

Cambridge International AS & A Level

# BIOLOGY (9700) P1

TOPIC WISE QUESTIONS + ANSWERS | COMPLETE SYLLABUS



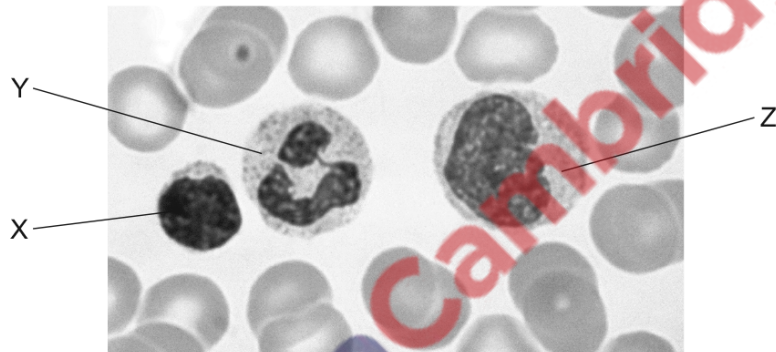
## Chapter 8

# Transport in mammals

### 8.1 The circulatory system

1114. 9700\_m20\_qp\_12 Q: 28

The photomicrograph shows three white blood cells labelled X, Y and Z.



Which row correctly identifies these cells?

	cell X	cell Y	cell Z
<b>A</b>	lymphocyte	monocyte	neutrophil
<b>B</b>	lymphocyte	neutrophil	monocyte
<b>C</b>	monocyte	neutrophil	lymphocyte
<b>D</b>	neutrophil	monocyte	lymphocyte

1115. 9700\_m20\_qp\_12 Q: 29

Which row correctly identifies the locations in which a type of molecule or cell is present?

	type of molecule or cell	blood	lymph	tissue fluid
<b>A</b>	antibody	✓	✓	✓
<b>B</b>	large plasma protein	✓	x	✓
<b>C</b>	lymphocyte	✓	✓	x
<b>D</b>	phagocyte	x	✓	✓

key

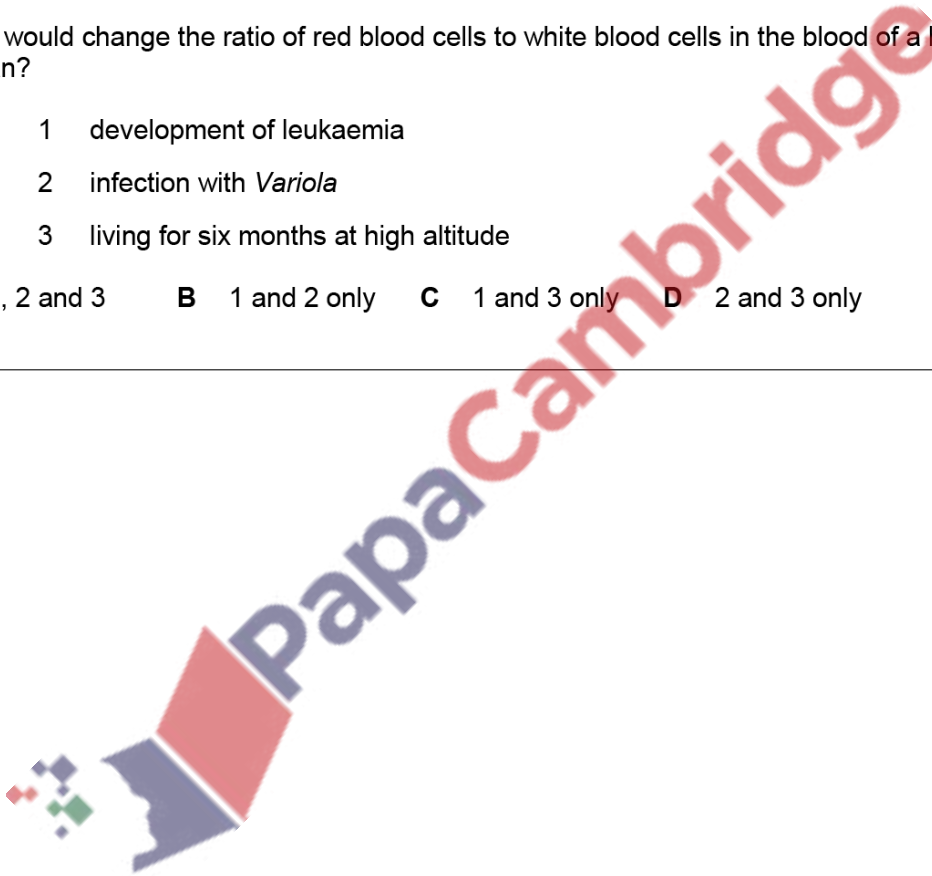
✓ = present

x = not present

1116. 9700\_m20\_qp\_12 Q: 31

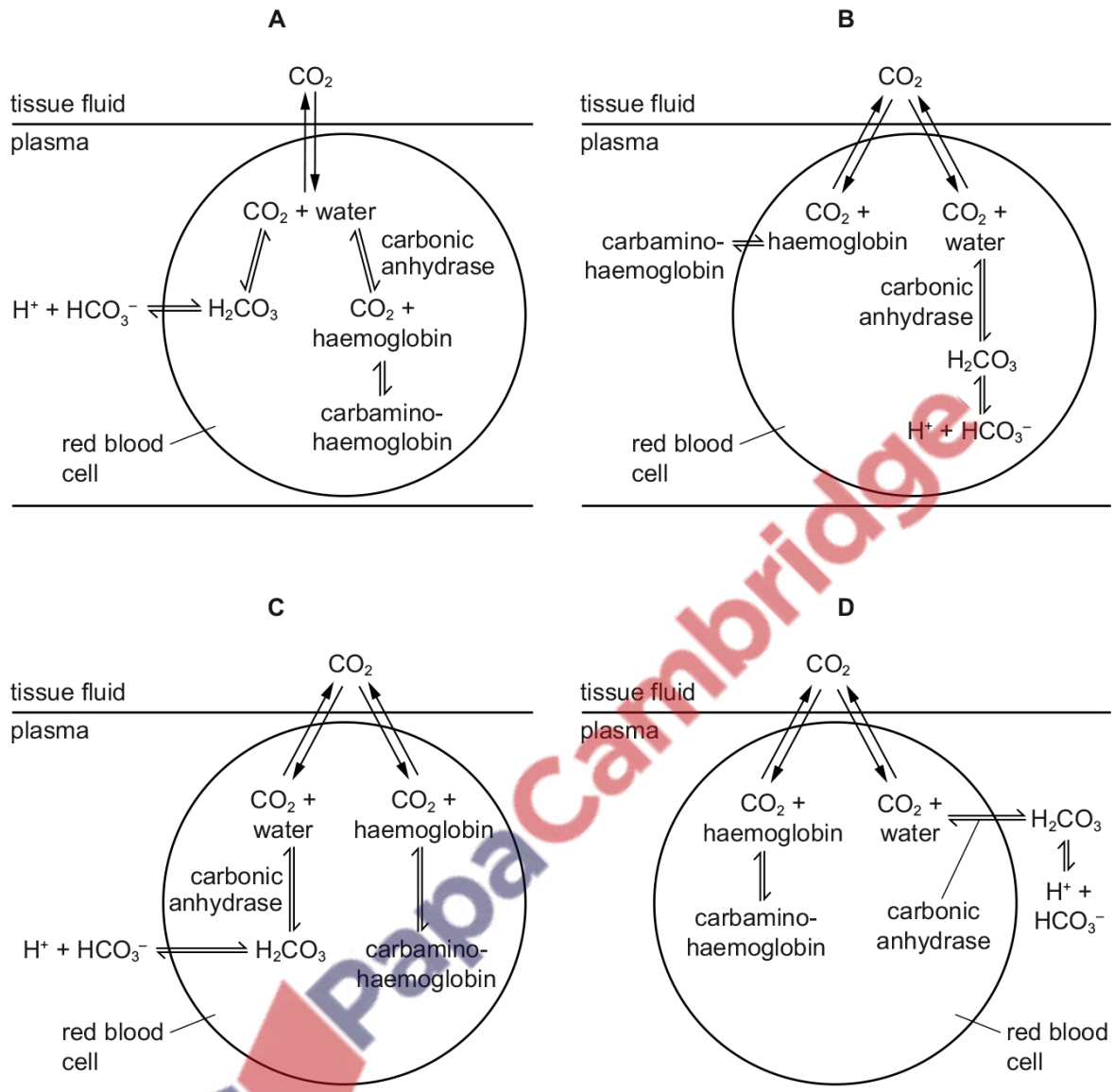
What would change the ratio of red blood cells to white blood cells in the blood of a healthy human?

- 1 development of leukaemia
- 2 infection with *Variola*
- 3 living for six months at high altitude

**A** 1, 2 and 3    **B** 1 and 2 only    **C** 1 and 3 only    **D** 2 and 3 only


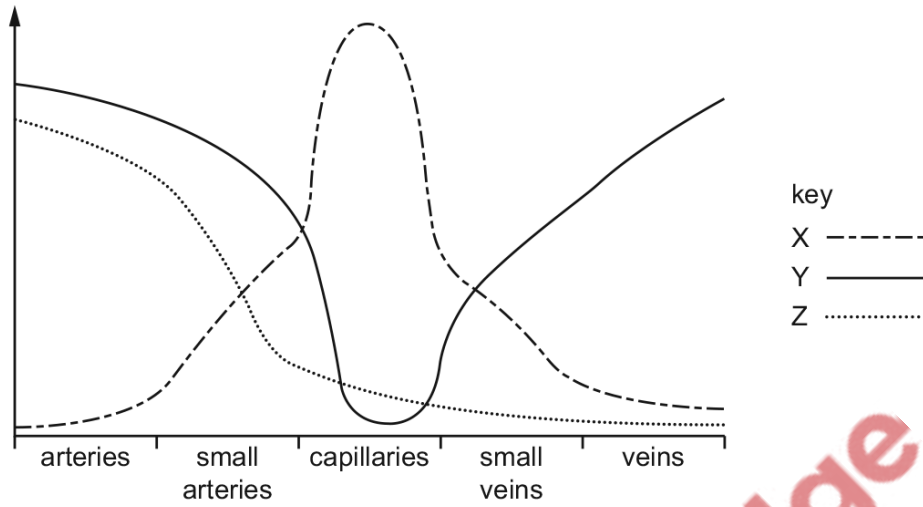
1117. 9700\_s20\_qp\_11 Q: 32

Which diagram shows the events that occur during transport of carbon dioxide by the blood?



1118. 9700\_s20\_qp\_12 Q: 29

The graph represents data on blood vessels and blood flow.



Which row correctly identifies the curves?

	speed of blood flow	pressure of blood	total cross-sectional area
<b>A</b>	X	Y	Z
<b>B</b>	X	Z	Y
<b>C</b>	Y	Z	X
<b>D</b>	Z	X	Y

1119. 9700\_s20\_qp\_12 Q: 30

Which components of blood are present in lymph?

	white blood cells	proteins	sodium ions
<b>A</b>	✓	✓	✓
<b>B</b>	✓	x	✓
<b>C</b>	x	✓	✓
<b>D</b>	x	✓	x

key  
✓ = present  
x = not present

1120. 9700\_s20\_qp\_12 Q: 31

What correctly describes the significance of the increase of the red blood cell count of humans who move from living at low altitude to high altitude?

- A** After a few weeks at high altitude, the number of red blood cells increases to compensate for the lower availability of oxygen in the air.
  - B** At high altitude, the bone marrow produces more red blood cells to provide binding sites for the increased number of oxygen molecules available.
  - C** At high concentrations of oxygen in the blood, a cytokine stimulates the production of red blood cells to increase the oxygen-carrying capacity of the blood.
  - D** After only a few days at high altitude the number of red blood cells increases considerably to compensate for the lower availability of oxygen in the air.
- 

1121. 9700\_s20\_qp\_13 Q: 28

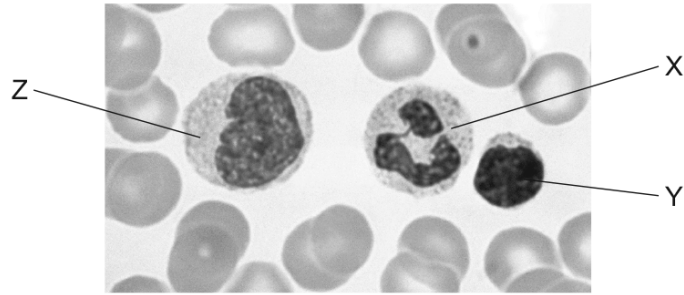
Which statements about blood vessels are correct?

- 1 Collagen fibres in the walls of arteries and veins prevent overstretching.
  - 2 Elastic fibres in large arteries allow stretching during ventricular systole.
  - 3 Smooth muscle in arteries controls the distribution of blood to different parts of the body.
  - 4 Veins have valves because their walls are thin.
- A** 1, 2, 3 and 4
  - B** 1, 2 and 3 only
  - C** 2 and 4 only
  - D** 3 and 4 only
- 



1122. 9700\_s20\_qp\_13 Q: 29

The photomicrograph shows three white blood cells labelled X, Y and Z.



Which row correctly identifies these cells?

	cell X	cell Y	cell Z
<b>A</b>	lymphocyte	neutrophil	monocyte
<b>B</b>	lymphocyte	monocyte	neutrophil
<b>C</b>	monocyte	lymphocyte	neutrophil
<b>D</b>	neutrophil	lymphocyte	monocyte

1123. 9700\_s20\_qp\_13 Q: 30

The enzyme carbonic anhydrase catalyses the reaction:



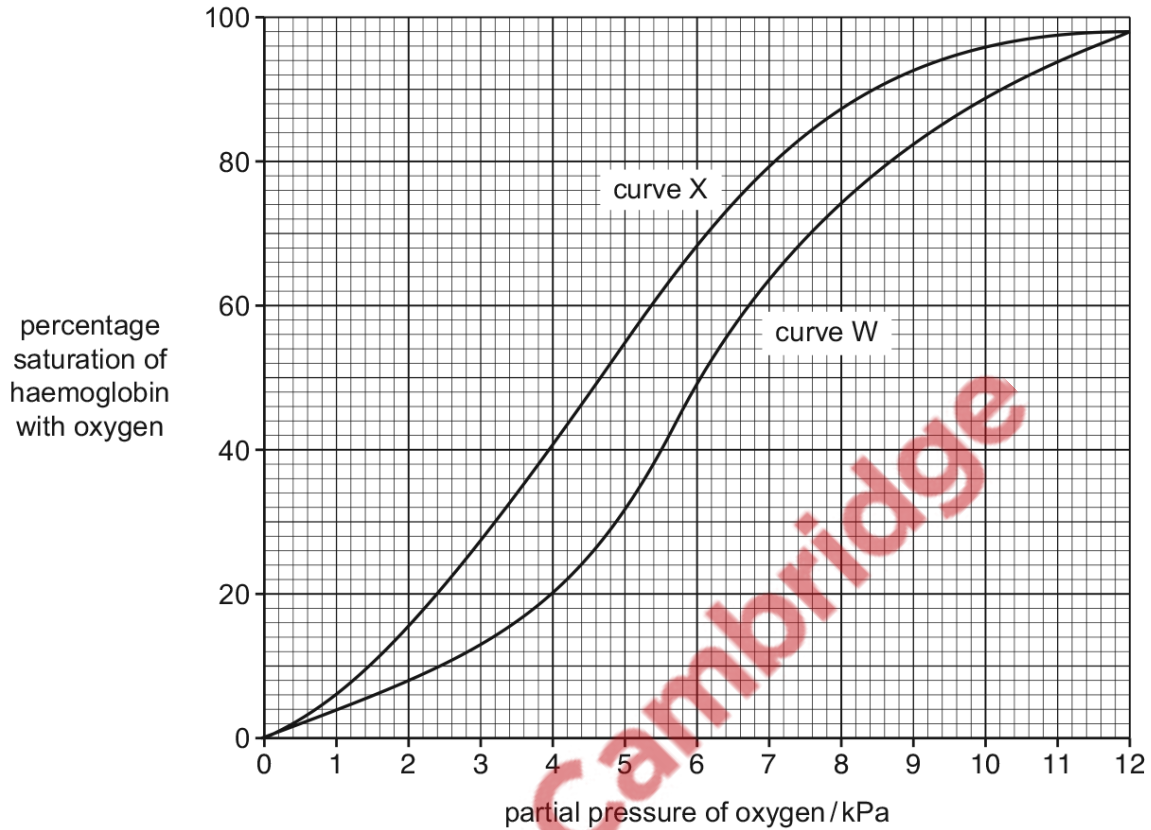
Which statements describe the role of the enzyme carbonic anhydrase?

- 1 to speed up the decrease in pH of blood in the presence of carbon dioxide
- 2 to facilitate the Bohr effect in haemoglobin
- 3 to speed up the reaction between carbon dioxide and water

**A** 1, 2 and 3      **B** 1 only      **C** 2 only      **D** 3 only

1124. 9700\_s20\_qp\_13 Q: 31

The graph shows the oxygen dissociation curves of adult haemoglobin at two partial pressures of carbon dioxide W and X.



Which pair of statements are correct?

- 1 Curve W shows the oxygen dissociation curve at a higher concentration of carbon dioxide than curve X.
- 2 Curve X shows the oxygen dissociation curve at a higher concentration of carbon dioxide than curve W.
- 3 At a partial pressure of oxygen of 7.0 kPa the haemoglobin from curve W has a higher affinity for oxygen than haemoglobin from curve X.
- 4 At a partial pressure of oxygen of 7.0 kPa the haemoglobin from curve X has a higher affinity for oxygen than haemoglobin from curve W.

