of increasing the carbon dioxide concentration on the oxygen haemoglobin dissociation curve.



(i) State the percentage saturation of haemoglobin with oxygen at a partial pressure of 5 kPa of oxygen when the partial pressure of carbon dioxide is:

1.0 kPa .....

1.5 kPa .....[1]

(ii) The percentage saturation of haemoglobin with oxygen **decreases** as the partial pressure of carbon dioxide increases.

Explain how this happens.

.....

.....

.....

.....[2]

www.youtube.com/megalecture
MEGA LECTURE
www.megalecture.com

(iii) Name the effect of increasing carbon dioxide concentration on the oxygen dissociation curve.

For Examiner Use

.....[1]

(iv) Explain the importance of the effect of carbon dioxide on haemoglobin as shown in Fig. 2.2.

.....

.....

.....

.....

.....

.....[3]

[Total: 16]

Q11.

3 **(a)** Explain how the structure of red blood cells is suited to their function of transporting oxygen to body tissues.

Ex

.....

.....

.....

.....

.....

.....[3]

www.youtube.com/megalecture
MEGA LECTURE
www.megalecture.com

(b) The circulating red blood cell is metabolically active but only lives for about 120 days. During this time, some important enzymes are gradually broken down and this may contribute to the death of the cell.

Explain why the red blood cell is **not** able to replace important enzymes that have been broken down.

.....

.....

.....

.....

.....[2]

(c) Red blood cells are broken down by phagocytic cells in the liver and spleen. The haemoglobin is broken down into haem and globin before further processing. Some of the components of haemoglobin are re-used in the body.

(i) Name the mineral ion released from the breakdown of haem.

.....[1]

(ii) State the products of globin hydrolysis.

.....[1]

Haemoglobin plays an important role in carrying oxygen and carbon dioxide.

Fig. 3.1 summarises some of the events that occur as blood enters a capillary located in an area of actively respiring cells.

www.youtube.com/megalecture
MEGA LECTURE
www.megalecture.com

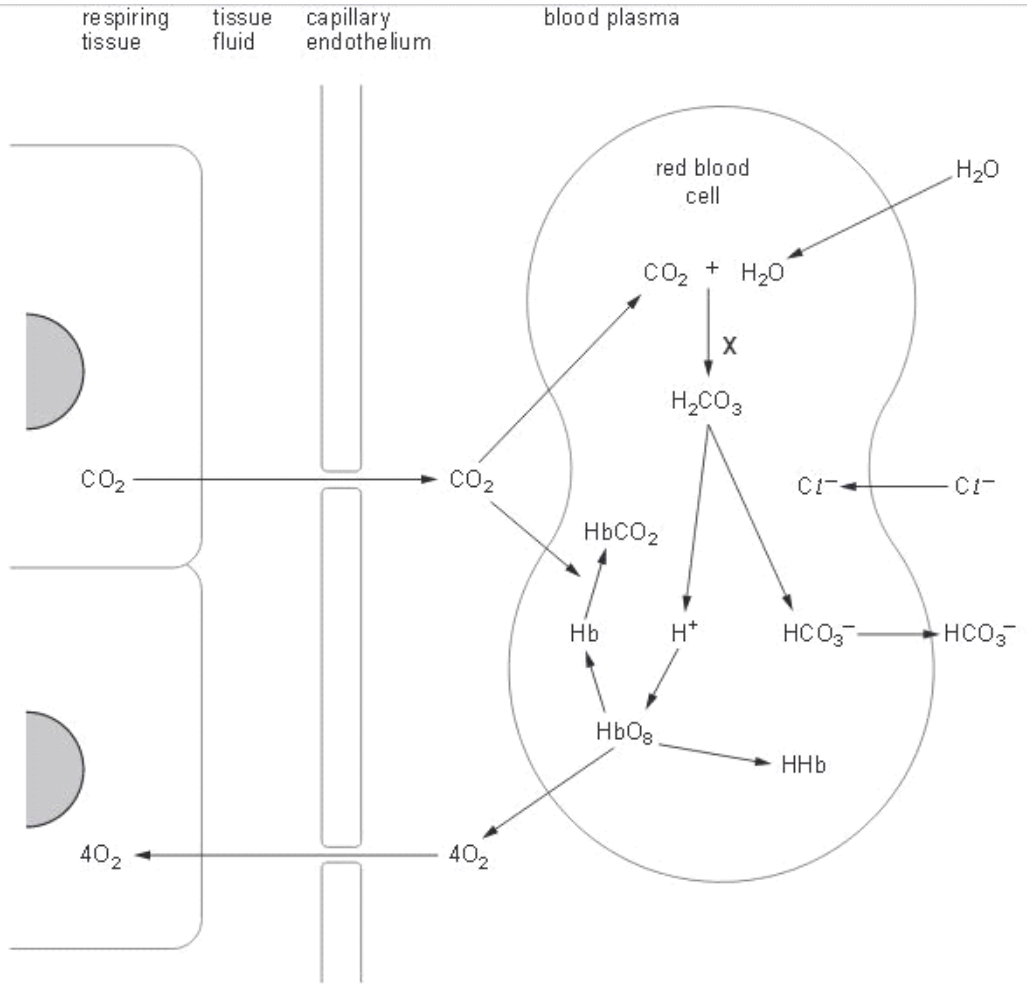


Fig. 3.1

(d) State the name of the enzyme that catalyses the reaction occurring at **X**.

.....[1]

www.youtube.com/megalecture
MEGA LECTURE
www.megalecture.com

(e) With reference to Fig. 3.1, describe **and** explain how carbon dioxide (CO_2) and hydrogen ions (H^+) play a role in the unloading of oxygen from haemoglobin.

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....[5]

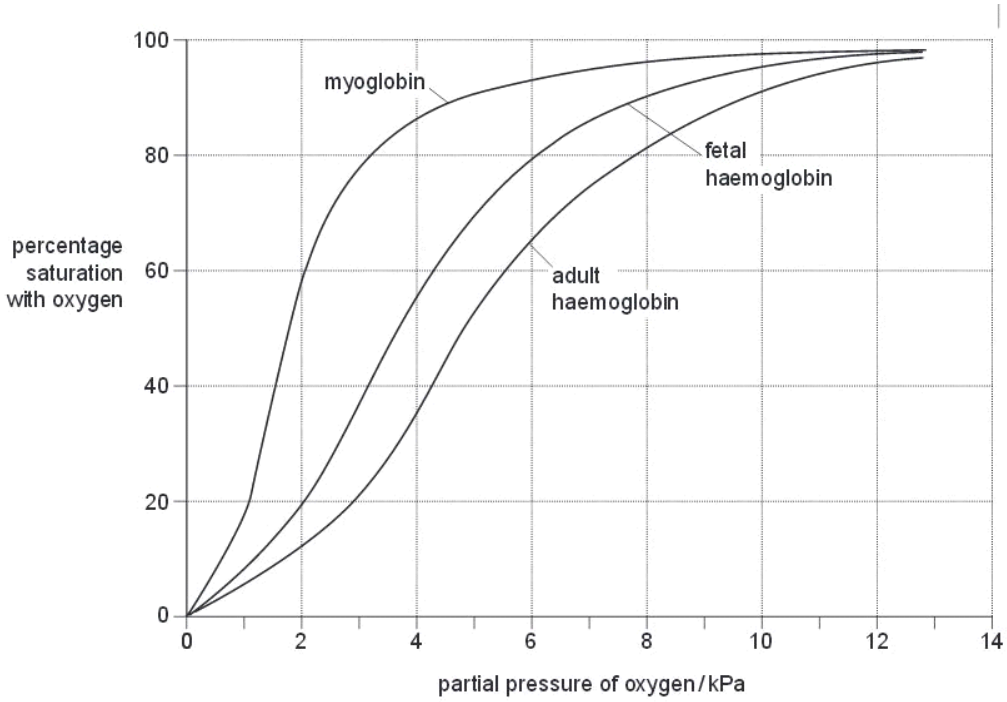
[Total: 13]

Q12.