**A** 1 and 3

**B** 1 and 4

**C** 2 and 3

**D** 2 and 4



1125. 9700\_s20\_qp\_13 Q: 32

A person has two blood tests one month apart. The number of each type of cell in a fixed sample size is counted.

type of cell	first test	after one month
red blood cells	normal	higher
lymphocytes	normal	higher

What could this suggest about the person based on the results after one month?

	body temperature higher	moved to higher altitude	ATP synthesis in cells is higher
<b>A</b>	no	no	yes
<b>B</b>	no	yes	no
<b>C</b>	yes	no	no
<b>D</b>	yes	yes	yes

1126. 9700\_w20\_qp\_11 Q: 28

Which are present in the walls of capillaries?

	endothelium	smooth muscle	elastic tissue	collagen fibres
<b>A</b>	✓	x	x	x
<b>B</b>	✓	x	x	✓
<b>C</b>	x	✓	x	✓
<b>D</b>	x	✓	✓	x

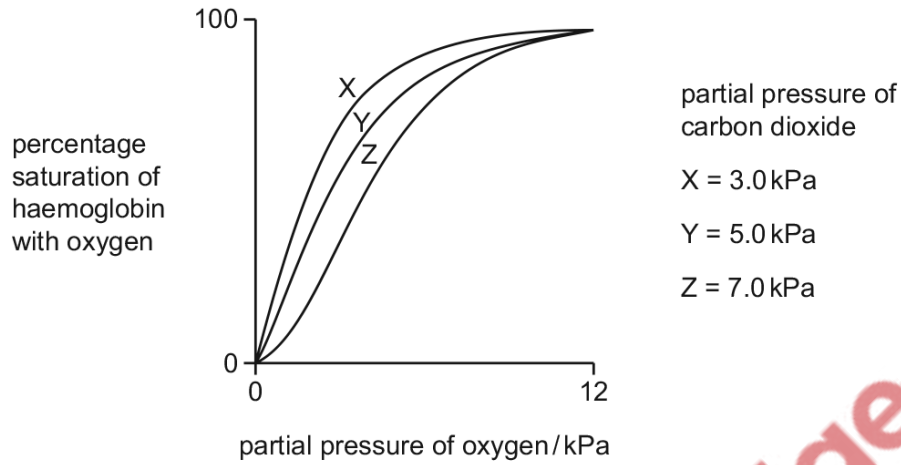
key

✓ = present

x = not present

1127. 9700\_w20\_qp\_11 Q: 31

The graph shows the effect of three different partial pressures of carbon dioxide on the oxygen dissociation curve for human haemoglobin.



What effect does decreasing the partial pressure of carbon dioxide have on haemoglobin?

- A It is less efficient at taking up oxygen and less efficient at releasing oxygen.
- B It is less efficient at taking up oxygen and more efficient at releasing oxygen.
- C It is more efficient at taking up oxygen and less efficient at releasing oxygen.
- D It is more efficient at taking up oxygen and more efficient at releasing oxygen.

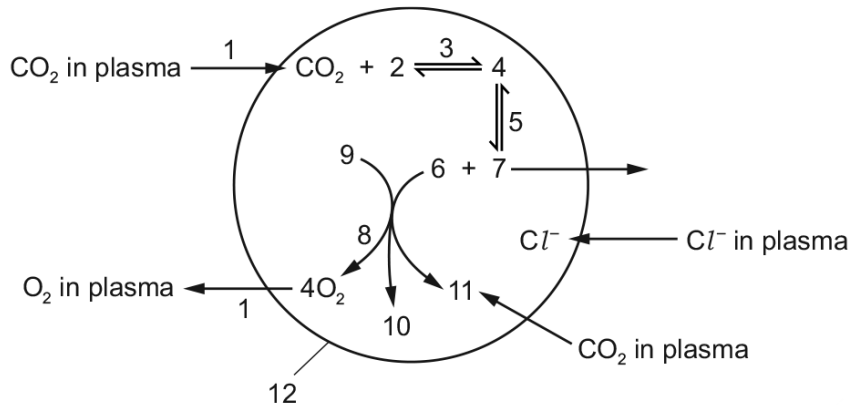
1128. 9700\_w20\_qp\_12 Q: 27

Why is the mammalian circulatory system described as a double circulation?

- A Blood flows twice through the heart in one complete cardiac cycle.
- B Blood flows twice through the heart in one complete circuit of the body.
- C Blood remains within arteries, capillaries and veins.
- D Blood transports both oxygen and carbon dioxide.

1129. 9700\_w20\_qp\_12 Q: 30

The diagram is a summary of the role of haemoglobin in the transport of carbon dioxide.

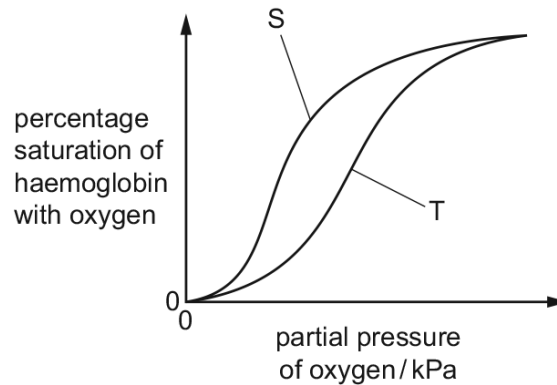


Which set of labels is correct?

- A 1 = facilitated diffusion, 4 = carbonic acid, 7 = hydrogencarbonate ions
- B 2 = water, 8 = dissociation, 10 = carbaminohaemoglobin
- C 3 = carbonic anhydrase, 9 = oxyhaemoglobin, 11 = carbaminohaemoglobin
- D 5 = carbonic anhydrase, 6 = hydrogen ions, 12 = red blood cell

1130. 9700\_w20\_qp\_12 Q: 31

The graph shows the oxygen dissociation curves of haemoglobin from two species of mammal, S and T.



Which statements could explain the difference in the oxygen dissociation curves of species S and species T?

- 1 Species T has a lower haemoglobin concentration in its red blood cells than species S.
- 2 The haemoglobin in species T has a lower affinity for oxygen than the haemoglobin in species S.
- 3 Species T lives at higher altitudes than species S.

**A** 1, 2 and 3    **B** 1 and 2 only    **C** 2 only    **D** 3 only

1131. 9700\_w20\_qp\_13 Q: 28

Which are present in the walls of veins?

	endothelium	smooth muscle	elastic tissue	collagen fibres
<b>A</b>	✓	✗	✓	✓
<b>B</b>	✗	✓	✗	✓
<b>C</b>	✓	✓	✓	✗
<b>D</b>	✓	✓	✓	✓

key  
✓ = present  
✗ = not present

1132. 9700\_w20\_qp\_13 Q: 30

What effect does decreasing carbon dioxide concentration have on haemoglobin?

- A** It is less efficient at taking up oxygen and less efficient at releasing oxygen.
- B** It is less efficient at taking up oxygen and more efficient at releasing oxygen.
- C** It is more efficient at taking up oxygen and less efficient at releasing oxygen.
- D** It is more efficient at taking up oxygen and more efficient at releasing oxygen.

1133. 9700\_w20\_qp\_13 Q: 31

Why does the red blood cell count increase in humans as they start living at high altitude?

- A** to allow more carbon dioxide to be excreted by the lungs, preventing a fall in blood pH
- B** to allow more oxygen to be taken up by the haemoglobin as the partial pressure of oxygen is lower
- C** to allow more oxygen to be taken up by the lungs as there is a lower percentage of oxygen in the air
- D** to allow more oxygen to be transported as the affinity of haemoglobin for oxygen is lowered

1134. 9700\_m19\_qp\_12 Q: 29

Which row correctly identifies the locations in which a type of molecule or cell can be present?

	type of molecule or cell	blood	lymph	tissue fluid
<b>A</b>	antigens	✓	x	x
<b>B</b>	glucose	✓	x	✓
<b>C</b>	lymphocyte	x	✓	✓
<b>D</b>	neutrophil	✓	✓	✓

key

✓ = can be present

x = cannot be present

1135. 9700\_m19\_qp\_12 Q: 30

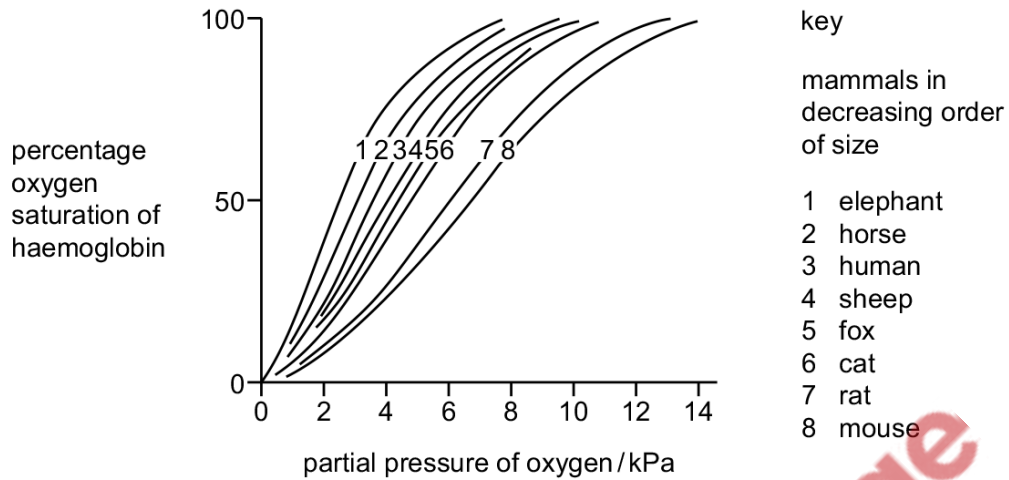
Which statements about the formation of haemoglobin acid are correct?

- 1 It is linked to the action of carbonic anhydrase.
- 2 It prevents blood from becoming too acidic by removing excess hydrogen ions.
- 3 It can only occur when oxygen associates with haemoglobin.

- A** 1, 2 and 3
- B** 1 and 2 only
- C** 1 only
- D** 2 and 3 only

1136. 9700\_m19\_qp\_12 Q: 31

The graph shows the oxygen dissociation curves of haemoglobin for eight species of mammal.



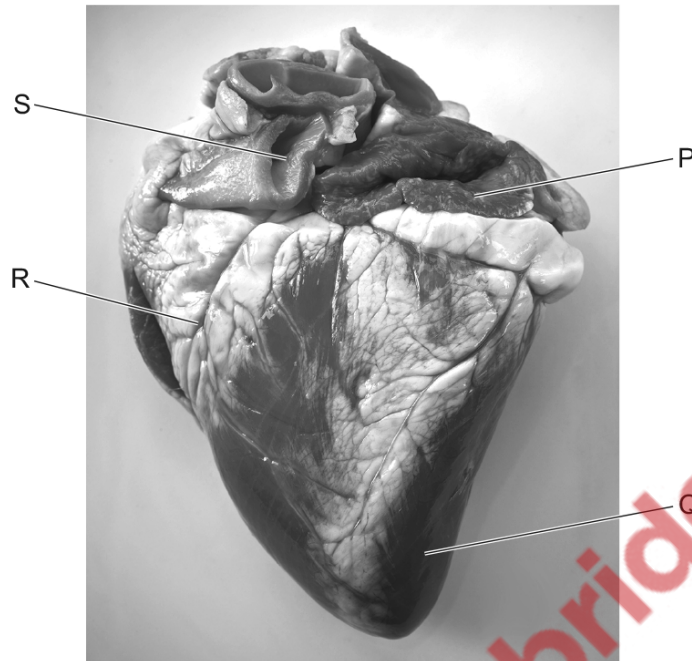
Which conclusion is consistent with the data shown in the graph?

- A The haemoglobin of larger mammals will combine with oxygen at a lower partial pressure of oxygen than that of smaller mammals.
- B The haemoglobin of larger mammals will release oxygen at a higher partial pressure of oxygen than that of smaller mammals.
- C The metabolic activity of the mammal is directly proportional to the ability of its haemoglobin to release oxygen.
- D The size of the mammal is directly proportional to the ability of its haemoglobin to release oxygen.



1137. 9700\_s19\_qp\_11 Q: 30

The photograph shows an external view of the front of a mammalian heart.



Which row identifies the position of the structures labelled P, Q, R and S?

	P	Q	R	S
<b>A</b>	left atrium	cardiac muscle	Purkyne tissue	pulmonary vein
<b>B</b>	left atrium	left ventricle	coronary artery	vena cava
<b>C</b>	right atrium	cardiac muscle	Purkyne tissue	aorta
<b>D</b>	right atrium	right ventricle	coronary artery	pulmonary artery

1138. 9700\_s19\_qp\_11 Q: 32

Athletes often move from low altitude to high altitude to train for a race.

Which statements about the effect of training at high altitude are correct?

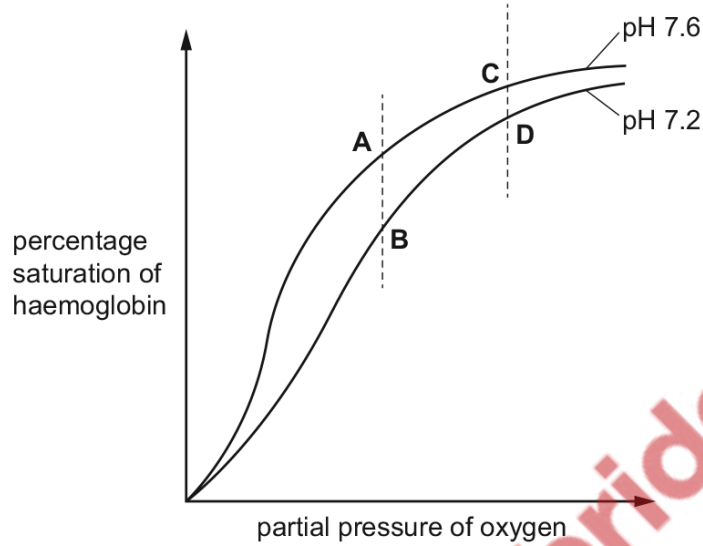
- 1 Higher concentrations of carbon dioxide stimulate greater oxygen dissociation.
- 2 Lower concentrations of oxygen stimulate the uptake of more oxygen by red blood cells.
- 3 Lower partial pressures of oxygen stimulate higher production of red blood cells.

**A** 1 and 2 only    **B** 2 and 3 only    **C** 1 only    **D** 3 only

1139. 9700\_s19\_qp\_11 Q: 33

The graph shows the oxygen haemoglobin dissociation curves at pH 7.6 and at pH 7.2.

Which point on the graph shows the percentage saturation of haemoglobin in the blood leaving an active muscle?



1140. 9700\_s19\_qp\_12 Q: 28

At a certain point in a cardiac cycle, the pressure in the right ventricle is lower than that in the right atrium and lower than that in the pulmonary artery.

Which row is correct?

	atrioventricular valve	semilunar valve
<b>A</b>	closed	closed
<b>B</b>	closed	open
<b>C</b>	open	closed
<b>D</b>	open	open



1141. 9700\_s19\_qp\_13 Q: 32

The table shows some information about three blood vessels, P, Q and R, from a mammal.

	diameter /mm	wall thickness /mm	percentage composition of wall		
			muscle	collagen	elastin
P	25	2	22	33	40
Q	20	1	25	40	25
R	4	1	35	25	30

Which row identifies blood vessels P, Q and R?

	P	Q	R
<b>A</b>	artery	vein	artery
<b>B</b>	artery	vein	capillary
<b>C</b>	vein	artery	capillary
<b>D</b>	vein	artery	vein

1142. 9700\_s19\_qp\_13 Q: 33

Which row correctly identifies the locations in which a type of molecule or cell is present?

	type of molecule or cell	blood	lymph	tissue fluid
<b>A</b>	antigen	✓	✓	✓
<b>B</b>	glucose	✓	x	✓
<b>C</b>	lymphocyte	x	✓	x
<b>D</b>	neutrophil	x	✓	✓

key

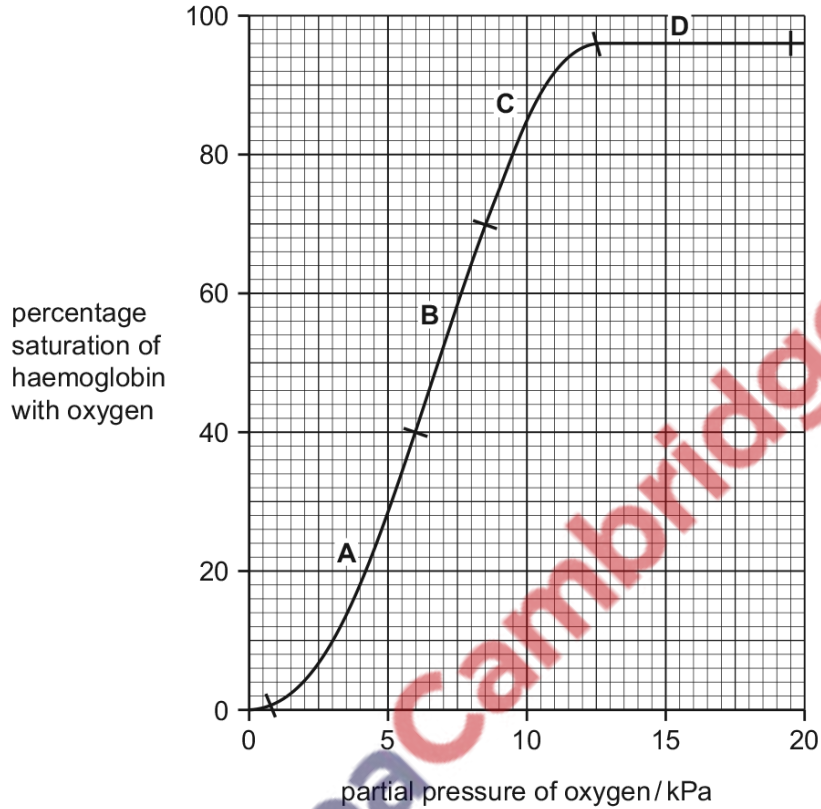
✓ = is present

x = is not present

1143. 9700\_s19\_qp\_13 Q: 34

The graph shows the percentage saturation of haemoglobin with oxygen at different partial pressures of oxygen.

Which range of partial pressures of oxygen results in the greatest change of percentage saturation of haemoglobin per kPa?



1144. 9700\_s19\_qp\_13 Q: 35

How many layers of cell surface membrane separate an oxygen molecule in the air space of an alveolus from the nearest haemoglobin molecule?

- A** 3      **B** 4      **C** 5      **D** 6

1145. 9700\_s19\_qp\_13 Q: 36

Which biochemical is formed and what happens to the oxygen dissociation curve of adult haemoglobin when carbon dioxide combines with haemoglobin?

	biochemical formed	oxygen dissociation curve
<b>A</b>	carbaminohaemoglobin	shifts to the left
<b>B</b>	carbaminohaemoglobin	shifts to the right
<b>C</b>	carboxyhaemoglobin	shifts to the left
<b>D</b>	carboxyhaemoglobin	shifts to the right

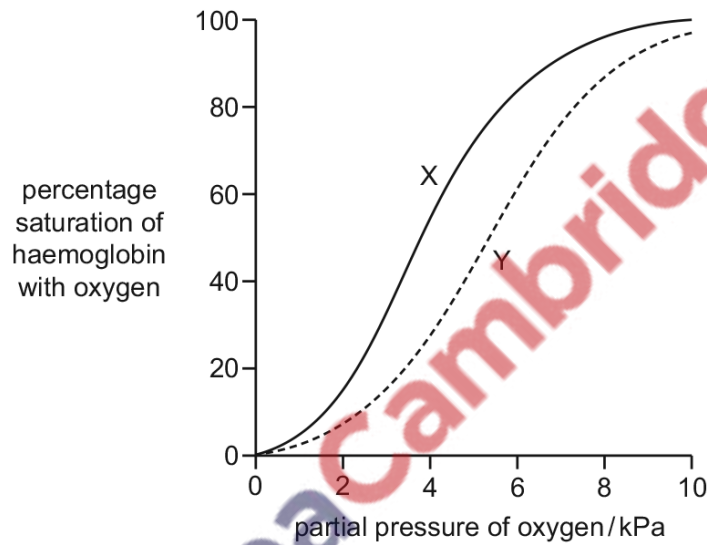
1146. 9700\_w19\_qp\_11 Q: 29

Which statement about oxygen combining with haemoglobin is correct?

- A All oxygen molecules which combine stop the haemoglobin molecule changing shape.
- B Four oxygen molecules can combine with each haem group.
- C The first oxygen molecule to combine does not affect the shape of haemoglobin.
- D The second oxygen molecule to combine makes it easier for the third to combine.

1147. 9700\_w19\_qp\_11 Q: 30

The diagram shows the Bohr effect.

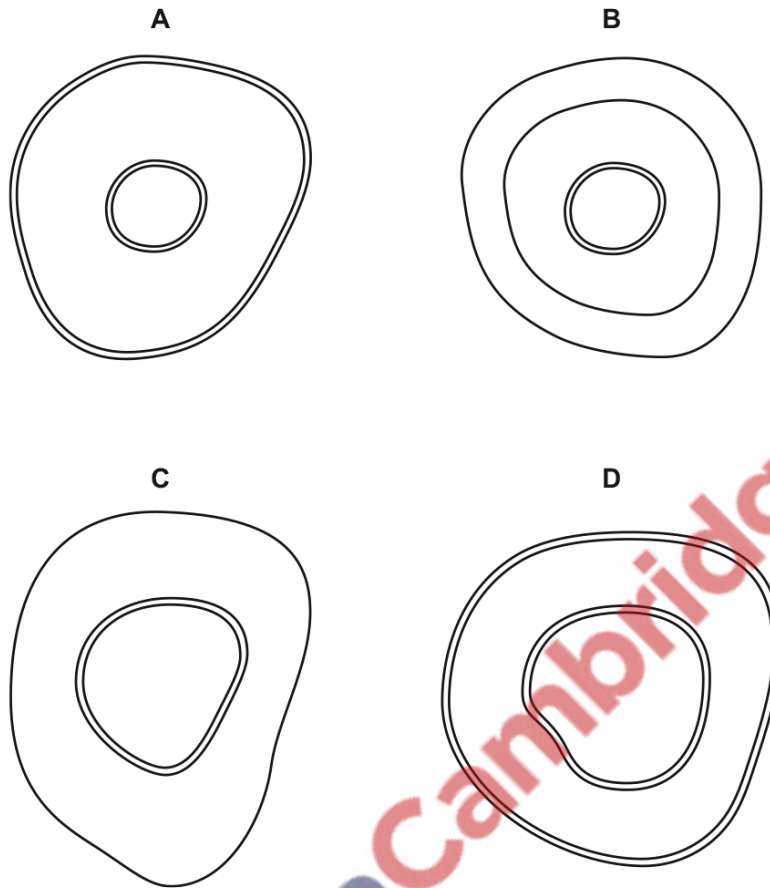


What causes the shift from X to Y?

- A decreased concentration of carbon dioxide and high pH
- B decreased concentration of carbon dioxide and low pH
- C increased concentration of carbon dioxide and high pH
- D increased concentration of carbon dioxide and low pH

1148. 9700\_w19\_qp\_11 Q: 31

Which plan diagram represents the tissues in a major vein?



1149. 9700\_w19\_qp\_11 Q: 32

Ventricular septal defect (VSD) is a heart defect that people can have from birth. People with VSD have a hole in the wall (septum) that separates the left and right ventricles.

What could happen in a person with VSD?

- 1 Blood will leak through the hole, mostly from right to left.
- 2 The volume of blood circulating through the lungs will be higher than in a person without VSD.
- 3 Less oxygen will be delivered to the body tissues.

**A** 1, 2 and 3    **B** 1 and 2 only    **C** 1 and 3 only    **D** 2 and 3 only

1150. 9700\_w19\_qp\_12 Q: 27

Which are present in the walls of arteries?

	endothelium	smooth muscle	elastic tissue	collagen fibres
<b>A</b>	✓	✓	✓	✓
<b>B</b>	✓	✓	✓	✗
<b>C</b>	✓	✗	✓	✓
<b>D</b>	✗	✓	✗	✓

key

✓ = present

✗ = not present

1151. 9700\_w19\_qp\_12 Q: 29

Which row correctly identifies the molecules or cells that are present in the different locations?

	type of molecule or cell	blood	lymph	tissue fluid
<b>A</b>	antibodies	✗	✓	✓
<b>B</b>	large plasma proteins	✓	✗	✓
<b>C</b>	lymphocytes	✓	✓	✗
<b>D</b>	phagocytes	✓	✓	✓

key

✓ = present

✗ = not present

1152. 9700\_w19\_qp\_12 Q: 30

When active tissues have high carbon dioxide concentrations, oxyhaemoglobin releases oxygen to these tissues.

What encourages this release in the presence of high concentrations of carbon dioxide?

- 1 carboxyhaemoglobin forms more readily
- 2 oxyhaemoglobin dissociates more readily
- 3 haemoglobin needs higher concentrations of oxygen to become saturated

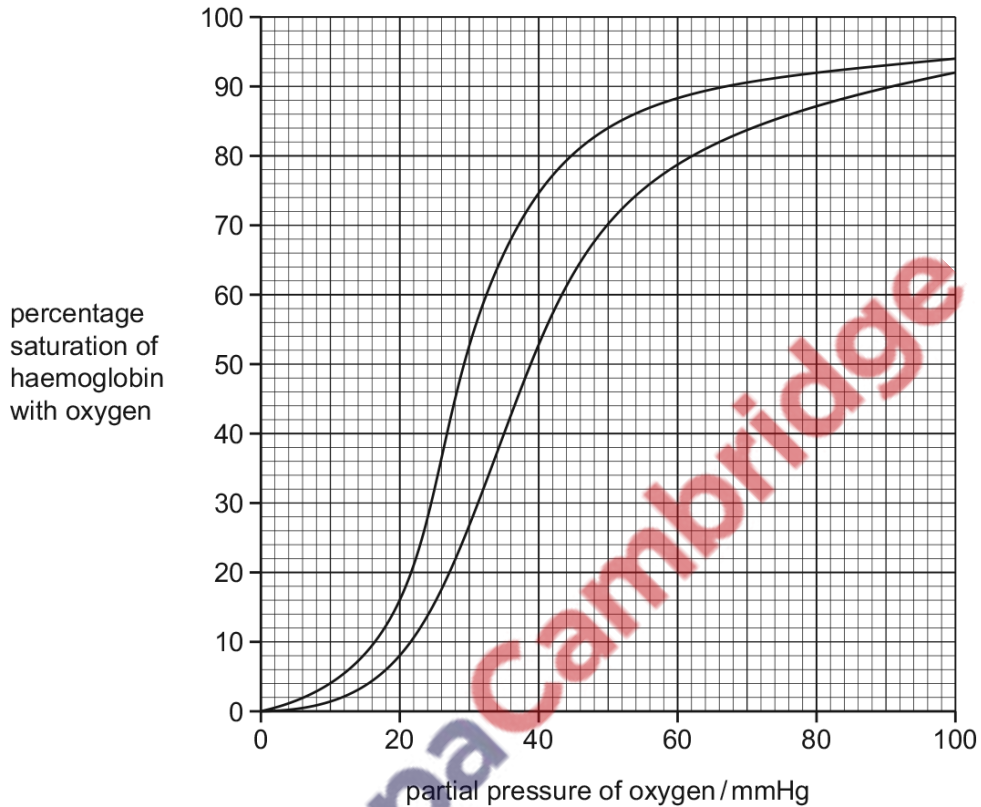
**A** 1, 2 and 3    **B** 1 and 2 only    **C** 1 and 3 only    **D** 2 and 3 only

1153. 9700\_w19\_qp\_12 Q: 31

The graph shows oxygen dissociation curves of haemoglobin at two different carbon dioxide concentrations.

The partial pressure of oxygen in the lungs is 100 mmHg.

The partial pressure of oxygen in metabolically active tissues is 35 mmHg.



What is the percentage saturation of haemoglobin with oxygen at the lungs and in metabolically active tissues?

	percentage saturation of haemoglobin with oxygen	
	lungs	metabolically active tissue
<b>A</b>	92	40
<b>B</b>	92	66
<b>C</b>	94	40
<b>D</b>	94	66

1154. 9700\_w19\_qp\_13 Q: 31

Red blood cells may contain a molecule known as 2,3-bisphosphoglycerate (2,3-BPG).

When 2,3-BPG binds to haemoglobin a higher partial pressure of oxygen is needed to bring about 50% saturation of haemoglobin with oxygen.

Which statements about the effect of 2,3-BPG are correct?

- 1 2,3-BPG in red blood cells causes the oxygen dissociation curve to shift to the right.
- 2 The binding of 2,3-BPG to haemoglobin reduces the Bohr effect.
- 3 The binding of 2,3-BPG to haemoglobin lowers the affinity of the haemoglobin for oxygen.
- 4 When 2,3-BPG is absent, oxyhaemoglobin is less likely to unload oxygen.

**A** 1 and 2      **B** 1 and 3      **C** 2 and 3      **D** 3 and 4

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1155. 9700\_w19\_qp\_13 Q: 33

What explains why the red blood cell count of humans increases when they remain at high altitudes?

- A** Haemoglobin is not saturated with oxygen in the lungs.
  - B** The partial pressure of oxygen in the air is higher.
  - C** The percentage of oxygen in the air has decreased.
  - D** There is more carbon dioxide, increasing the Bohr effect.
- 

1156. 9700\_m18\_qp\_12 Q: 31

Which of these statements about the formation of haemoglobinic acid are correct?

- 1 It depends on the formation of carbaminohaemoglobin.
- 2 It removes excess hydrogen ions preventing the blood becoming too acidic.
- 3 It is linked to the action of carbonic anhydrase.

**A** 1, 2 and 3      **B** 1 and 2 only      **C** 1 only      **D** 2 and 3 only

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1157. 9700\_m18\_qp\_12 Q: 32

What can combine with the haem group of a haemoglobin molecule?

- 1 oxygen
- 2 carbon dioxide
- 3 carbon monoxide

**A** 1, 2 and 3      **B** 1 and 3 only      **C** 2 and 3 only      **D** 3 only

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1158. 9700\_m18\_qp\_12 Q: 33

Which factors would help a person to adjust from living at a low altitude to living at a high altitude?

- 1 formation of fewer red blood cells
- 2 an increase in the oxygen-carrying capacity of the blood
- 3 an increase in the output of blood by the heart

**A** 1, 2 and 3    **B** 1 and 2 only    **C** 1 and 3 only    **D** 2 and 3 only

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1159. 9700\_s18\_qp\_11 Q: 29

Which effect could be due to a reduced concentration of carbonic anhydrase?

- A** Carbaminohaemoglobin concentrations will decrease.
  - B** Less oxygen is released from oxyhaemoglobin for active tissues.
  - C** The pH of the blood will be lowered.
  - D** The rate of dissociation of carbonic acid is increased.
- 

1160. 9700\_s18\_qp\_11 Q: 30

Which statement correctly compares blood plasma and tissue fluid in a healthy person?

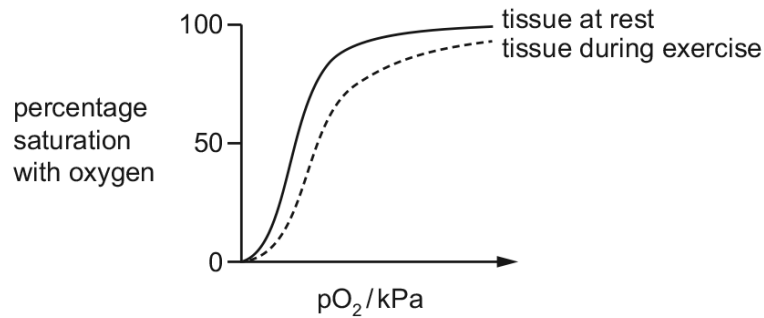
- A** Blood plasma contains more protein than tissue fluid.
  - B** Both blood plasma and tissue fluid contain red blood cells.
  - C** Tissue fluid contains white blood cells whereas blood plasma does not.
  - D** Tissue fluid is formed from blood plasma and is not returned to blood plasma.
- 





1161. 9700\_s18\_qp\_12 Q: 32

The graph shows two oxygen dissociation curves, one for a tissue at rest and one for the same tissue during exercise.



What factors have caused the difference in the position of the dissociation curve during exercise compared with the dissociation curve for the tissue at rest?

- 1 increase in pH
- 2 decrease in pH
- 3 increase in haemoglobin affinity for O<sub>2</sub>
- 4 decrease in haemoglobin affinity for O<sub>2</sub>

**A** 1 and 3      **B** 1 and 4      **C** 2 and 3      **D** 2 and 4

1162. 9700\_s18\_qp\_12 Q: 33

Which of these statements about the formation of haemoglobin acid are correct?

- 1 It can only occur with the dissociation of oxygen from haemoglobin.
- 2 It removes excess hydrogen ions preventing blood becoming too acidic.
- 3 It is linked to the action of carbonic anhydrase.

**A** 1, 2 and 3      **B** 1 and 2 only      **C** 1 only      **D** 2 and 3 only

1163. 9700\_s18\_qp\_13 Q: 31

Which statement about the role in the mammalian circulatory system of the heart, blood vessels and blood is correct?

- A** The contraction of heart muscle causes blood to enter arteries that pump the blood to organs, causing the formation of tissue fluid between cells before returning to the heart in veins.
- B** The heart connects two sets of blood vessels so that oxygen from the lungs can be distributed by red blood cells and wastes can be collected from tissues by blood plasma for removal.
- C** The heart muscle contracts and relaxes causing blood, carrying materials from one part of the body to another, to move through blood vessels that connect the different parts of the body.
- D** The heart provides enough pressure to push blood through arteries to capillaries between cells causing filtration of blood and the formation of tissue fluid which diffuses back into veins.

1164. 9700\_s18\_qp\_13 Q: 32

What explains how the maximum uptake of oxygen occurs as blood passes through the capillaries of the lungs?

- A** Each haemoglobin molecule can temporarily bind to four oxygen atoms.
- B** Oxyhaemoglobin formation increases the capacity of red blood cells to transport oxygen.
- C** The binding of the first oxygen molecule to haemoglobin decreases the molecule's affinity for binding other oxygen molecules.
- D** The dissociation of carbon dioxide from carboxyhaemoglobin allows more haemoglobin to be available for oxygen binding.

1165. 9700\_s18\_qp\_13 Q: 33

At high altitudes, the oxygen content of the air may be a third of that at sea level.

As a person climbs a mountain, their body gradually adjusts to the high altitude.

What is increased during this period of adjustment?

- A** the concentration of haemoglobin in the red blood cells
- B** the oxygen-carrying capacity of the haemoglobin
- C** the number of red blood cells per mm<sup>3</sup> of blood
- D** the rate at which haemoglobin releases oxygen to the tissues

1166. 9700\_w18\_qp\_11 Q: 30

Blood, tissue fluid and lymph each have a different composition.

Which row shows the composition of lymph?

	water	antibodies	lipid
<b>A</b>	✓	✓	✓
<b>B</b>	✓	✓	✗
<b>C</b>	✓	✗	✓
<b>D</b>	✗	✓	✓

key

✓ = present

✗ = absent

1167. 9700\_w18\_qp\_11 Q: 31

Which row shows the change in concentration of some substances in red blood cells when carbon dioxide diffuses from active cells?

	carbonic anhydrase	hydrogencarbonate ions	hydrogen ions
<b>A</b>	decreases	no change	no change
<b>B</b>	increases	increases	increases
<b>C</b>	no change	decreases	increases
<b>D</b>	no change	increases	increases

1168. 9700\_w18\_qp\_12 Q: 31

Which process can be carried out by a mature red blood cell?