4 In mammals, haemoglobin is used to transport oxygen and myoglobin is used to store oxygen in muscles.

Fig. 4.1 shows the oxygen dissociation curves for myoglobin, fetal haemoglobin and adult haemoglobin.

www.youtube.com/megalecture
MEGA LECTURE
www.megalecture.com



(a) (i) Name the cells in which haemoglobin is found.

..... [1]

(ii) Use Fig. 4.1 to determine the percentage saturation of **myoglobin** and **adult haemoglobin** when the partial pressure of oxygen is 3 kPa.

myoglobin .....

adult haemoglobin ..... [1]

(iii) There is a large difference between the percentage saturation of myoglobin and that of adult haemoglobin at **low** partial pressures of oxygen. Suggest reasons for this.

For Examiner's Use

.....

.....

.....

..... [2]

www.youtube.com/megalecture
MEGA LECTURE
www.megalecture.com

(b) Fetal haemoglobin has a different oxygen binding affinity to that of adult haemoglobin, as shown in Fig. 4.1. Normally, after birth, the production of the fetal form stops and the adult form is produced.

In a rare condition known as Hereditary Persistence of Fetal Haemoglobin (HPFH), fetal haemoglobin continues to be produced well into adulthood in addition to adult haemoglobin. This condition, however, usually lacks any symptoms.

(i) Explain, with reference to Fig. 4.1, the significance of the difference in oxygen binding affinity between fetal and adult haemoglobin.

.....

.....

.....

..... [2]

(ii) Suggest why HPFH usually lacks symptoms.

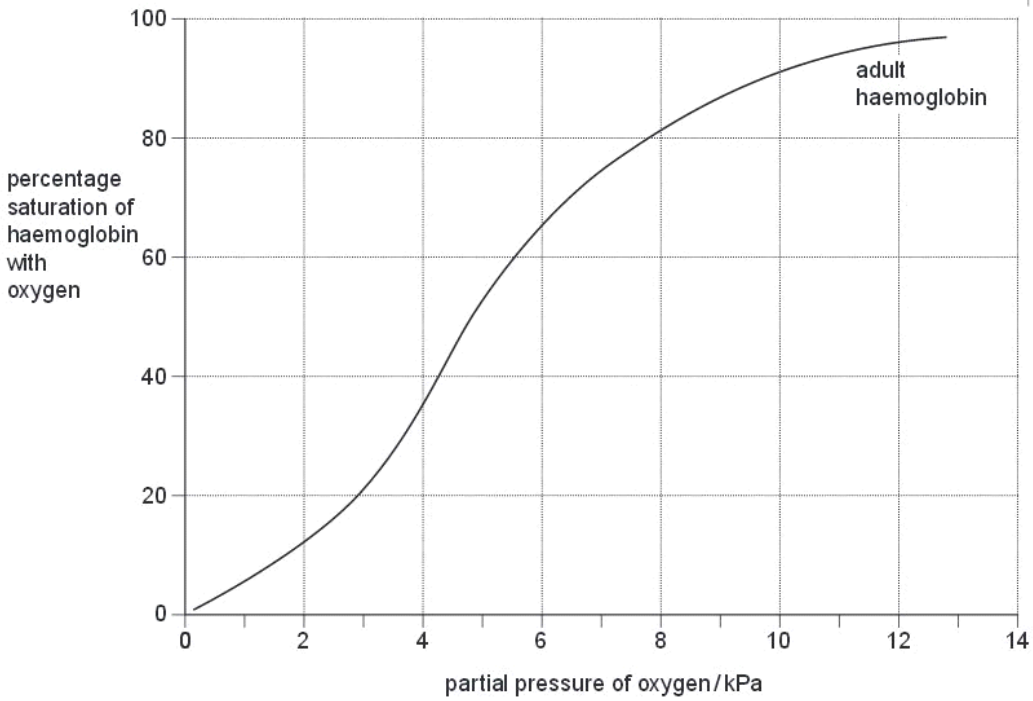
.....

.....

..... [1]

(c) Sketch on Fig. 4.2 the dissociation curve you would expect for adult haemoglobin if the concentration of carbon dioxide is increased. [2]

For Examiner's Use



www.youtube.com/megalecture
MEGA LECTURE
www.megalecture.com

Q13.

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.

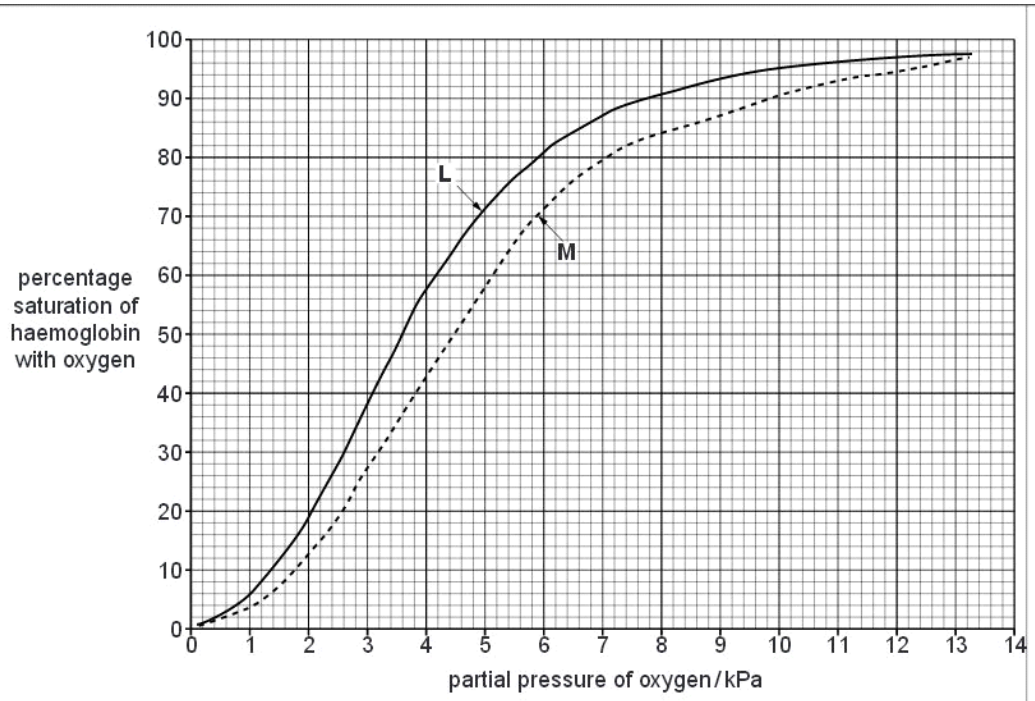


Fig. 3.1

(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]

www.youtube.com/megalecture
MEGA LECTURE
www.megalecture.com

(ii) With reference to Fig. 3.1, describe how the dissociation curve for person **M differs** from the dissociation curve for person **L**.