- A** active transport
- B** cell division
- C** phagocytosis
- D** protein synthesis

1169. 9700\_w18\_qp\_12 Q: 32

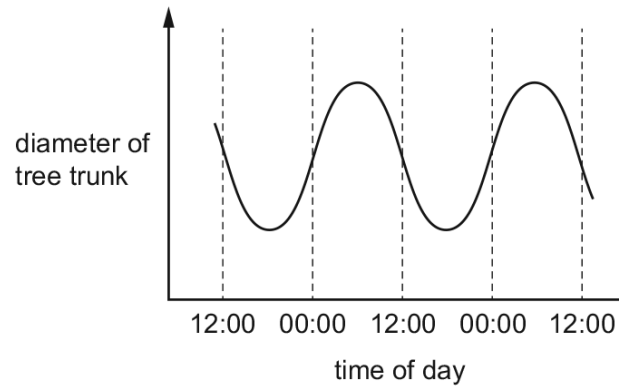
Haemoglobin can bind to carbon dioxide, carbon monoxide and oxygen.

Which statement about the binding sites of haemoglobin is correct?

- A** Carbon dioxide and carbon monoxide bind to one site, oxygen binds to a different site.
- B** Carbon dioxide and oxygen bind to one site, carbon monoxide binds to a different site.
- C** Carbon monoxide and oxygen bind to one site, carbon dioxide binds to a different site.
- D** Carbon monoxide, oxygen and carbon dioxide all bind to different sites.

1170. 9700\_w18\_qp\_13 Q: 28

The graph shows the diameter of a tree trunk over time.



Which statement explains these changes?

- A Cohesive tension forces increased during the day.
- B Columns of water break up during the day.
- C Mass flow of sucrose decreased during the day.
- D Root pressure increased during the day.

---

1171. 9700\_w18\_qp\_13 Q: 29

What is found in **all** blood vessels, lymph and tissue fluid?

- 1 carbon dioxide
  - 2 glucose
  - 3 white blood cells
  - 4 antibodies
- A 1, 2, 3 and 4
  - B 1, 2 and 3 only
  - C 1, 3 and 4 only
  - D 2 and 4 only

1172. 9700\_w18\_qp\_13 Q: 30

Which reactions will be taking place in blood that is passing through active tissues?

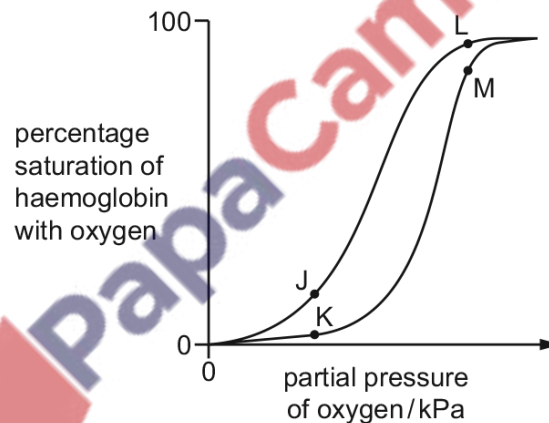
- 1  $\text{HbO}_8 \rightarrow \text{Hb} + 4\text{O}_2$
- 2  $\text{HbO}_8 + \text{H}^+ \rightarrow \text{HHb} + 4\text{O}_2$
- 3  $\text{HCO}_3^- + \text{H}^+ \rightarrow \text{H}_2\text{CO}_3$
- 4  $\text{H}_2\text{O} + \text{CO}_2 \rightarrow \text{H}_2\text{CO}_3$

- A** 1, 2, 3 and 4  
**B** 1, 2 and 4 only  
**C** 1, 3 and 4 only  
**D** 2 and 3 only

1173. 9700\_w18\_qp\_13 Q: 31

The graph shows the percentage saturation of haemoglobin with oxygen at a range of partial pressures of oxygen and at two partial pressures of carbon dioxide.

One curve is at the partial pressure of carbon dioxide in the lungs and the other curve at the partial pressure of carbon dioxide in the liver.



Which points on the curves correspond to the percentage saturation of haemoglobin at the lungs and at the liver?

- A** L and J      **B** L and K      **C** M and J      **D** M and K

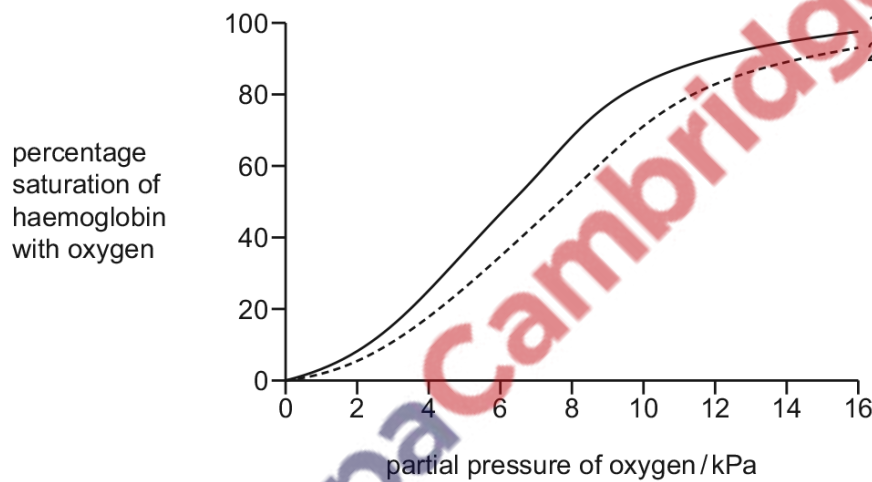
1174. 9700\_s17\_qp\_11 Q: 35

Which row is correct for the pulmonary artery?

	blood carried	muscle in walls	lumen size
<b>A</b>	deoxygenated	thick	small
<b>B</b>	deoxygenated	thin	large
<b>C</b>	oxygenated	thick	small
<b>D</b>	oxygenated	thin	large

1175. 9700\_s17\_qp\_11 Q: 36

The graph shows oxygen dissociation curves of adult oxyhaemoglobin in different carbon dioxide concentrations, 1 and 2.



Which conditions could change the shape of curve 1 to the shape of curve 2?

- A** high carbon dioxide concentration causing a decrease in pH
- B** high carbon dioxide concentration causing an increase in pH
- C** low carbon dioxide concentration causing a decrease in pH
- D** low carbon dioxide concentration causing an increase in pH

1176. 9700\_s17\_qp\_12 Q: 27

What is systolic blood pressure?

- A** the blood pressure in the arteries when the heart is relaxing
- B** the blood pressure in the left ventricle at the end of a contraction
- C** the maximum blood pressure in the arteries
- D** the maximum blood pressure in the right ventricle

1177. 9700\_s17\_qp\_12 Q: 28

When they remain at high altitudes the red blood cell count of humans increases.

Why does this occur?

- 1 to increase the Bohr effect
- 2 to increase the diffusion gradient for oxygen in the lungs
- 3 to maintain transport of oxygen

**A** 1, 2 and 3    **B** 1 and 2 only    **C** 2 and 3 only    **D** 3 only

1178. 9700\_s17\_qp\_12 Q: 29

Which comparisons of blood, tissue fluid and lymph are correct?

- 1 Blood has a higher concentration of proteins than tissue fluid because the larger proteins are too big to pass through the endothelial pores into tissue fluid.
- 2 Lymph has a higher concentration of lymphocytes than tissue fluid as a high number of lymphocytes are located in lymph nodes.
- 3 Macrophages are too large to leave the blood to enter tissue fluid whereas neutrophils, which are much smaller, can enter tissue fluid and pass into lymph.

**A** 1, 2 and 3    **B** 1 and 2 only    **C** 2 and 3 only    **D** 3 only

1179. 9700\_s17\_qp\_12 Q: 30

A number of different tissues occur in the walls of major blood vessels.

Which row correctly identifies the main tissues found in the three layers of the wall of an artery?

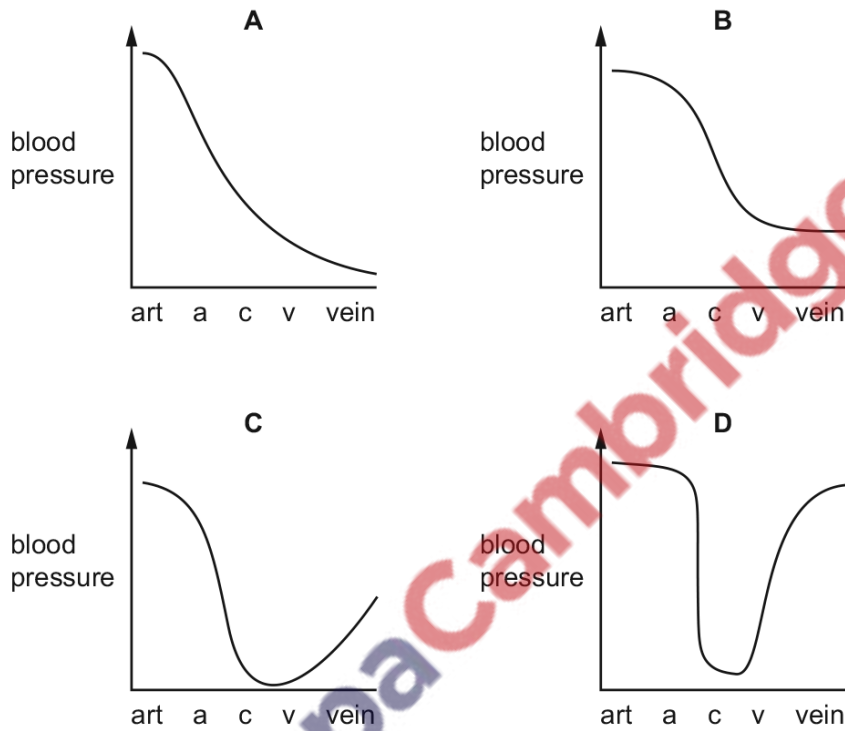
	outer layer (tunica externa)	middle layer (tunica media)	inner layer (tunica intima)
<b>A</b>	collagen	elastic	endothelium
<b>B</b>	collagen	muscle	elastic
<b>C</b>	elastic	collagen	endothelium
<b>D</b>	muscle	collagen	elastic

1180. 9700\_s17\_qp\_13 Q: 27

As blood flows from an artery to a vein, the blood pressure in the vessels changes. The four graphs represent data for blood vessels in the sequence shown.

key	artery	arteriole (small artery)	capillaries	venule (small vein)	veins
	art	a	c	v	vein

Which graph shows these changes correctly?



1181. 9700\_s17\_qp\_13 Q: 28

How is most carbon dioxide transported in the blood?

- A as carbaminohaemoglobin
- B as carbonic acid
- C as hydrogencarbonate ions
- D in solution in cytoplasm



1182. 9700\_s17\_qp\_13 Q: 29

When a doctor or nurse takes a blood sample from a person they use a needle to penetrate a vein, not an artery.

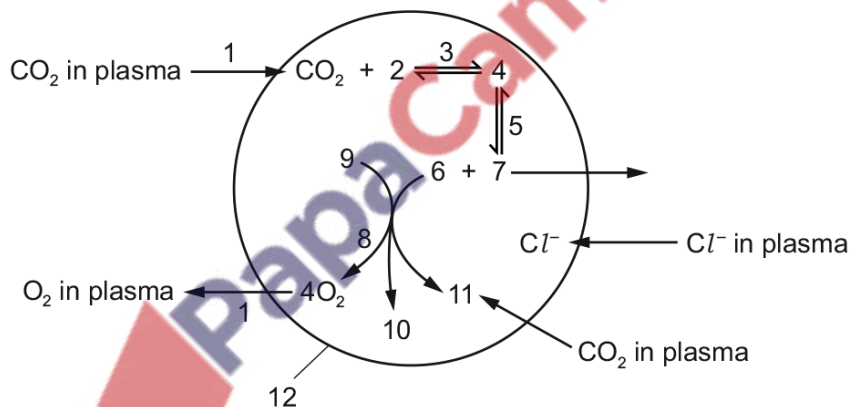
Which reasons explain why veins are used?

- 1 Arteries carry blood under more pressure than veins.
- 2 Arteries have a thicker middle layer than veins.
- 3 Veins carry deoxygenated blood.
- 4 Veins have a larger lumen than arteries.

- A 1, 2, 3 and 4  
 B 1, 2 and 3 only  
 C 1, 2 and 4 only  
 D 3 and 4 only

1183. 9700\_s17\_qp\_13 Q: 30

The diagram is an incomplete summary explaining the role of haemoglobin in the carriage of carbon dioxide.



Which set of labels is correct?

- A 1 = facilitated diffusion, 4 = carbonic acid, 7 = hydrogencarbonate ions  
 B 2 = water, 8 = dissociation, 10 = carbaminohaemoglobin  
 C 3 = carbonic anhydrase, 9 = oxyhaemoglobin, 11 = carbaminohaemoglobin  
 D 5 = carbonic anhydrase, 6 = hydrogen ions, 12 = red blood cell

1184. 9700\_w17\_qp\_11 Q: 28

Which substances could displace oxygen from oxyhaemoglobin?

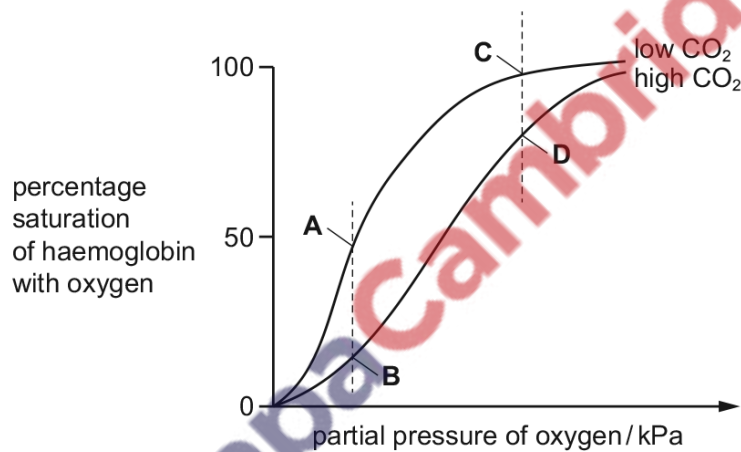
- 1 carbon dioxide
- 2 carbon monoxide
- 3 hydrogencarbonate ions
- 4 hydrogen ions

**A** 1 and 2      **B** 1 and 4      **C** 2 and 3      **D** 2 and 4

1185. 9700\_w17\_qp\_11 Q: 29

The graph shows the affinity of haemoglobin for oxygen at two different concentrations of carbon dioxide.

Which point on the graph shows the percentage saturation of haemoglobin entering the pulmonary artery?



1186. 9700\_w17\_qp\_12 Q: 31

Which statement about the human circulatory system is correct?

- A** Blood passes twice through the heart in one complete circulation.
- B** Blood, tissue fluid and lymph are all parts of the circulatory system.
- C** Capillaries have the lowest blood pressure.
- D** Veins in the circulatory system all carry deoxygenated blood.

1187. 9700\_w17\_qp\_12 Q: 33

Haemoglobin can bind to carbon dioxide, carbon monoxide and oxygen.

- 1 carbon dioxide
- 2 carbon monoxide
- 3 oxygen

Which gases share a binding site?

- A** 1, 2 and 3    **B** 1 and 2 only    **C** 1 and 3 only    **D** 2 and 3 only
- 

1188. 9700\_w17\_qp\_13 Q: 34

Which of these processes are responsible for the Bohr shift?

- 1 Carbon dioxide reacts with haemoglobin to form carbaminohaemoglobin.
- 2 Carbon dioxide reacts with water to form carbonic acid.
- 3 Haemoglobinic acid is formed from the dissociation of carbonic acid.

- A** 1, 2 and 3    **B** 1 only    **C** 2 and 3 only    **D** 3 only
- 

1189. 9700\_m16\_qp\_12 Q: 28

Cardiac muscle is made up of many fibres that form the walls of the chambers of the heart.

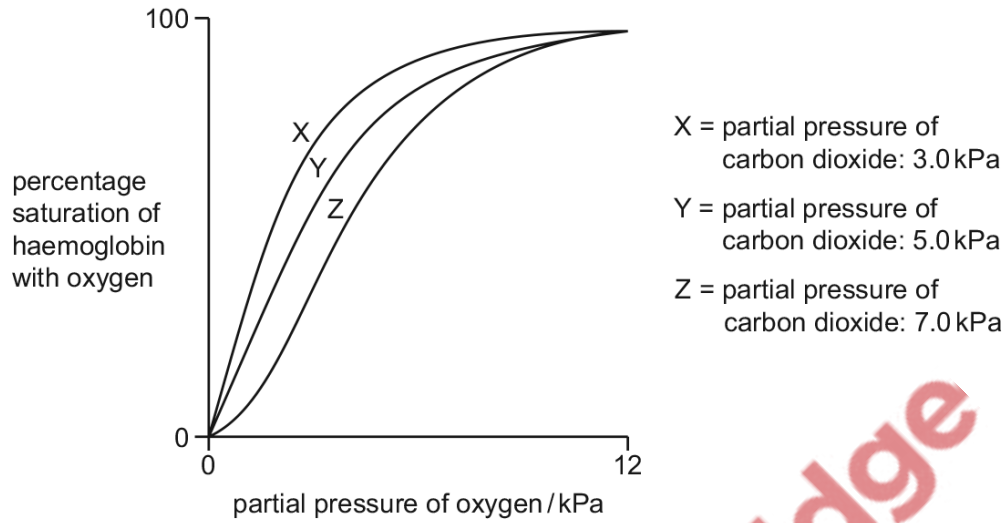
When the heart contracts, these fibres shorten in length so the muscle creates a force that exerts a pressure on the blood, causing it to move.

Which statement explains the difference in thickness of the walls of ventricles of the heart?

- A** There is more muscle in the wall of the right ventricle than that of the left ventricle because more pressure is needed to push blood into the aorta than into the pulmonary artery.
- B** The number of muscle fibres in the left ventricle is greater than the number in the right ventricle so their contraction has more force, exerting more pressure on blood.
- C** The space available to fill with blood inside the left ventricle is smaller than that of the right ventricle so more pressure is needed to force blood out.
- D** The wall of the right ventricle is thicker than that of the left ventricle because it has to resist more pressure when the muscle of the right ventricle contracts.
-

1190. 9700\_m16\_qp\_12 Q: 30

The diagram shows the effect of three different concentrations of carbon dioxide on the oxygen dissociation curve for human haemoglobin.



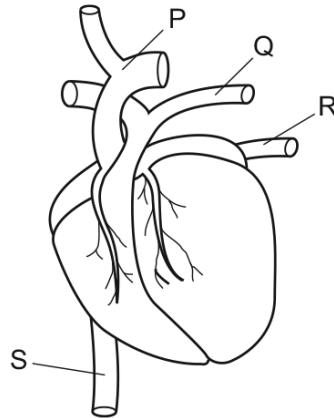
What effect does increasing carbon dioxide concentration have on haemoglobin?

- A It makes it less efficient at taking up oxygen and less efficient at releasing it.
- B It makes it less efficient at taking up oxygen and more efficient at releasing it.
- C It makes it more efficient at taking up oxygen and less efficient at releasing it.
- D It makes it more efficient at taking up oxygen and more efficient at releasing it.



1191. 9700\_s16\_qp\_11 Q: 28

The diagram is an external view of the mammalian heart and the associated blood vessels.



Which statement about the blood vessels associated with a normal, healthy heart is correct?

- A P and Q carry blood with more oxyhaemoglobin than haemoglobin.
- B P and R carry blood that is saturated with oxygen.
- C S and P carry blood with a low oxygen concentration.
- D S and R carry blood with more haemoglobin than oxyhaemoglobin.

1192. 9700\_s16\_qp\_11 Q: 30

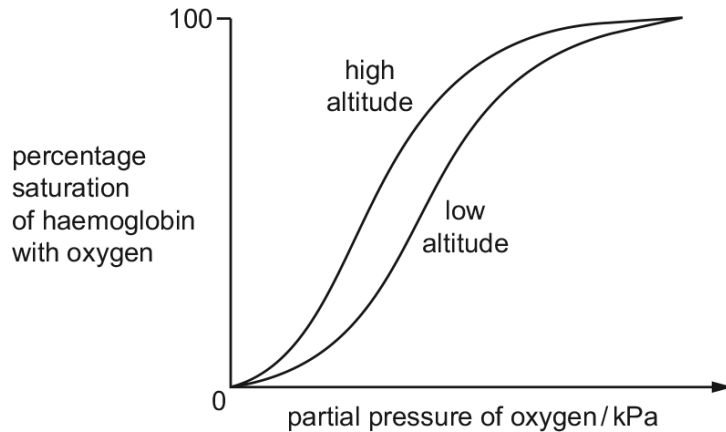
Which does **not** occur when a red blood cell arrives at the alveolus?

- A Carbaminohaemoglobin releases carbon dioxide from the  $\alpha$ -globin and  $\beta$ -globin polypeptide chains.
- B Carbonic acid in the red blood cell forms carbon dioxide and water.
- C Hydrogencarbonate ions diffuse from the plasma into the red blood cell.
- D Hydrogen ions are released from haemoglobin acid and diffuse out of the red blood cell.



1193. 9700\_s16\_qp\_11 Q: 31

The graph shows the oxygen dissociation curves for haemoglobin of animals that live at high altitude and animals that live at low altitude.



What explains the oxygen dissociation curve at **high** altitude?

- A Haemoglobin has a higher affinity for oxygen.
- B Haemoglobin releases oxygen more readily.
- C The change in partial pressure of carbon dioxide causes a Bohr effect.
- D The decrease in percentage of carbon dioxide causes the curve to shift to the left.

1194. 9700\_s16\_qp\_12 Q: 27

Which of the tissue types below are present in the walls of **all** blood vessels?

- 1 collagen
- 2 elastic
- 3 endothelial
- 4 smooth muscle

- A 1, 2, 3 and 4
- B 1, 2 and 4 only
- C 2 and 3 only
- D 3 only

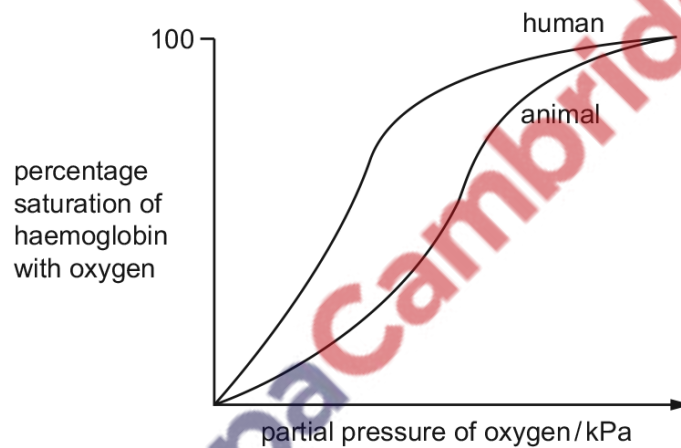
1195. 9700\_s16\_qp\_12 Q: 28

Which components of blood are present in tissue fluid?

	phagocytes	proteins	sodium ions	
<b>A</b>	✓	✓	✓	key ✓ = present ✗ = absent
<b>B</b>	✓	✗	✗	
<b>C</b>	✗	✓	✓	
<b>D</b>	✗	✓	✗	

1196. 9700\_s16\_qp\_12 Q: 29

The graph shows changes in percentage saturation of haemoglobin with oxygen in the blood of a human and of another animal. The partial pressure of carbon dioxide remains constant at 1.0 kPa and the temperature is constant at 25 °C.



Which conclusion is supported by the graph?

- A** At 25 °C the affinity of haemoglobin for oxygen increases more in humans than in the animal.
- B** Haemoglobin in the animal carries less oxygen than haemoglobin in the human.
- C** Oxygen is more easily released from haemoglobin in animal muscle than in human muscle.
- D** The Bohr effect in the haemoglobin of the animal is greater than in human haemoglobin.

1197. 9700\_s16\_qp\_12 Q: 30

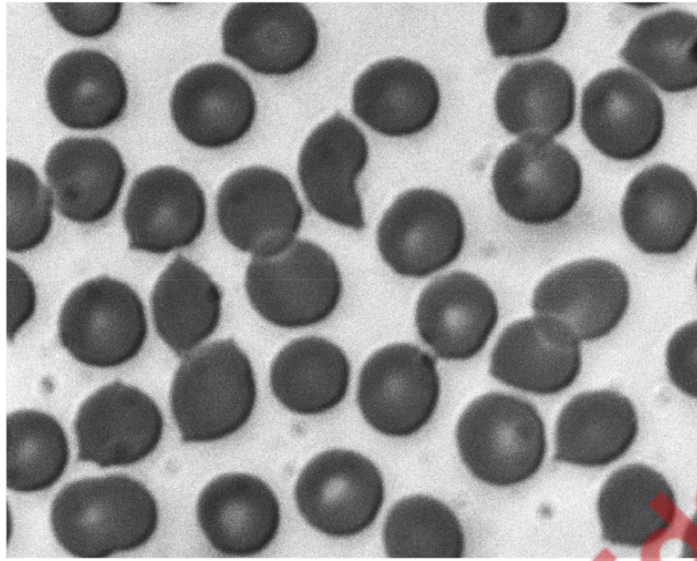
Which statements about the formation of haemoglobinic acid are correct?

- 1 It can only occur with the dissociation of oxygen from haemoglobin.
- 2 It acts to prevent excess hydrogen ions causing acidity in blood.
- 3 It depends on the release of hydrogen ions by the action of carbonic anhydrase.

- A** 1, 2 and 3    **B** 1 and 2 only    **C** 2 and 3 only    **D** 1 only

1198. 9700\_s16\_qp\_12 Q: 31

The photograph shows a type of blood cell.



Which statements about these cells are correct?

- 1 Oxygen diffuses through the phospholipid bilayer.
- 2 Sodium ions diffuse through the phospholipid bilayer.
- 3 Water passes in and out of these cells by osmosis.

**A** 1, 2 and 3    **B** 1 and 2 only    **C** 1 and 3 only    **D** 2 and 3 only

1199. 9700\_s16\_qp\_13 Q: 29

Which components of blood are present in lymph?

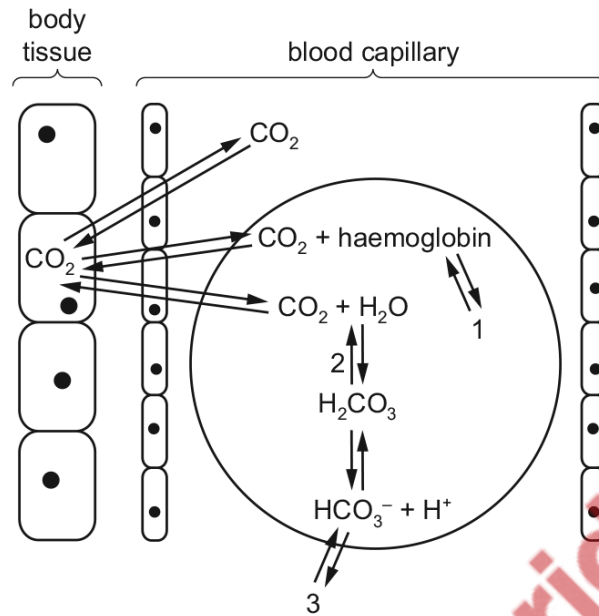
	white blood cells	proteins	sodium ions
<b>A</b>	✓	✓	✓
<b>B</b>	✓	X	✓
<b>C</b>	X	✓	✓
<b>D</b>	X	✓	X

key  
✓ = present  
X = absent



1200. 9700\_s16\_qp\_13 Q: 30

Which row gives the correct labels for the diagram shown?



	1	2	3
<b>A</b>	carbaminohaemoglobin	carbonic anhydrase	hydrogencarbonate
<b>B</b>	carbonic anhydrase	carbaminohaemoglobin	carbon dioxide
<b>C</b>	carbonic anhydrase	carbaminohaemoglobin	hydrogencarbonate
<b>D</b>	hydrogencarbonate	carbon dioxide	carbonic anhydrase

1201. 9700\_s16\_qp\_13 Q: 31

An increase in carbon dioxide in human blood shifts the oxyhaemoglobin dissociation curve to the right.

What is the explanation for this effect?

- A** An increase in carbon dioxide concentration increases the breathing rate.
- B** Carbon dioxide is more soluble than oxygen and displaces it.
- C** Diffusion of carbon dioxide between the alveoli and the blood is more rapid.
- D** Increasing the H<sup>+</sup> concentration decreases haemoglobin affinity for oxygen.

1202. 9700\_s16\_qp\_13 Q: 32

A person has two blood tests one month apart. The number of each type of cell in a fixed sample size is counted.

type of cell	first test	after one month
red blood cells	normal	higher
lymphocytes	normal	higher

What could this suggest about the person based on the results after one month?

	body temperature higher	moved to higher altitude	ATP synthesis in cells is higher
<b>A</b>	no	no	yes
<b>B</b>	no	yes	no
<b>C</b>	yes	no	no
<b>D</b>	yes	yes	yes

1203. 9700\_w16\_qp\_11 Q: 28

Which statement about haemoglobin is correct?

- A** Carbon dioxide increases its affinity for oxygen.
- B** Its affinity for oxygen changes with altitude.
- C** It can combine reversibly with carbon monoxide.
- D** It can combine with carbon dioxide.

1204. 9700\_w16\_qp\_11 Q: 30

What is the reason for the increase in red blood cells in humans at high altitudes?

- A** to compensate for the low percentage saturation of haemoglobin
- B** to enable haemoglobin to unload more oxygen in the tissues by the Bohr effect
- C** to ensure that haemoglobin is almost 90% saturated when it reaches the tissues
- D** to increase the number of mitochondria in the blood for ATP production

1205. 9700\_w16\_qp\_11 Q: 31

Which statement explains why the oxygen dissociation curve for haemoglobin is S-shaped?

- A At high oxygen concentrations, oxygen dissociates from the haemoglobin molecule.
  - B Haemoglobin becomes saturated at low partial pressures of oxygen.
  - C Oxygenated haemoglobin accepts hydrogen ions from carbonic acid.
  - D The shape of the haemoglobin molecule changes when oxygen binds to it.
- 

1206. 9700\_w16\_qp\_11 Q: 32

Which reactions take place in a capillary in an alveolus?

- 1 carbon dioxide + water  $\rightarrow$  carbonic acid
- 2 carbon dioxide + haemoglobin  $\rightarrow$  carbaminohaemoglobin
- 3 haemoglobinic acid  $\rightarrow$  haemoglobin + hydrogen ions
- 4 hydrogencarbonate ions + hydrogen ions  $\rightarrow$  carbon dioxide + water

- A 1 and 2      B 3 and 4      C 3 only      D 4 only
- 

1207. 9700\_w16\_qp\_12 Q: 29

Which blood vessels carry blood into the atria of the heart?

- A coronary artery and pulmonary artery
  - B pulmonary artery and vena cava
  - C pulmonary vein and vena cava
  - D vena cava and coronary artery
- 

1208. 9700\_w16\_qp\_12 Q: 30

Which statement describes the effect of increased carbon dioxide concentration on the oxygen dissociation curve of human haemoglobin and its significance?

- A The curve shifts to the left allowing haemoglobin to bind more oxygen in active tissues.
  - B The curve shifts to the left allowing haemoglobin to offload more oxygen in active tissues.
  - C The curve shifts to the right allowing haemoglobin to bind more oxygen in active tissues.
  - D The curve shifts to the right allowing haemoglobin to offload more oxygen in active tissues.
-

1209. 9700\_w16\_qp\_12 Q: 31

What combines with haemoglobin to form carbaminohaemoglobin?

- A carbon dioxide
- B carbon monoxide
- C carbonic acid
- D hydrogencarbonate ions

---

1210. 9700\_w16\_qp\_13 Q: 27

The following are all structural components of blood vessels.

- 1 collagen fibres
- 2 elastic fibres
- 3 endothelial cells
- 4 smooth muscle cells

Which row shows the components in an artery and a vein?

	artery	vein
<b>A</b>	1, 2 and 4	1, 3 and 4
<b>B</b>	2, 3 and 4	1, 3 and 4
<b>C</b>	1, 2, 3 and 4	1, 2, 3 and 4
<b>D</b>	1, 2, 3 and 4	2, 3 and 4

---

1211. 9700\_w16\_qp\_13 Q: 28

Scientists have shown that the oxygen dissociation curves for haemoglobin of smaller mammals are to the right of those of larger mammals.

What does this suggest about the haemoglobin of smaller mammals?

- A It carries more oxygen when the partial pressure of oxygen is higher.
  - B It releases oxygen less easily at lower partial pressures of oxygen.
  - C It saturates with oxygen more easily.
  - D It unloads oxygen more easily.
-

1212. 9700\_w16\_qp\_13 Q: 29

Which row could be correct for the average blood pressure in different parts of the human circulatory system?

	blood pressure				key
	right atrium	artery in arm	vein in arm	capillary in arm	
<b>A</b>	+	++++	++	+++	++++ highest average blood pressure
<b>B</b>	++	++++	+++	+	+++
<b>C</b>	+++	++	++++	+	++
<b>D</b>	++++	+++	+	++	+ lowest average blood pressure

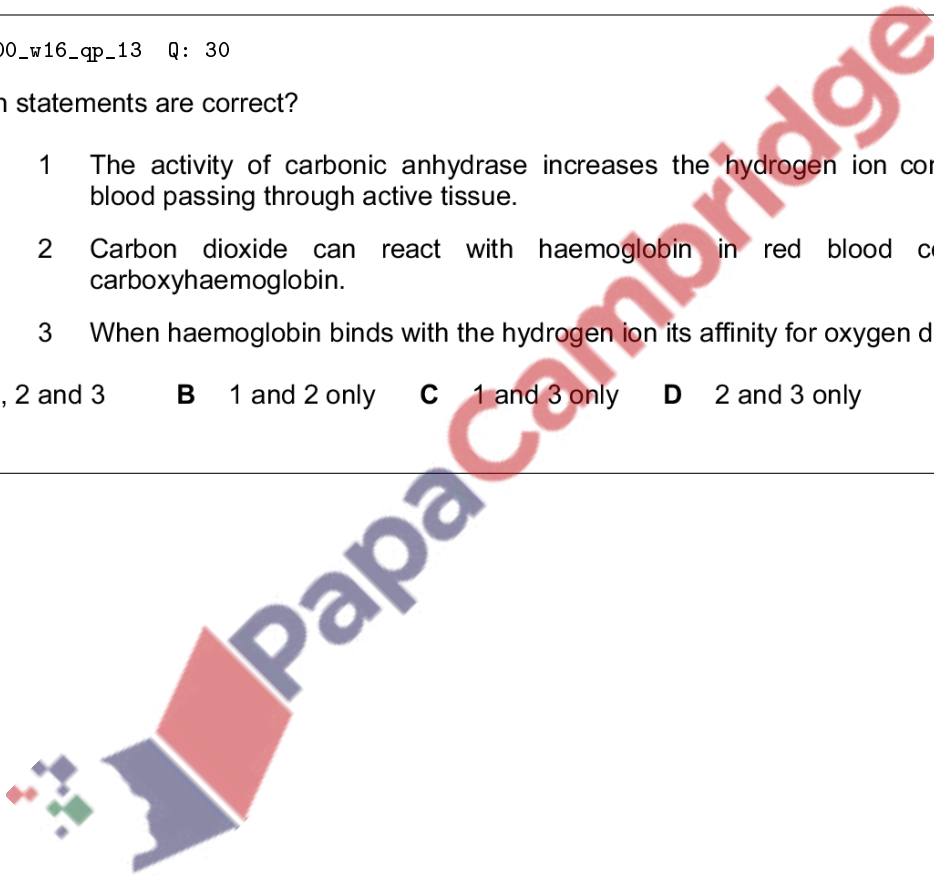
↓

1213. 9700\_w16\_qp\_13 Q: 30

Which statements are correct?