.....

.....

.....

.....

.....

..... [3]

(b) Explain the advantage of the position of the dissociation curve for people with sickle cell anaemia.

.....

.....

.....

.....

.....

..... [3]

www.youtube.com/megalecture
MEGA LECTURE
www.megalecture.com

(c) The partial pressure of oxygen in the lungs at sea level is about 13.5 kPa. At an altitude of 3000 metres the partial pressure of oxygen in the lungs is about 7.5 kPa.

When people move from sea level to high altitude they become adapted to the low partial pressure of oxygen.

Describe **and** explain how humans become adapted to the low partial pressure of oxygen at high altitude.

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....[4]

(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]

Q14.

www.youtube.com/megalecture
MEGA LECTURE
www.megalecture.com

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

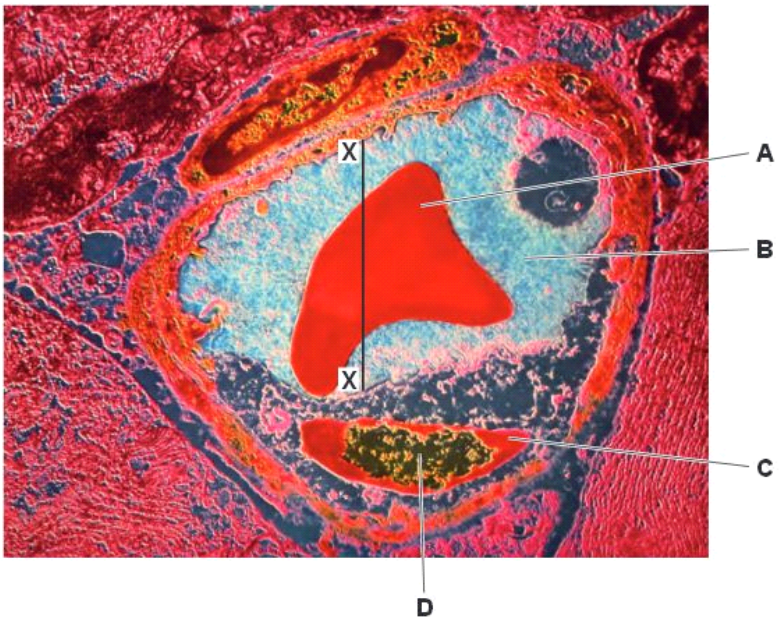


Fig. 1.1

(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]

www.youtube.com/megalecture
MEGA LECTURE
www.megalecture.com

(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.

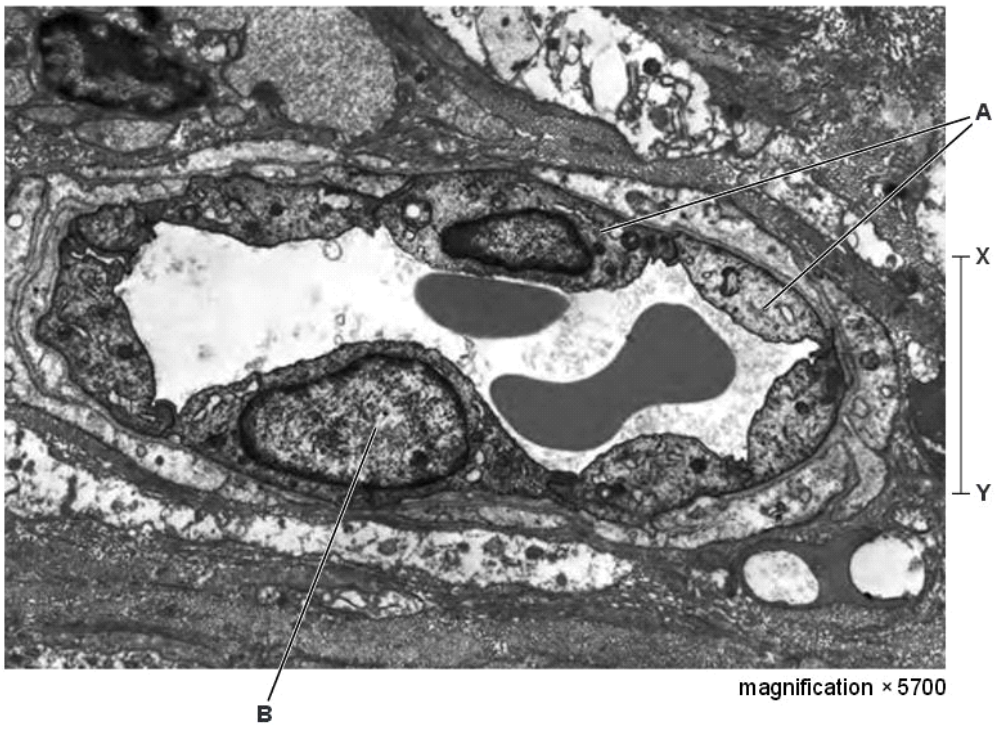
answer ..... μm [2]

[Total: 7]

Q15.

1 Capillaries are known as exchange vessels. Substances are exchanged between blood and tissue fluid as the blood flows through the capillaries.

Fig. 1.1 is an electron micrograph of a section through a capillary with two red blood cells.



magnification × 5700

www.youtube.com/megalecture
MEGA LECTURE
www.megalecture.com

(a) (i) Name the cells labelled **A** and the structure labelled **B**.

A .....

B ..... [2]

(ii) Calculate the actual distance **X – Y** on Fig. 1.1.

Show your working and give your answer to the nearest micrometre (μm).

answer ..... μm [2]

(iii) Explain how capillaries are adapted for their function as exchange vessels.

For Examiner's Use

.....

.....

.....

.....

..... [2]

(b) Table 1.1 shows the composition of blood, tissue fluid and lymph.

Table 1.1

component	blood	tissue fluid	lymph
red blood cells / cells $mm^{-3} \times 10^6$	5.1	0.0	0.0
white blood cells / cells mm^{-3}	9000	75	1000000
glucose / g dm^{-3}	800	800	775
protein / g dm^{-3}	71	1	26

www.youtube.com/megalecture
MEGA LECTURE
www.megalecture.com

Explain the differences between the composition of blood, tissue fluid and lymph as shown in Table 1.1, for white blood cells, glucose and protein.

white blood cells .....

.....

.....

.....

glucose .....

.....

.....

.....

protein .....

.....

.....

..... [5]

(c) Outline how **red blood cells** are involved in the transport of carbon dioxide.

.....

.....

.....

.....

.....

.....

..... [3]

[Total: 14]

Q16.

www.youtube.com/megalecture
MEGA LECTURE
www.megalecture.com

6 **(a)** The statements below are some of the events that occur in the initiation and control of heart action during one cardiac cycle.

Place the events in the correct sequence, using **1** as the first event in the sequence.

event	correct sequence
Purkyne tissue conducts the wave of excitation	
atrioventricular node sends out a wave of excitation	
atria contract	
ventricles contract	
sinoatrial node sends out a wave of excitation	

[3]

(b) The wall of the left ventricle contains more cardiac muscle than the wall of the right ventricle.

Explain the difference in the thickness of the walls of the left and right ventricles of the heart, in terms of their functions.

.....

.....

.....

.....

..... [2]

[Total: 5]

Q.17.

www.youtube.com/megalecture
MEGA LECTURE
www.megalecture.com

1 Fig. 1.1 is a photomicrograph of a transverse section of an artery and a vein from a mammal.

Fig. 1.1

(a) State three ways, **visible in Fig. 1.1**, in which the artery differs from the vein.

1 .....

.....

2 .....

.....

3 .....

.....[3]

www.youtube.com/megalecture
MEGA LECTURE
www.megalecture.com

(b) The lungs contain arteries, veins and capillaries.

Explain the role of capillaries in the lungs.

.....

.....

.....

.....

.....[3]

(c) Describe the effect of tar from cigarettes on the lining of the gaseous exchange system.

.....

.....

.....

.....

.....

.....[3]

[Total: 9]

Q18.

www.youtube.com/megalecture
MEGA LECTURE
www.megalecture.com

Examiner Use

4 **(a)** Explain why the mammalian circulatory system is described as a closed double circulation.

.....

.....

.....

.....[2]

(b) Mature mammalian red blood cells have no nuclei. State **one** advantage and **one** disadvantage of this.

advantage .....

.....

.....

disadvantage .....

.....

.....[2]

Q19.

5 Table 5.1 shows blood cell counts for three different people.

Table 5.1

	number of cells per mm^3 of blood		
	healthy person at sea level	healthy person acclimatised to high altitude	person with a bacterial infection
red blood cells	5 400 000	6 100 000	5 300 000
T helper lymphocytes	1 000	1 050	850
phagocytes	5 400	5 600	8 750

www.youtube.com/megalecture
MEGA LECTURE
www.megalecture.com

(a) (i) Calculate the percentage increase in the number of red blood cells in the person acclimatised to high altitude compared with the person at sea level. Show your working and express your answer to the nearest whole number.

Answer = ... [2]

(ii) Explain the advantage of this increase in red blood cells to people who live at high altitude.

.....

.....

.....

.....

.....[2]

Q20.

6 Fig. 6.1 shows three stages in the cardiac cycle.

www.youtube.com/megalecture
MEGA LECTURE
www.megalecture.com

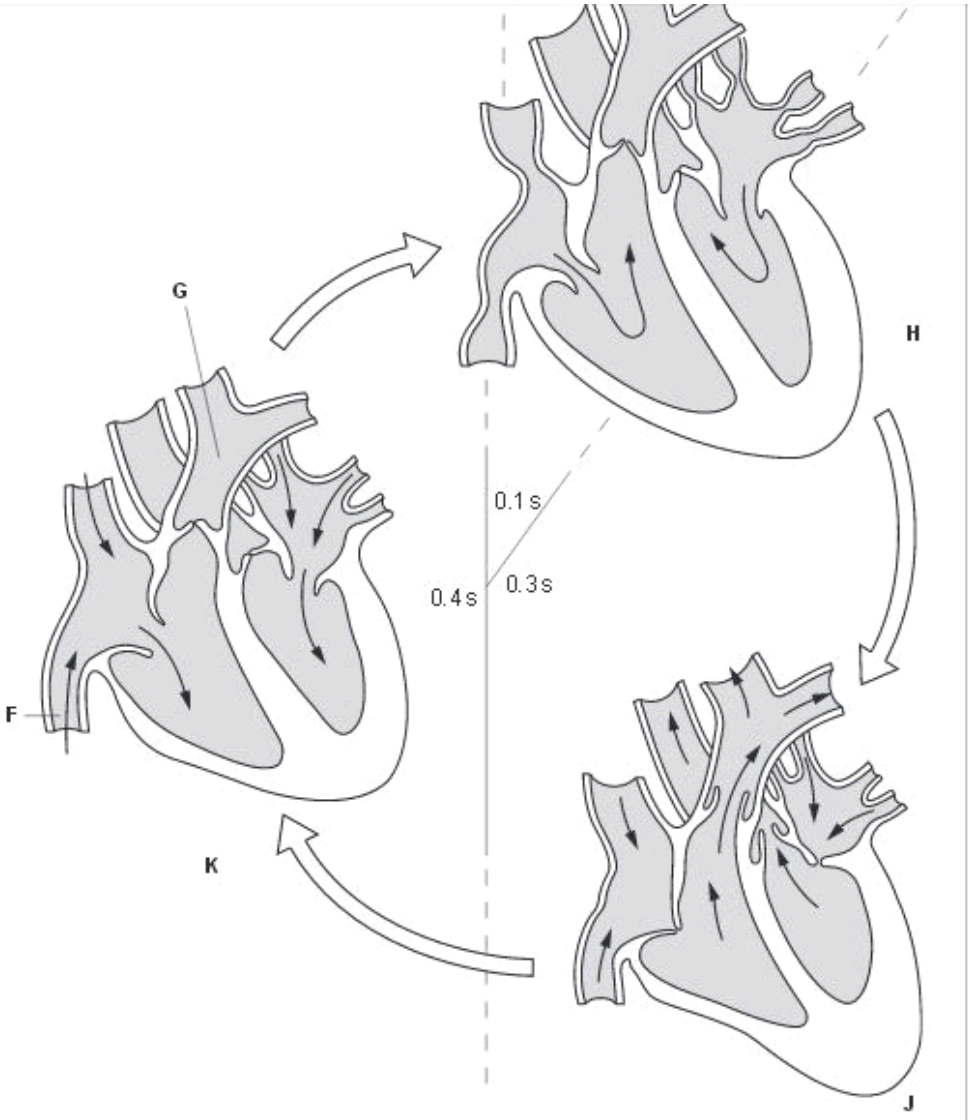


Fig. 6.1

(a) **(i)** Name the blood vessels labelled **F** and **G**.

F .....

G .....[2]

www.youtube.com/megalecture
MEGA LECTURE
www.megalecture.com

Use

(ii) Fig. 6.1 indicates that one heart beat takes 0.8 second.
State the heart rate in beats per minute.

Answer = ... [1]

(iii) Explain why the walls of the atria have thinner muscle than the walls of the ventricles.

.....

.....

.....

.....[2]

(b) Complete the table to show what is happening to the following parts of the **left** side of the heart at each of the stages, **H**, **J** and **K** as shown in Fig. 6.1:

- left atrium
- left ventricle
- aortic valve.

stage	left atrium	left ventricle	atrioventricular valve	aortic valve
H	contracts to force blood into left ventricle	....	open	closed
J	....	....	closed	.....
K	....	relaxes and fills with blood from left atrium	open	.....

[6]

[Total: 11]

Q21.

www.youtube.com/megalecture
MEGA LECTURE
www.megalecture.com

Online Classes : Megalecture@gmail.com
www.youtube.com/megalecture
www.megalecture.com

Use

2 Scientists have developed a variety of ways to represent the three dimensional structure of proteins. Fig. 2.1 shows one way of representing the structure of the protein, haemoglobin.