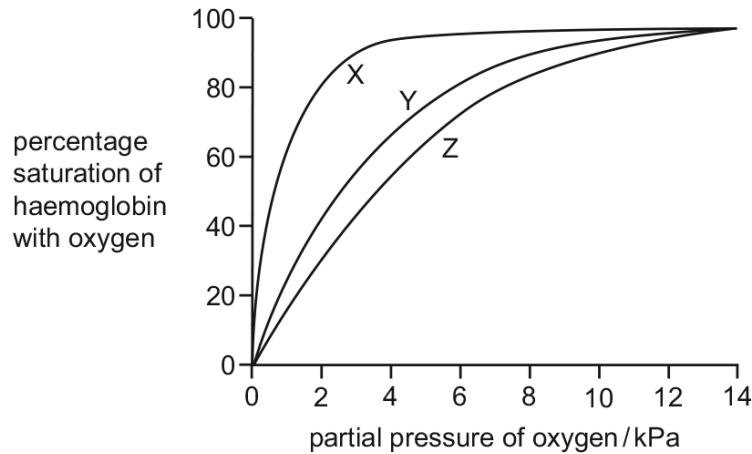
- 1 The activity of carbonic anhydrase increases the hydrogen ion concentration in blood passing through active tissue.
- 2 Carbon dioxide can react with haemoglobin in red blood cells to form carboxyhaemoglobin.
- 3 When haemoglobin binds with the hydrogen ion its affinity for oxygen decreases.

**A** 1, 2 and 3    **B** 1 and 2 only    **C** 1 and 3 only    **D** 2 and 3 only



1214. 9700\_s15\_qp\_11 Q: 27

The graph shows the oxygen dissociation curves for haemoglobin from three different animals.



Which of the haemoglobins, X, Y or Z, would be present in each of the animals 1, 2 or 3?

- 1 an adult human
- 2 a fish living in water that has a very low oxygen concentration
- 3 a very active mammal whose tissues have a much higher rate of respiration than an adult human

	1	2	3
A	X	Y	Z
B	Y	X	Z
C	Y	Z	X
D	Z	Y	X

1215. 9700\_s15\_qp\_11 Q: 28

What explains how the uptake of oxygen is maximised as blood passes through the capillaries of the lungs?

- A Each haemoglobin molecule can temporarily bind to four oxygen atoms.
- B Oxyhaemoglobin formation increases the capacity of red blood cells to transport oxygen.
- C The binding of the first oxygen molecule to haemoglobin decreases the molecule's affinity for binding other oxygen molecules.
- D The dissociation of carbon dioxide from carboxyhaemoglobin allows more haemoglobin to be available for oxygen binding.

1216. 9700\_s15\_qp\_11 Q: 29

What happens after carbonic anhydrase has catalysed a reaction involved in the transport of carbon dioxide?

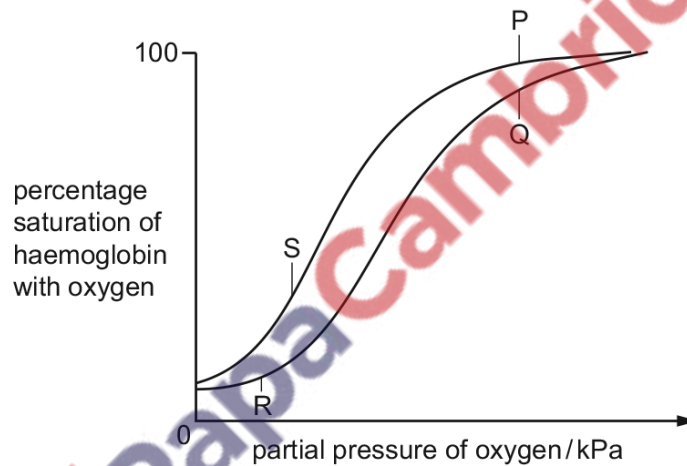
- A the dissociation of oxyhaemoglobin to haemoglobin and oxygen
- B the formation of carbaminohaemoglobin from carbon dioxide and haemoglobin
- C the formation of carbon dioxide and water from carbonic acid
- D the formation of oxyhaemoglobin from haemoglobin and oxygen

1217. 9700\_s15\_qp\_12 Q: 29

Resting muscle has a lower respiration rate than active muscle. The graph shows the oxygen dissociation curves for haemoglobin at carbon dioxide concentrations that are found in a resting muscle and an active muscle.

P and Q are at the partial pressures of oxygen found in the lungs.

R and S are at the partial pressures of oxygen found in **either** a resting muscle **or** an active muscle.



Which statements are correct?

- 1 The % saturation at P minus the % saturation at S represents the amount of oxygen delivered to a resting muscle.
- 2 The % saturation at Q represents the amount of oxygen carried to an active muscle.
- 3 The % saturation at R represents the amount of oxygen required by a resting muscle.
- 4 The % saturation at P minus the % saturation at Q represents the amount of oxygen delivered to an active muscle.
- 5 The % saturation at Q minus the % saturation at S represents the amount of oxygen delivered to a resting muscle.

- A 1 and 2      B 3 and 4      C 1 only      D 5

1218. 9700\_s15\_qp\_12 Q: 30

What does **not** help to maximise uptake of oxygen as blood flows through capillaries in the lungs?

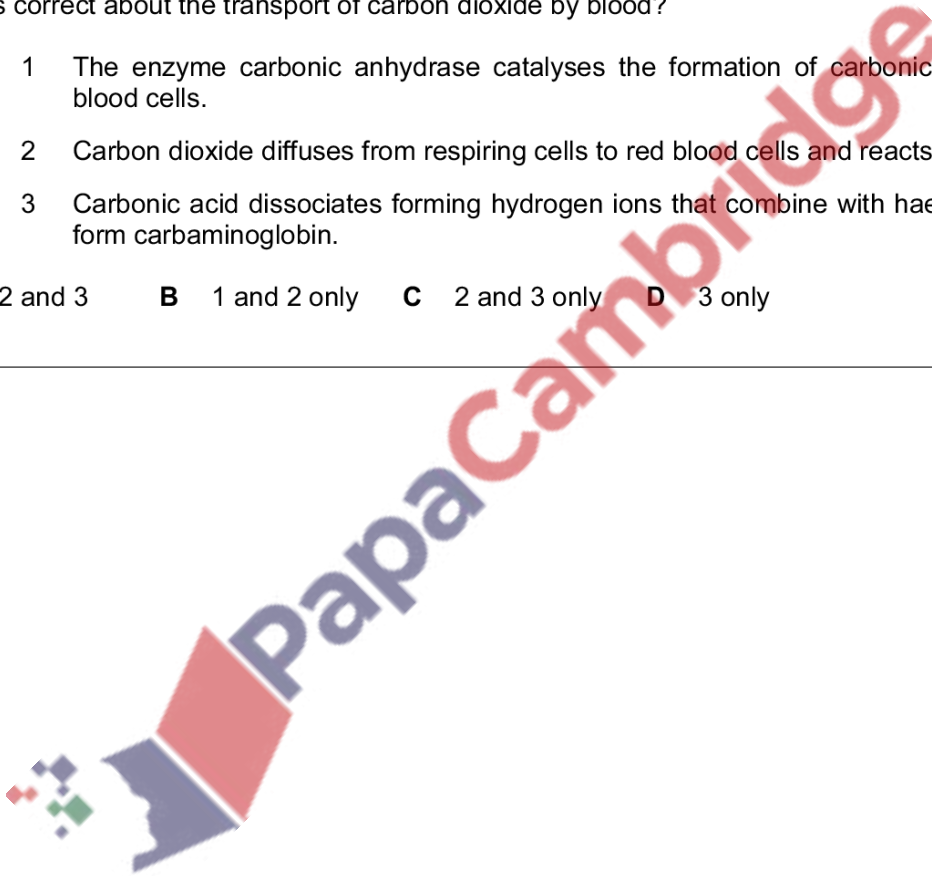
- A** Dissociation of carbon dioxide from carboxyhaemoglobin allows more haemoglobin to be available for oxygen binding.
  - B** Each haemoglobin molecule can temporarily bind to eight oxygen atoms.
  - C** Oxyhaemoglobin formation increases the capacity of red blood cells to transport oxygen.
  - D** The binding of the first oxygen molecule to haemoglobin increases the molecule's affinity for binding other oxygen molecules.
- 

1219. 9700\_s15\_qp\_13 Q: 27

What is correct about the transport of carbon dioxide by blood?

- 1 The enzyme carbonic anhydrase catalyses the formation of carbonic acid in red blood cells.
- 2 Carbon dioxide diffuses from respiring cells to red blood cells and reacts with water.
- 3 Carbonic acid dissociates forming hydrogen ions that combine with haemoglobin to form carbaminoglobin.

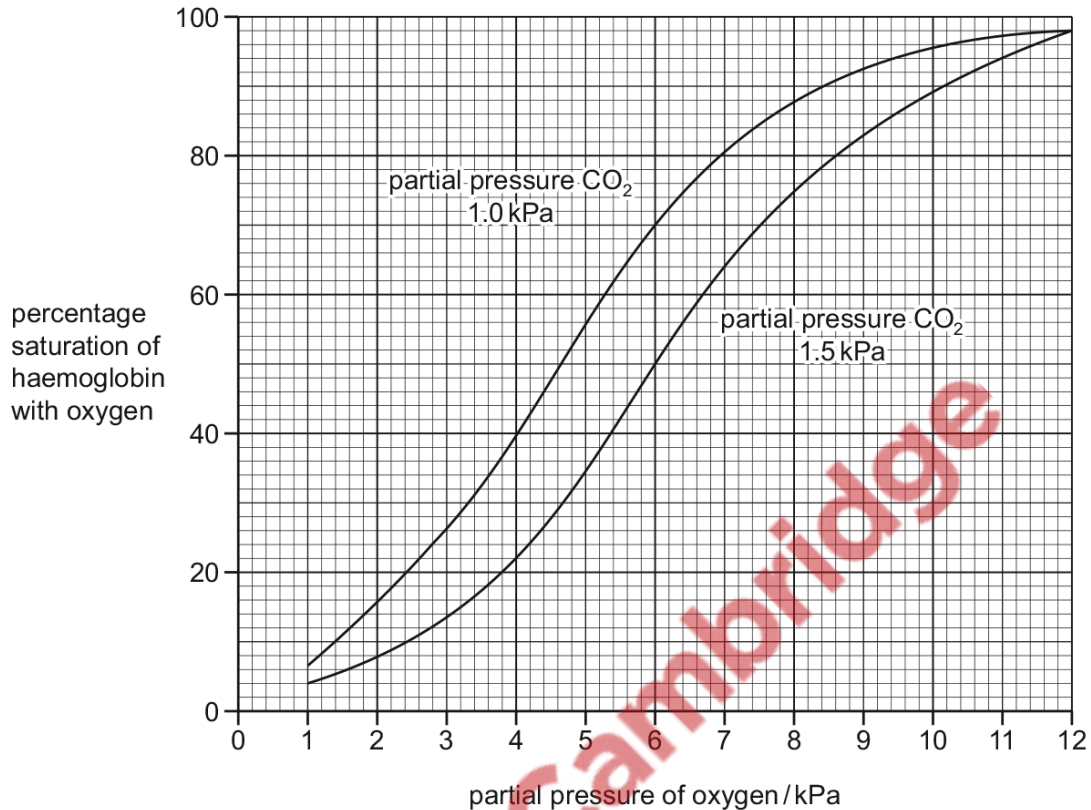
- A** 1, 2 and 3    **B** 1 and 2 only    **C** 2 and 3 only    **D** 3 only
- 





1220. 9700\_s15\_qp\_13 Q: 28

The graph shows the effect of different partial pressures of carbon dioxide ( $\text{CO}_2$ ) on the oxygen dissociation curve for haemoglobin.



What is the change in percentage oxygen saturation of haemoglobin at a partial pressure of oxygen of 6 kPa as the partial pressure of carbon dioxide changes from 1.0 kPa to 1.5 kPa?

- A** -26%      **B** -20%      **C** 20%      **D** 46%

1221. 9700\_s15\_qp\_13 Q: 30

Which effect could be due to a reduced concentration of carbonic anhydrase?

- A** carbaminohaemoglobin concentrations will decrease  
**B** less oxygen is released from oxyhaemoglobin in respiring tissues  
**C** the pH of the blood will be lowered  
**D** the rate of dissociation of carbonic acid is increased

1222. 9700\_w15\_qp\_11 Q: 27

Which reactions take place in a capillary in the lungs?

- 1 carbonic acid is formed from carbon dioxide and water
- 2 carbaminohaemoglobin is formed from carbon dioxide and haemoglobin
- 3 haemoglobinic acid is formed from haemoglobin and hydrogen ions
- 4 carbon dioxide and water are formed from hydrogen carbonate ions and hydrogen ions

**A** 1 and 2      **B** 3 and 4      **C** 3 only      **D** 4 only

---

1223. 9700\_w15\_qp\_11 Q: 28

Red blood cells may contain a molecule known as 2,3-bisphosphoglycerate (2,3BPG). When 2,3BPG binds to haemoglobin a higher partial pressure of oxygen is needed to bring about 50% saturation of haemoglobin with oxygen.

Which statements about the effect of 2,3BPG are correct?

- 1 2,3BPG in red blood cells causes the oxygen dissociation curve to shift to the left.
- 2 The binding of 2,3BPG to haemoglobin lowers the affinity of the haemoglobin for oxygen.
- 3 Binding of 2,3BPG to haemoglobin reduces the Bohr effect.
- 4 When 2,3BPG is absent, oxyhaemoglobin is less likely to unload oxygen.

**A** 1 and 3      **B** 2 and 4      **C** 1 only      **D** 2 only

---

1224. 9700\_w15\_qp\_11 Q: 29

Which statements about arteries are correct?

- 1 Artery walls can resist high pressure.
- 2 Arteries pump blood out of the heart.
- 3 Blood in arteries has the same flow rate as in veins.
- 4 The pulse in arteries is the result of a surge in blood that causes expansion of the artery wall.
- 5 There are semilunar valves at the junction of arteries with the heart.

**A** 1, 2, and 4      **B** 1, 3 and 5      **C** 1, 4 and 5      **D** 2, 3 and 4

---

1225. 9700\_w15\_qp\_11 Q: 31

Which statements are correct?

- 1 Tissue fluid has less protein and no red blood cells compared to plasma.
- 2 Lymph may contain lipids, carbon dioxide and phagocytes.
- 3 Tissue fluid contains glucose, amino acids, urea and carbon dioxide.

**A** 1, 2 and 3    **B** 1 and 2 only    **C** 1 and 3 only    **D** 2 and 3 only

1226. 9700\_w15\_qp\_11 Q: 33

Which process leads to atherosclerosis?

- A** a blood clot forming in a coronary artery
- B** contraction of muscles in arteries caused by nicotine
- C** formation of plaques in an artery wall
- D** loss of elasticity in an artery wall causing it to burst

1227. 9700\_w15\_qp\_12 Q: 27

Which components of blood are found in tissue fluid?

	glucose	proteins	white blood cells
<b>A</b>	✓	✓	✓
<b>B</b>	✓	✓	✗
<b>C</b>	✓	✗	✓
<b>D</b>	✗	✓	✓

key

✓ = present

✗ = absent

1228. 9700\_w15\_qp\_12 Q: 28

Which reactions take place in a capillary in an active tissue?

- 1 carbon dioxide and water are formed from hydrogencarbonate ions and hydrogen ions
- 2 carbonic acid is formed from carbon dioxide and water
- 3 carbaminohaemoglobin is formed from carbon dioxide and haemoglobin
- 4 haemoglobin and hydrogen ions are formed from haemoglobin acid

**A** 1 and 2    **B** 1 and 3    **C** 2 and 3    **D** 2 and 4

1229. 9700\_w15\_qp\_12 Q: 30

Red blood cells may contain a molecule known as 2,3-bisphosphoglycerate (2,3BPG). When 2,3BPG binds to haemoglobin a higher partial pressure of oxygen is needed to bring about 50% saturation of haemoglobin with oxygen.

Which statements about the effect of 2,3BPG are correct?

- 1 2,3BPG in red blood cells causes the oxygen dissociation curve to shift to the right.
- 2 The binding of 2,3BPG to haemoglobin reduces the Bohr effect.
- 3 The binding of 2,3BPG to haemoglobin lowers the affinity of the haemoglobin for oxygen.
- 4 When 2,3BPG is absent, oxyhaemoglobin is less likely to unload oxygen.

**A** 1 and 2      **B** 1 and 3      **C** 2 and 3      **D** 3 and 4

---

1230. 9700\_w15\_qp\_13 Q: 27

Which reactions take place in a capillary in an active tissue?

- 1 the formation of carbonic acid from carbon dioxide and water
- 2 the formation of carbaminohaemoglobin from carbon dioxide and haemoglobin
- 3 the formation of haemoglobinic acid from haemoglobin and hydrogen ions
- 4 the formation of carbon dioxide and water from hydrogen carbonate ions and hydrogen ions

**A** 1, 2, 3 and 4  
**B** 1, 2 and 3 only  
**C** 2 and 4 only  
**D** 3 and 4 only

---

1231. 9700\_w15\_qp\_13 Q: 28

What is present in the blood in human veins?

- 1 collagen
- 2 carbonic anhydrase
- 3 oxyhaemoglobin

**A** 1, 2 and 3      **B** 1 and 2 only      **C** 1 and 3 only      **D** 2 and 3 only

---

1232. 9700\_w15\_qp\_13 Q: 30

Which statement about the pulmonary artery is correct?