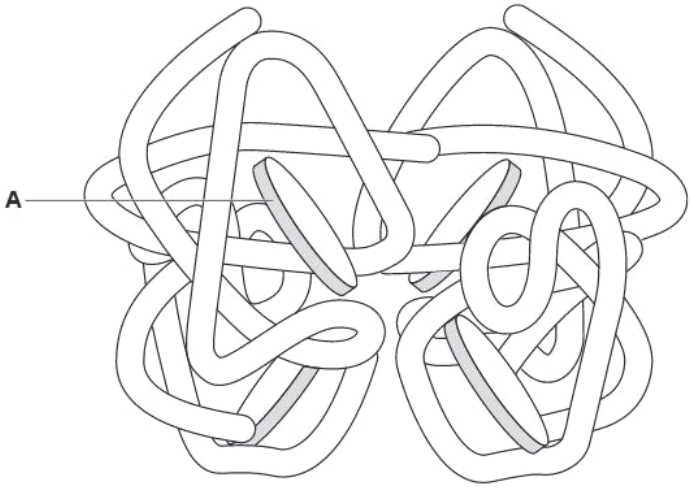


Fig. 2.1

(a) (i) Name **A** and state its role.

name .....

role .....

.....

.....[3]

(ii) With reference to Fig. 2.1, explain why a molecule of haemoglobin is said to show **both** tertiary structure and quaternary structure.

.....

.....

.....

.....

.....[2]

Fig. 2.2 shows the oxygen haemoglobin dissociation curve when the partial pressure of carbon dioxide is very low.

www.youtube.com/megalecture
MEGA LECTURE
www.megalecture.com

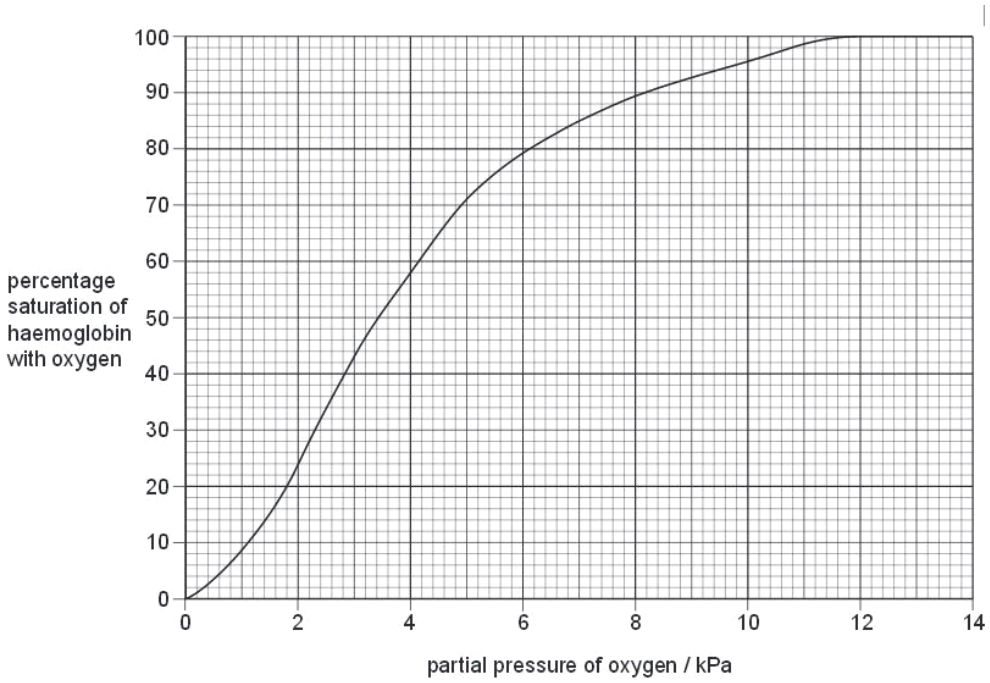


Fig. 2.2

(b) With reference to Fig. 2.2,

(i) state the percentage saturation of haemoglobin with oxygen at

4 kPa ..... %

12 kPa ..... % [2]

(ii) explain how the shape of the curve between 6 kPa and 2 kPa helps in the delivery of oxygen to respiring tissues.

.....

.....

.....

.....

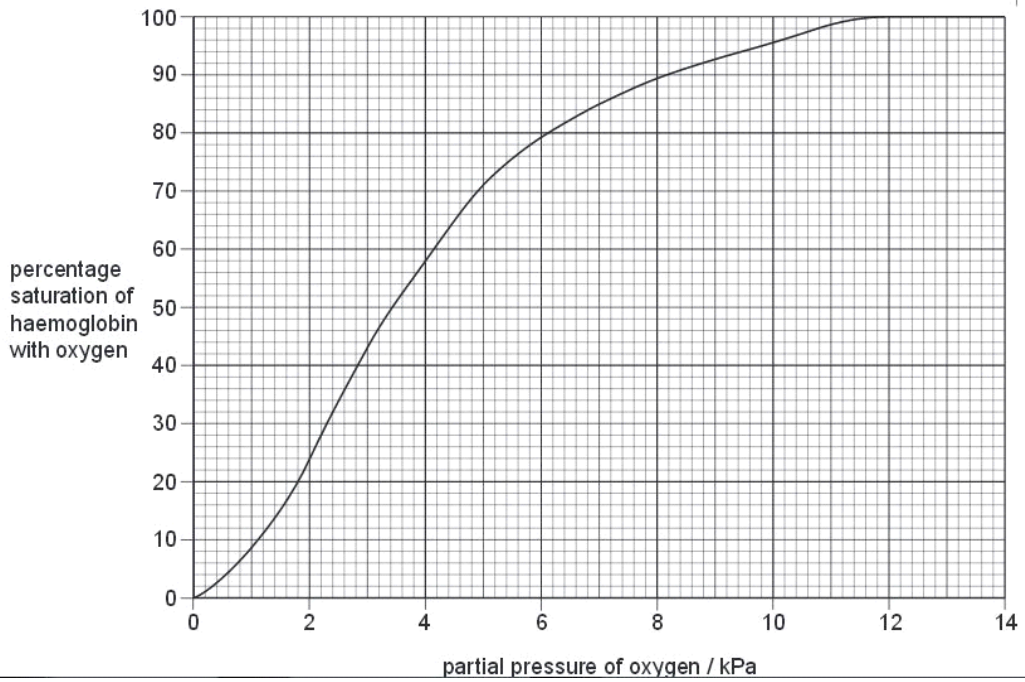
.....

.....

.....[4]

www.youtube.com/megalecture
MEGA LECTURE
www.megalecture.com

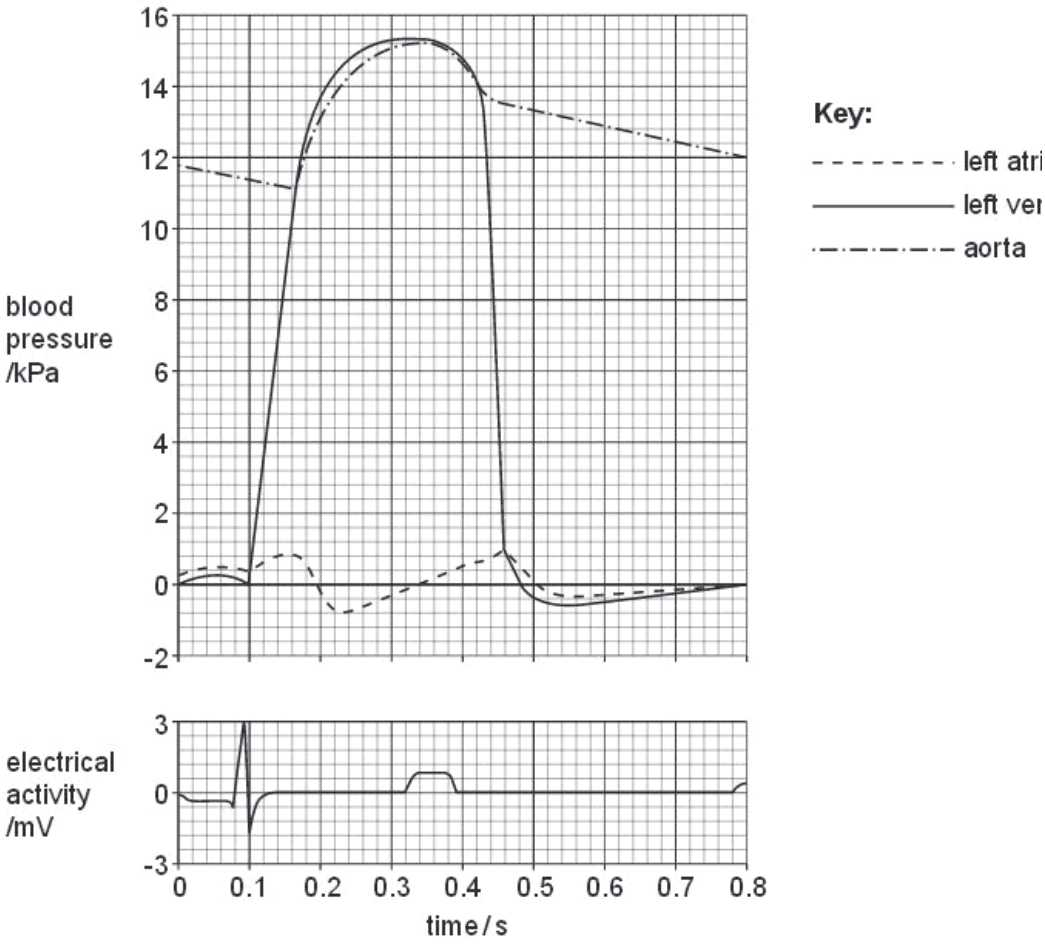
(c) **Sketch on** Fig. 2.3 below the dissociation curve that you would expect if the concentration of carbon dioxide is increased. [2]



Q22.

4 Fig. 4.1 shows the changes in blood pressure in the left atrium, left ventricle and aorta during one complete contraction of the heart. It also shows a recording of the electrical activity of the heart.

www.youtube.com/megalecture
MEGA LECTURE
www.megalecture.com



(a) Name the source of the electrical activity in the heart.

.....[1]

www.youtube.com/megalecture
MEGA LECTURE
www.megalecture.com

(b) Explain how the heart is coordinated so that the ventricle contracts after the atrium has contracted.

.....

.....

.....

.....

.....

.....

.....

..... **[4]**

(c) With reference to Fig. 4.1, calculate the heart rate in beats per minute. Show your working and express your answer to the nearest whole number.

Answer = ... beats min^{-1} [2]

(d) The pressure in the **right ventricle** is rarely higher than 4.0 kPa.

Explain why the pressure in the right ventricle is much lower than that in the left ventricle.

.....

.....

.....

.....[2]

[Total: 9]

Q23.

www.youtube.com/megalecture
MEGA LECTURE
www.megalecture.com

Online Classes : Megalecture@gmail.com
www.youtube.com/megalecture
www.megalecture.com

4 **(a)** Mammals have a closed, double circulation.

State what is meant by the term *double circulation*.

.....

..... [1]

Fig. 4.1 shows part of the circulation in a mammalian tissue. The central part is enlarged to show a capillary, a cell supplied by the capillary, and vessel **Z.**

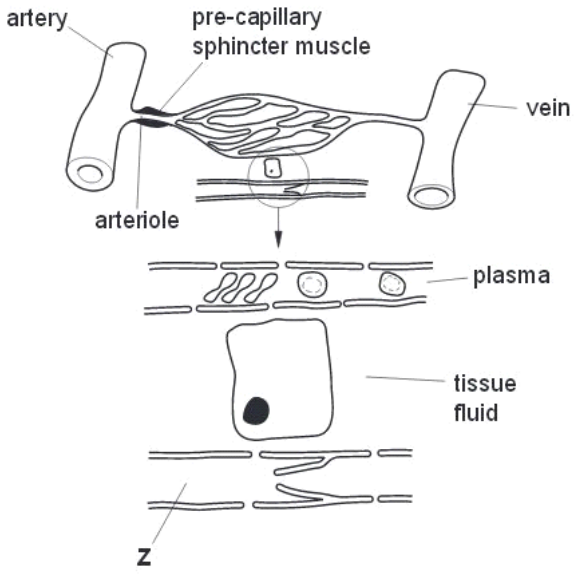


Fig. 4.1

(b) Explain why the wall of the artery is thicker than the wall of the vein.

.....

.....

.....

..... [2]

(c) Suggest one role for the pre-capillary sphincter muscle shown in Fig. 4.1.

.....

..... [1]

www.youtube.com/megalecture
MEGA LECTURE
www.megalecture.com

(d) With reference to Fig. 4.1, describe the role of capillaries in forming tissue fluid.

For Examiner's Use

.....

.....

.....

.....

.....

..... [3]

(e) **(i)** Describe three ways in which plasma differs from tissue fluid.

1. .....

.....

2. .....

.....

3. .....

..... [3]

(ii) Name the fluid in vessel **Z**.

..... [1]

[Total: 11]

Q24.

www.youtube.com/megalecture
MEGA LECTURE
www.megalecture.com

Online Classes : Megalecture@gmail.com
www.youtube.com/megalecture
www.megalecture.com

(c) Fig. 2.1 shows a cross section of a coronary artery partially blocked by plaque causing atherosclerosis.

For Examiner's Use

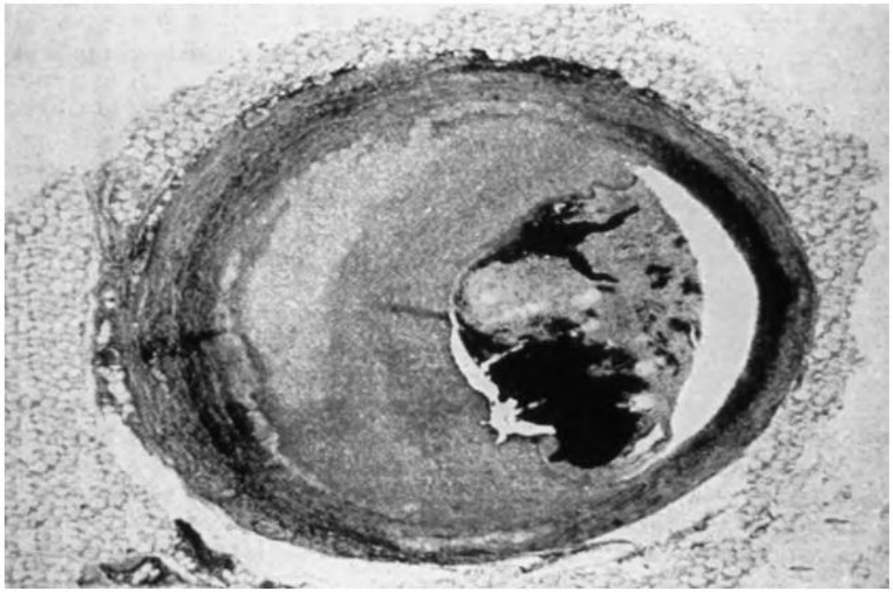


Fig. 2.1

Explain why atherosclerosis in coronary arteries may limit the ability of people to take vigorous exercise.