- A it contains a series of valves
- B it contains blood at high pressure
- C it contains blood moving towards the heart
- D it contains oxygenated blood

1233. 9700\_w15\_qp\_13 Q: 31

Red blood cells may contain a molecule known as 2,3-bisphosphoglycerate (2,3BPG). When 2,3BPG binds to haemoglobin a higher partial pressure of oxygen is needed to bring about 50% saturation of haemoglobin with oxygen.

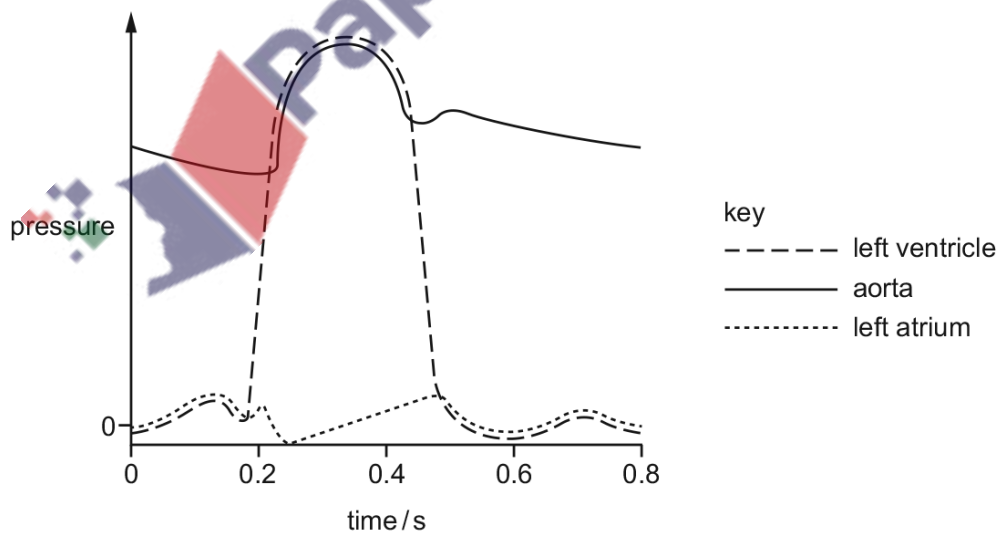
Which statement about the effect of 2,3BPG is correct?

- A 2,3BPG in red blood cells causes the oxygen dissociation curve to shift to the left.
- B Binding of 2,3BPG to haemoglobin reduces the Bohr effect.
- C The binding of 2,3BPG to haemoglobin lowers the affinity of the haemoglobin for oxygen.
- D When 2,3BPG is absent, oxyhaemoglobin is less likely to unload oxygen.

## 8.2 The heart

1234. 9700\_m20\_qp\_12 Q: 30

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



At which time are the semi-lunar valves in the heart open?

- A 0.1s
- B 0.3s
- C 0.5s
- D 0.7s

1235. 9700\_s20\_qp\_11 Q: 29

What explains why the left and right sides of the heart contract simultaneously?

- A Both atria have a sinoatrial node.
- B Both sides of the heart are supplied by the same coronary artery.
- C Purkyne tissue links the two sides of the heart.
- D There is no barrier to electrical excitation between two sides of the heart.

1236. 9700\_s20\_qp\_11 Q: 30

The statements list some of the events in the cardiac cycle. They are not in the correct order.

- 1 The impulse travels through Purkyne tissue.
- 2 A wave of excitation sweeps across the atria.
- 3 The atrioventricular node delays the impulse for a fraction of a second.
- 4 The sinoatrial node contracts.
- 5 The wave of excitation sweeps upwards from the base of the ventricles.
- 6 The ventricles contract.
- 7 The atria contract.

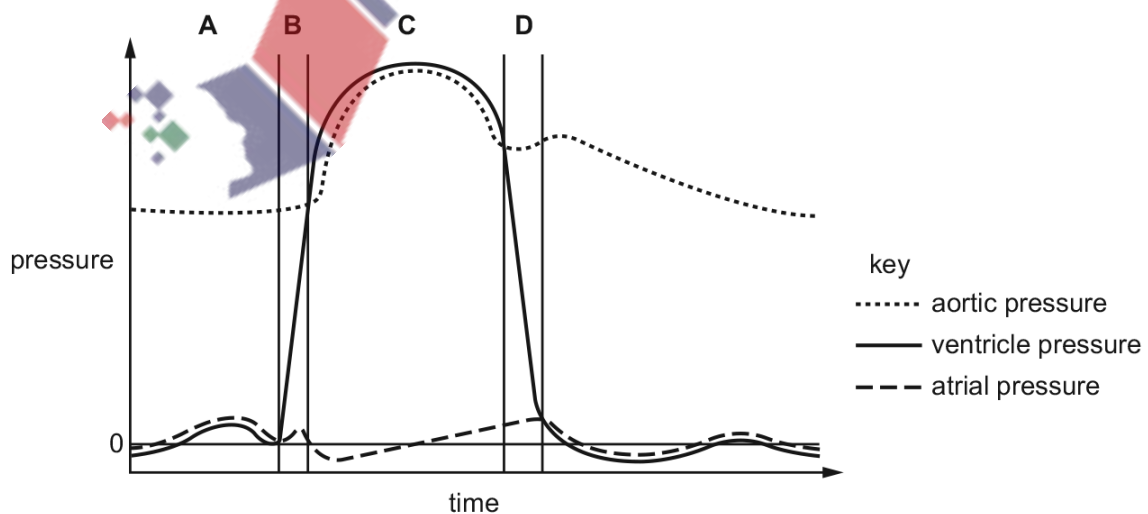
Which statement describes the third of these events to occur in the cardiac cycle?

- A 1
- B 3
- C 4
- D 7

1237. 9700\_s20\_qp\_11 Q: 31

The diagram shows pressure changes in different parts of the heart during one cardiac cycle.

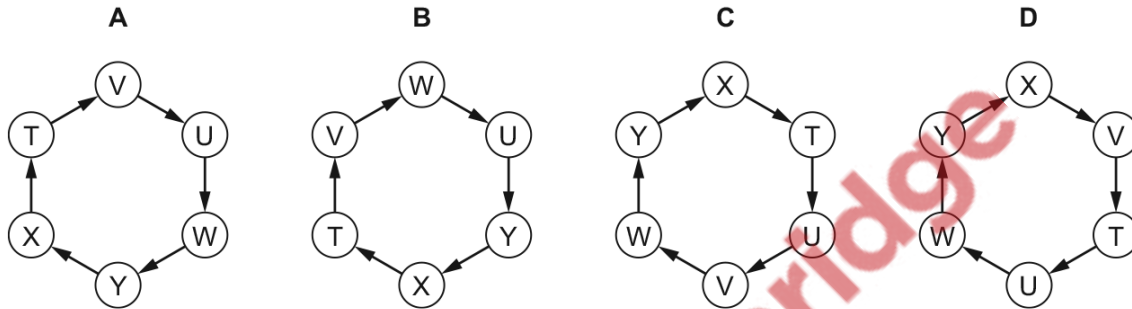
During which period are the semilunar valves open and the atrioventricular valves closed?



1238. 9700\_w20\_qp\_11 Q: 30

Which sequence of letters correctly identifies the order of events during the cardiac cycle?

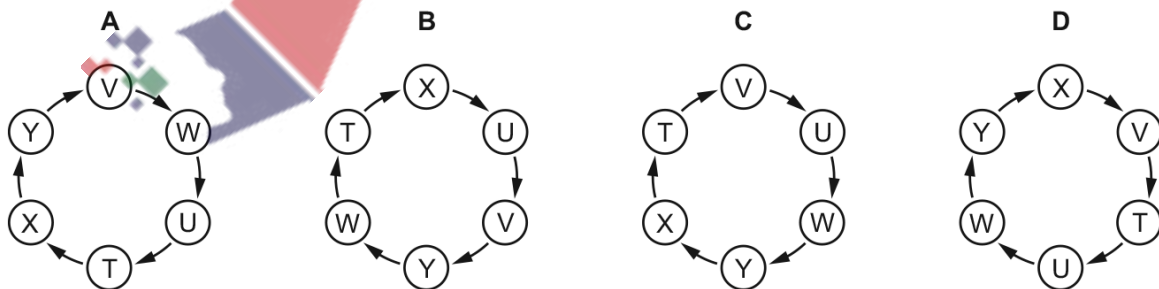
- T atrial walls contract
- U impulse is delayed a fraction of a second
- V wave of excitation enters the atrioventricular node
- W wave of excitation passes down the Purkyne tissue
- X wave of excitation spreads from the sinoatrial node
- Y ventricles contract



1239. 9700\_w20\_qp\_12 Q: 28

Which sequence of letters correctly identifies the order of events during the cardiac cycle?

- T atrial walls contract
- U impulse is delayed a fraction of a second
- V wave of excitation enters the atrioventricular node
- W wave of excitation passes down the Purkyne tissue
- X wave of excitation spreads from the sinoatrial node
- Y ventricles contract



1240. 9700\_w20\_qp\_12 Q: 29

Which factors affect blood pressure?

- 1 the diameter of the blood vessels
- 2 the systolic pressure of the heart ventricles
- 3 the volume of blood returning to the heart in each cardiac cycle

**A** 1, 2 and 3      **B** 1 and 2 only      **C** 1 and 3 only      **D** 2 and 3 only

---

1241. 9700\_m19\_qp\_12 Q: 32

The statements list some of the events in the cardiac cycle. They are not in the correct order.

- 1 The impulse travels through Purkyne tissue.
- 2 The ventricles contract.
- 3 The atrioventricular node delays the impulse for a fraction of a second.
- 4 The muscle tissue of the sinoatrial node contracts.
- 5 The wave of excitation sweeps upwards from the base of the ventricles.
- 6 A wave of excitation sweeps across the atria.
- 7 The atria contract.

Which statement describes the second of these events to occur in the cardiac cycle?

**A** 1      **B** 4      **C** 6      **D** 7

---

1242. 9700\_s19\_qp\_11 Q: 31

What happens during ventricular systole?

- 1 The atrioventricular node transmits an electrical signal to the apex of the heart.
- 2 The pressure in the ventricles drops below the pressure in the atria.
- 3 The atrioventricular valves close and the semilunar valves open.

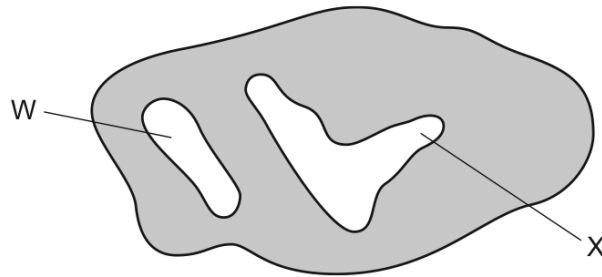
**A** 1 and 2 only      **B** 1 and 3 only      **C** 2 only      **D** 3 only

---



1243. 9700\_s19\_qp\_12 Q: 27

The diagram shows a cross-section through a mammalian heart.

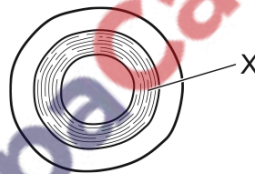


Which chambers of the heart are represented by W and X?

	W	X
<b>A</b>	left ventricle	right ventricle
<b>B</b>	right atrium	left atrium
<b>C</b>	right atrium	right ventricle
<b>D</b>	right ventricle	left ventricle

1244. 9700\_s19\_qp\_12 Q: 30

The diagram shows a transverse section through an artery.

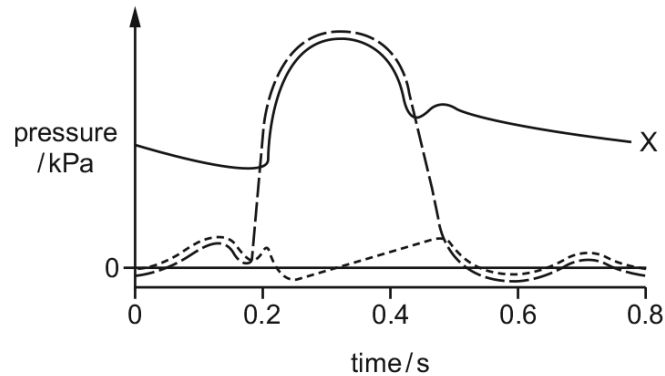


Which statement describes the tissues present in layer X?

- A** collagen and smooth muscle only
- B** elastic fibres and collagen only
- C** elastic fibres and smooth muscle only
- D** elastic fibres, collagen and smooth muscle

1245. 9700\_w19\_qp\_11 Q: 33

The diagram shows the pressure changes in some structures of the **right side** of the heart during the cardiac cycle.



Which structure is represented by X?

- A pulmonary artery
- B right atrium
- C right ventricle
- D vena cava

1246. 9700\_w19\_qp\_12 Q: 28

The statements list some of the events in the cardiac cycle. They are not in the correct order.

Which statement describes the fifth of these events to occur in the cardiac cycle?

- 1 The impulse travels through Purkyne tissue.
- 2 A wave of excitation sweeps across the atria.
- 3 The atrioventricular node delays the impulse for a fraction of a second.
- 4 The sinoatrial node contracts.
- 5 The wave of excitation sweeps upwards from the base of the ventricles.
- 6 The ventricles contract.
- 7 The atria contract.

- A 1                      B 3                      C 4                      D 7

1247. 9700\_w19\_qp\_13 Q: 30

Which is the correct sequence for the opening of the valves in the mammalian heart during one cardiac cycle?

- |  |  |
|--|--|
| <p><b>A</b></p> <p>right atrioventricular valve</p> <p style="text-align: center;">↓</p> <p>pulmonary semilunar valve</p> <p style="text-align: center;">↓</p> <p>left atrioventricular valve</p> <p style="text-align: center;">↓</p> <p>aortic semilunar valve</p> | <p><b>B</b></p> <p>left atrioventricular valve</p> <p style="text-align: center;">↓</p> <p>aortic semilunar valve</p> <p style="text-align: center;">↓</p> <p>right atrioventricular valve</p> <p style="text-align: center;">↓</p> <p>pulmonary semilunar valve</p> |
| <p><b>C</b></p> <p>left atrioventricular valve<br/>and<br/>aortic semilunar valve</p> <p style="text-align: center;">↓</p> <p>right atrioventricular valve<br/>and<br/>pulmonary semilunar valve</p>   | <p><b>D</b></p> <p>left atrioventricular valve<br/>and<br/>right atrioventricular valve</p> <p style="text-align: center;">↓</p> <p>aortic semilunar valve<br/>and<br/>pulmonary semilunar valve</p>   |

1248. 9700\_w19\_qp\_13 Q: 32

Aortic stenosis is a heart valve disorder in which the aortic semilunar valve opening is narrow.

Which effect could aortic stenosis have on heart structure and function?

- A** The cardiac muscle of the left ventricle wall is thinned by blood leaking out of the left ventricle during ventricular diastole.
- B** There is less cardiac muscle in the left ventricle and reduced diastolic blood pressure, caused by the smaller blood volume entering the left atrium.
- C** The tendons of the heart valves are weakened by blood being forced back through the left atrioventricular valve into the left atrium.
- D** The wall of the left ventricle thickens, leading to an enlarged heart and inability to relax and fill completely during diastole.

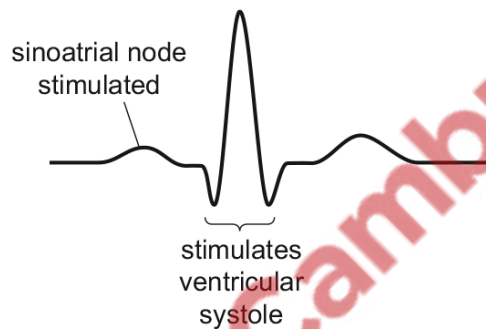
1249. 9700\_m18\_qp\_12 Q: 30

Which statement about the blood flow in the cardiac cycle is correct?

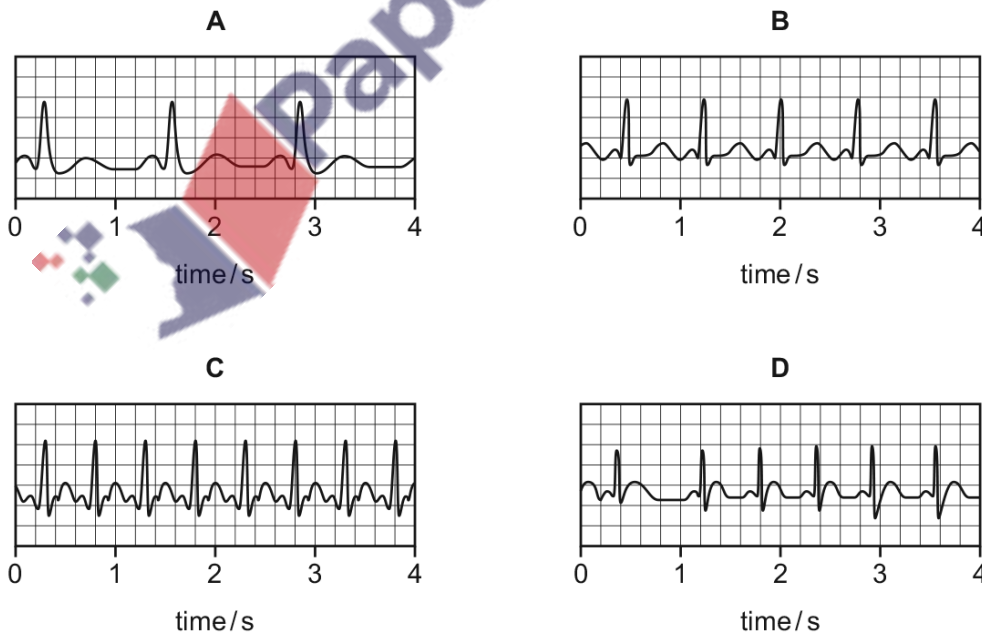
- A** Blood flows into the aorta through the semilunar valve due to contraction of the right ventricle.
- B** Blood flows into the left atrium through the pulmonary artery when the wall of the left atrium relaxes.
- C** Blood flows into the right atrium through the vena cava when the wall of the right atrium relaxes.
- D** Blood flows into the right ventricle through the semilunar valve due to contraction of the right atrium.