.....

.....

.....

.....

.....

.....[3]

www.youtube.com/megalecture
MEGA LECTURE
www.megalecture.com

(d) Describe the effects of nicotine and carbon monoxide in cigarette smoke on the cardiovascular system.

For Examiner's Use

nicotine .....

.....

.....

.....

.....

.....

carbon monoxide .....

.....

.....

.....

.....

.....[3]

[Total: 13]

Q25.

Red blood cells each contain about 240 million molecules of haemoglobin that transport oxygen and carbon dioxide.

E

(c) Describe the role of haemoglobin in the **transport** of oxygen and carbon dioxide.

oxygen .....

.....

.....

.....

carbon dioxide .....

.....

.....

.....[4]

www.youtube.com/megalecture
MEGA LECTURE
www.megalecture.com

(d) The haematocrit is the proportion of the blood that is composed of red blood cells. Samples of blood were taken from an athlete who lived at sea level since birth and moved to live and train at an altitude of 5000 m for three weeks. The haematocrit and the number of red blood cells per mm^3 were determined before moving to high altitude and after three weeks at that altitude. The results are shown in Table 3.2.

Table 3.2

altitude	haematocrit	number of red blood cells × 10^6 per mm^3
sea level	0.45	6.1
5000 m (after three weeks)	0.53	7.3

(i) Calculate the percentage increase in the number of red blood cells per mm^3 after three weeks at 5000 m. Show your working.

Answer = ... % [2]

(ii) Explain why the haematocrit increases at altitude.

.....

.....

.....

.....

.....

.....[3]

Q26.

www.youtube.com/megalecture
MEGA LECTURE
www.megalecture.com

Online Classes : Megalecture@gmail.com
www.youtube.com/megalecture
www.megalecture.com

2 **(a)** Describe the function of each of the following structures in the human heart:

(i) sinoatrial node (SAN)

.....

.....

..... [2]

(ii) atrioventricular node (AVN)

.....

.....

..... [2]

(iii) left atrioventricular (bicuspid) valve.

.....

.....

.....

..... [2]

(b) Fig. 2.1 shows the changes in blood pressure in the left atrium, left ventricle and aorta during one complete cardiac cycle.

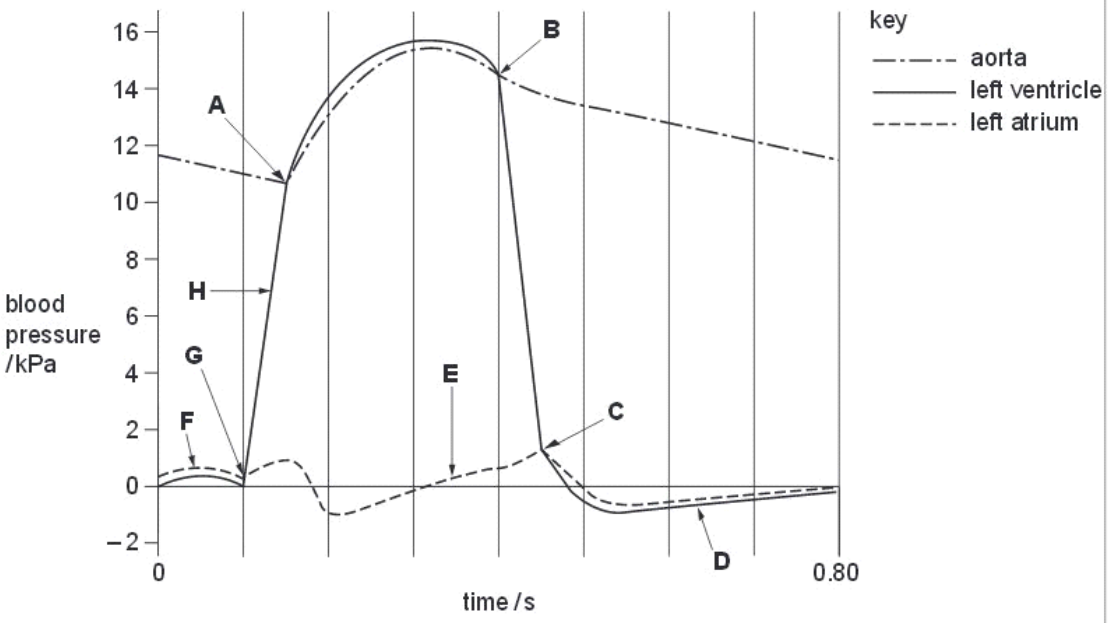


Fig. 2.1

www.youtube.com/megalecture
MEGA LECTURE
www.megalecture.com

Complete the table below using the appropriate letter, **A** to **H**, to match the points from the graph to the correct statement.

You must only put one letter in each box. You may use each letter once, more than once or not at all.

statement	letter
left atrioventricular (bicuspid) valve starting to open	
left atrioventricular (bicuspid) valve starting to close	
left ventricle starting to contract	
minimum blood remaining in left ventricle	

[4]

[Total: 10]

Q27.

5 Mammals have closed, double circulatory systems.

(a) Explain what are meant by the terms *closed* and *double* as applied to mammalian circulatory systems.

closed .....

.....

.....

double .....

.....

.....[2]

www.youtube.com/megalecture
MEGA LECTURE
www.megalecture.com

Fig. 5.1 shows a longitudinal section through a mammalian heart.

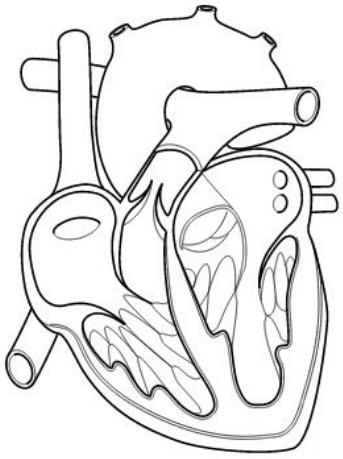


Fig. 5.1

(b) Use label lines and the letters **P**, **Q**, **R** and **S** to label the following on Fig. 5.1:

P the right atrium

Q a semilunar valve

R a blood vessel that carries deoxygenated blood

S the position of Purkyne tissue [4]

www.youtube.com/megalecture
MEGA LECTURE
www.megalecture.com

Catheters are small tubes that are inserted into blood vessels. A catheter was inserted into an artery in the arm and then moved into the aorta and then into the left ventricle during a diagnostic investigation. The catheter contained a device to measure the blood pressure in the aorta and in the left ventricle. The results are shown in Fig. 5.2.

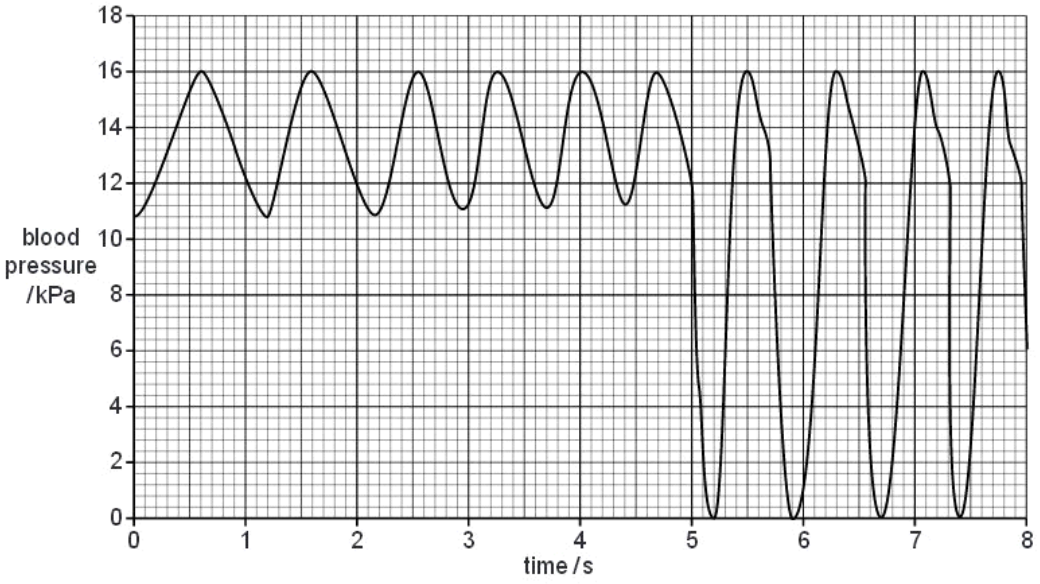


Fig. 5.2

(c) (i) Calculate the heart rate during the period of the investigation.

Show your working.

answer .....[2]

(ii) Describe **and** explain the differences in pressure as the catheter moves from the aorta into the left ventricle.

.....

.....

.....

.....

.....

.....

.....

.....[4]

www.youtube.com/megalecture
MEGA LECTURE
www.megalecture.com

Fig. 5.3 is an X-ray showing narrowing in the blood vessels supplying muscles in the heart. A catheter is used to insert a dye into the blood vessels so that they appear clearly in the X-ray. The arrows indicate where there is narrowing of the blood vessels.

For Examiner Use

Fig. 5.3

(d) (i) Name the blood vessels shown in Fig. 5.3.

.....[1]

(ii) State the likely effect of narrowing of these blood vessels.

.....[1]

(e) Suggest ways in which the condition shown in Fig. 5.3 may be treated.

.....

.....

.....

.....[2]

[Total: 16]

Q28.

www.youtube.com/megalecture
MEGA LECTURE
www.megalecture.com

Online Classes : Megalecture@gmail.com
www.youtube.com/megalecture
www.megalecture.com

6 Coronary artery bypass grafting is the most common heart operation in the world.

For Examiner Use

Fig. 6.1 is a diagram of a coronary bypass. The graft is a section of a healthy blood vessel. The blood vessel used in Fig. 6.1 is the internal mammary artery. It is a common choice for surgeons as it is quite resistant to arteriosclerosis.

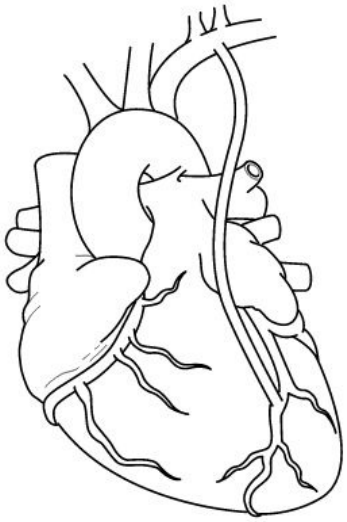


Fig. 6.1

(a) Use label lines and the following letters to label the following on Fig. 6.1:

A aorta
B coronary artery
C internal mammary artery
D pulmonary artery
E right atrium
F vena cava [3]

(b) On Fig. 6.1, mark with an **X**, the diseased area of the coronary artery for which the surgery has been performed. [1]

www.youtube.com/megalecture
MEGA LECTURE
www.megalecture.com

(c) With reference to coronary heart bypass surgery, discuss the difficulties in achieving a balance between prevention and cure.

.....

.....

.....

.....

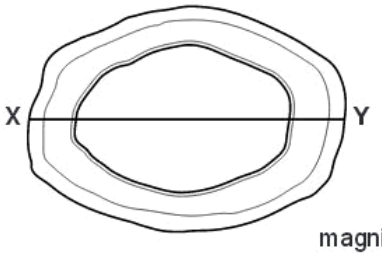
.....

..... [3]

[Total: 7]

Q29.

1 Fig. 1.1 is a diagram of a transverse section through a vein.



magnification × 35

Fig. 1.1

(a) Calculate the actual diameter of the vein marked by the line **X–Y**.

Show your working and give your answer in millimetres (mm).

answer ..... mm [2]

www.youtube.com/megalecture
MEGA LECTURE
www.megalecture.com

(b) The presence of a valve would help to confirm that the blood vessel in Fig. 1.1 is a vein and not an artery.

Describe three structural features of the blood vessel shown in Fig. 1.1 that would help to identify it as a vein and **not** as an artery.

1. .....

.....

.....

2. .....

.....

.....

3. .....

.....

.....[3]

(c) Explain how the following structural features of a capillary are related to its function.

(i) The capillary wall is composed of a single layer of squamous epithelial cells.

.....

.....[1]

(ii) The diameter of the capillary lumen is approximately 8 μm.

.....

.....[1]

Q30.

www.youtube.com/megalecture
MEGA LECTURE
www.megalecture.com

4 Fig. 4.1 is a diagram of a section through a mammalian heart.

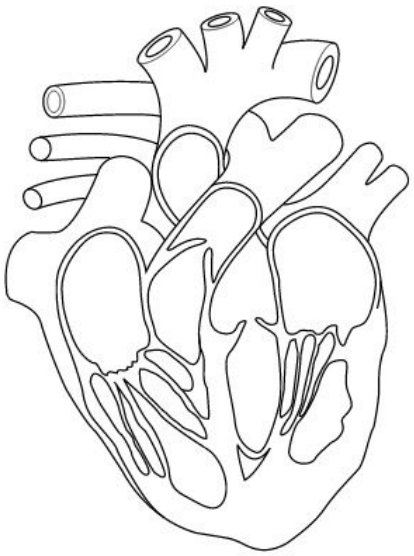


Fig. 4.1

(a) Use a label line and the appropriate letter to label each of the following on Fig. 4.1:

W right atrium

X tricuspid valve

Y aorta.

[3]

(b) Starting from the left ventricle, describe the route taken by the blood as it travels to the lungs.

.....

.....

.....

.....

.....

.....

..... [3]

www.youtube.com/megalecture
MEGA LECTURE
www.megalecture.com

(c) Describe **and** explain how the structure of the human **gas exchange surface** is adapted for maximum efficiency.

For Examiner's Use

.....

.....

.....

.....

.....

.....

.....

.....

.....

..... **[4]**

[Total: 10]

Q31.

(b) Nicotine has an effect on the cardiovascular system, such as making platelets sticky, so causing blood to clot. This increases the risk of thrombosis and reduces blood flow.

Outline **other** effects of nicotine on the cardiovascular system.

.....

.....

.....

.....

.....

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

www.youtube.com/megalecture
MEGA LECTURE
www.megalecture.com