1250. 9700\_s18\_qp\_11 Q: 28

The diagram shows the changes in electrical activity in the heart muscle during one cardiac cycle. This is called an electrocardiograph (ECG).



Which electrocardiogram shows a rate of 75 beats per minute?



1251. 9700\_s18\_qp\_12 Q: 30

Which statement explains why the ventricles contract after the atria?

- A The band of fibres between the atria and the ventricles conducts the excitation wave slowly.
- B The excitation wave has to pass through a small area of conducting fibres in the septum.
- C The excitation wave has to travel further to reach the base of the ventricles than to spread across the atria.
- D The excitation wave travels slowly through the Purkyne tissue to reach the base of the septum.

1252. 9700\_s18\_qp\_12 Q: 31

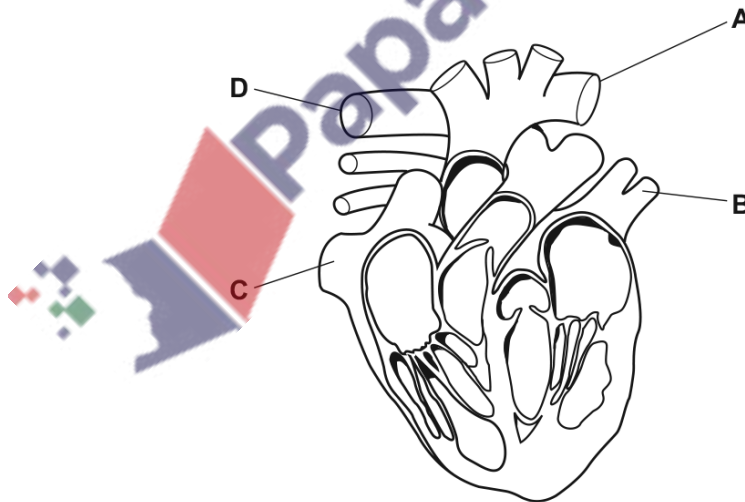
If the left atrioventricular valve in the heart does not close completely it results in blood flowing back into the atrium during ventricular systole.

What would be the immediate effect of this back flow?

- A blood flowing from the heart carries less oxygen because less blood enters the lungs
- B diastolic pressure in the left ventricle falls because less blood enters the pulmonary artery
- C lower systolic pressure in the left atrium and less blood enters the pulmonary artery
- D raised pressure in the left atrium and less blood enters the aorta

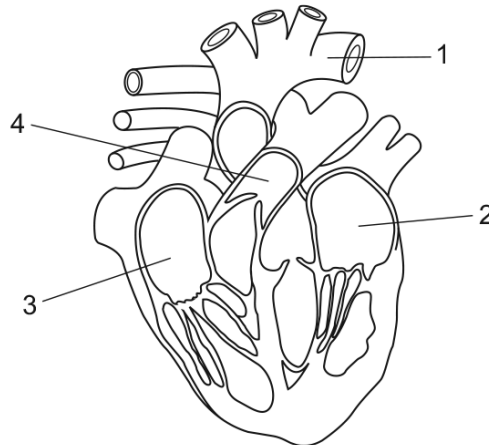
1253. 9700\_s18\_qp\_13 Q: 30

Which blood vessel has the thickest walls?



1254. 9700\_w18\_qp\_11 Q: 29

The diagram shows a section through the heart and the associated blood vessels.



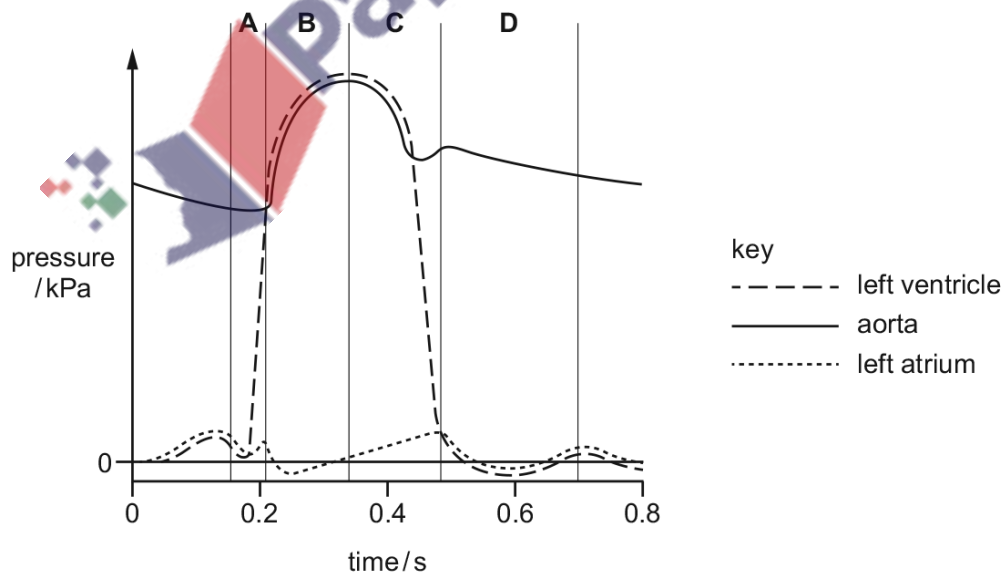
What is correct for the flow of blood through the heart?

- A 1 → 2 → 3 → 4
- B 2 → 1 → 3 → 4
- C 3 → 4 → 1 → 2
- D 4 → 3 → 2 → 1

1255. 9700\_w18\_qp\_11 Q: 32

The diagram shows the pressure changes in various structures of the left side of the heart during the cardiac cycle.

At the end of which period is the ventricle full of blood?



1256. 9700\_w18\_qp\_12 Q: 29

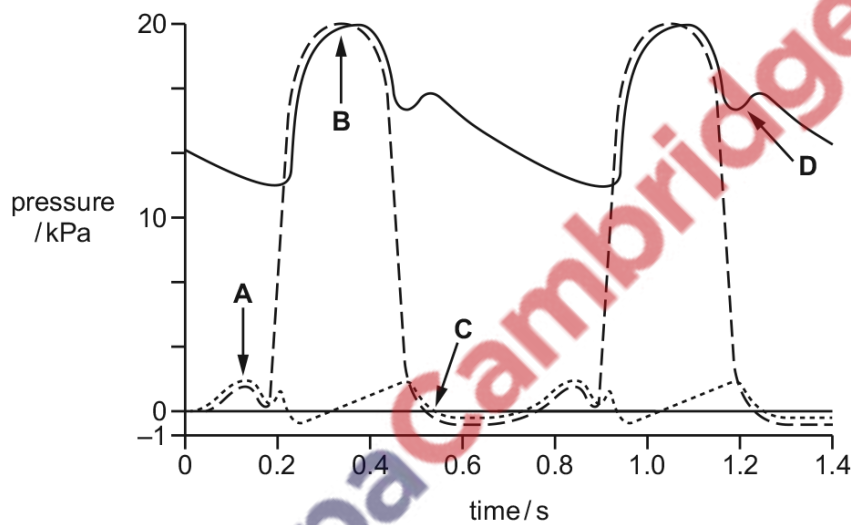
What describes the role of the atrio-ventricular node of the heart?

- A It causes the muscles of the ventricles to contract from the apex upwards.
- B It delays the transmission of a wave of electrical activity from the sinoatrial node.
- C It initiates a new wave of electrical activity in the ventricles.
- D It provides a non-conducting barrier between the atria and the ventricles.

1257. 9700\_w18\_qp\_12 Q: 30

The diagram shows pressure changes during the cardiac cycle.

Which arrow indicates ventricular systole?



1258. 9700\_m17\_qp\_12 Q: 33

The contraction of the heart is coordinated through electrical impulses passing through the cardiac muscle.

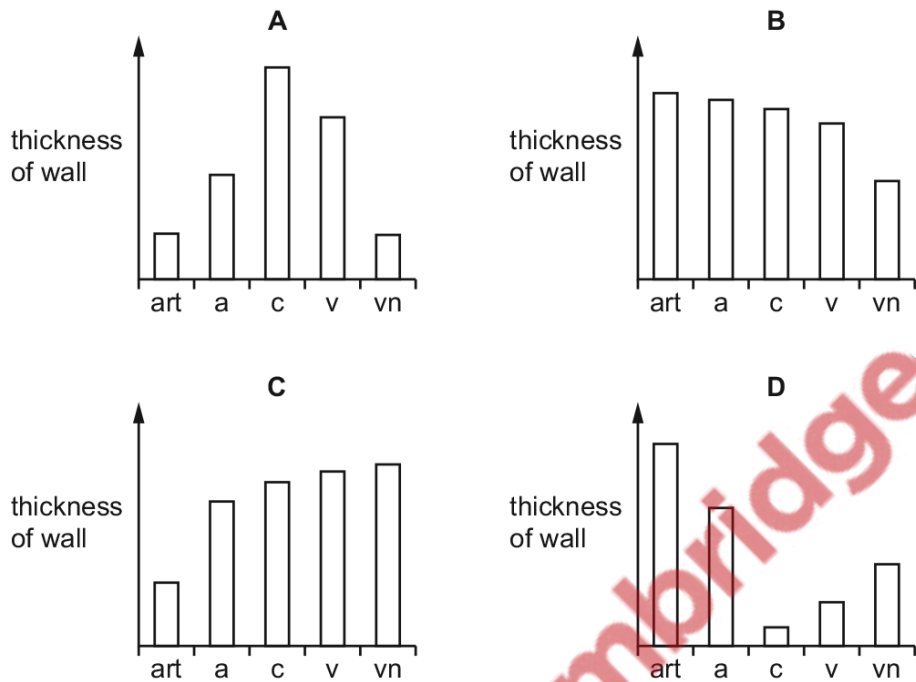
What is the correct order of part of the sequence of these impulses?

- A right and left atria → atrioventricular node → Purkyne tissue → ventricular walls
- B right and left atria → Purkyne tissue → ventricular walls → atrioventricular node
- C right and left atria → sinoatrial node → atrioventricular node → ventricular walls
- D sinoatrial node → right and left atria → Purkyne tissue → atrioventricular node

1259. 9700\_m17\_qp\_12 Q: 34

As blood flows from an artery to a vein, the thickness of the walls of the vessels changes.

Which bar chart shows these changes correctly?



key

- art = artery
- a = arteriole (small artery)
- c = capillary
- v = venule (small vein)
- vn = vein

1260. 9700\_s17\_qp\_11 Q: 33

The contraction of the heart is coordinated through electrical impulses passing through the cardiac muscle.

Which is the correct order of part of the sequence of these impulses?

- A** right and left atria → sinoatrial node → atrioventricular node → ventricular walls
- B** sinoatrial node → right and left atria → atrioventricular node → Purkyne tissue
- C** sinoatrial node → right and left atria → Purkyne tissue → atrioventricular node
- D** sinoatrial node → right and left atria → Purkyne tissue → ventricular walls



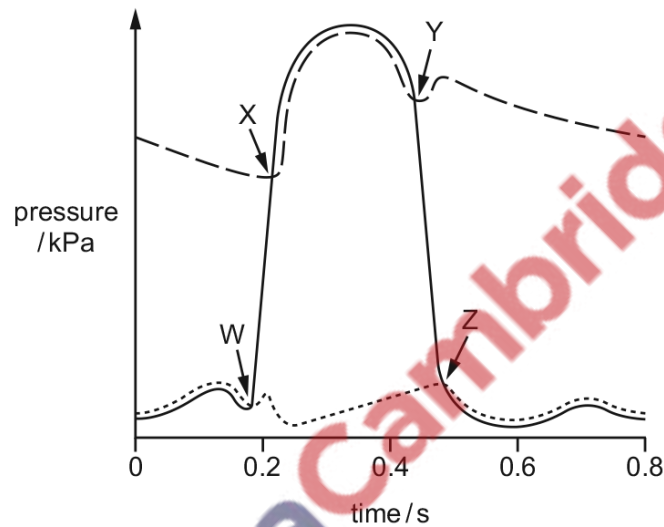
1261. 9700\_s17\_qp\_11 Q: 34

Which features enable the aorta to withstand ventricular systole?

- A collagen fibres and elastin fibres
- B collagen fibres and smooth muscle
- C elastin fibres and endothelium
- D endothelium and smooth muscle

1262. 9700\_s17\_qp\_12 Q: 26

The graph shows pressure changes during a cardiac cycle.



Which row correctly identifies W, X, Y, and Z?

	W	X	Y	Z
A	atrioventricular valves close	semi-lunar valves close	semi-lunar valves open	atrioventricular valves open
B	atrioventricular valves close	semi-lunar valves open	semi-lunar valves close	atrioventricular valves open
C	semi-lunar valves close	atrioventricular valves open	atrioventricular valves close	semi-lunar valves open
D	semi-lunar valves open	atrioventricular valves close	atrioventricular valves open	semi-lunar valves close

1263. 9700\_s17\_qp\_13 Q: 26

Three areas involved in the control of heart action are listed.

- 1 atrioventricular node
- 2 Purkyne tissue
- 3 sinoatrial node

In which order are they involved?

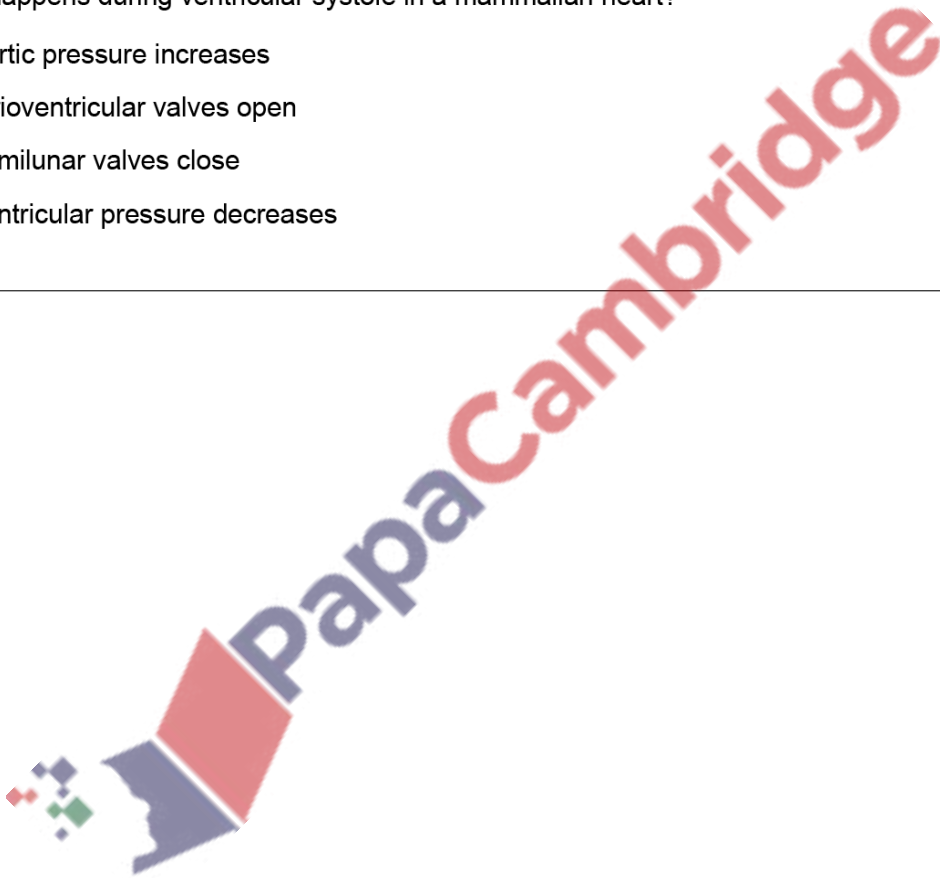
- A** 1 → 2 → 3    **B** 1 → 3 → 2    **C** 3 → 1 → 2    **D** 3 → 2 → 1

---

1264. 9700\_w17\_qp\_11 Q: 27

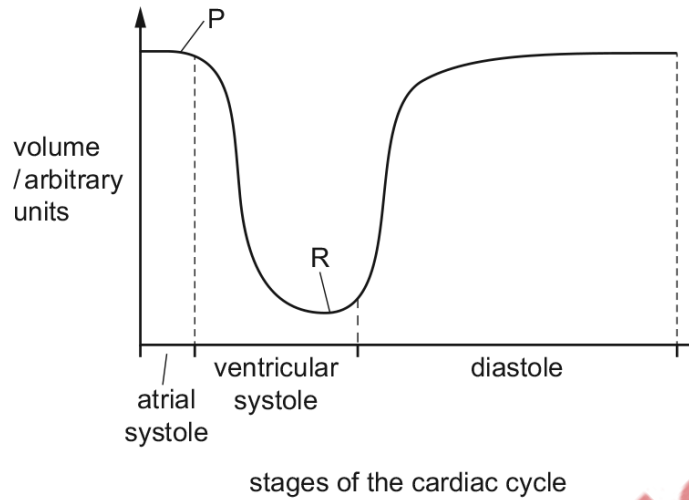
What happens during ventricular systole in a mammalian heart?

- A** aortic pressure increases
- B** atrioventricular valves open
- C** semilunar valves close
- D** ventricular pressure decreases



1265. 9700\_w17\_qp\_12 Q: 32

The graph shows changes in the volume of the ventricles during the cardiac cycle.



Which valves open and close at P and R?

	atrioventricular valve at P	semilunar valve at R
<b>A</b>	closes	closes
<b>B</b>	closes	opens
<b>C</b>	opens	closes
<b>D</b>	opens	opens

1266. 9700\_w17\_qp\_13 Q: 32

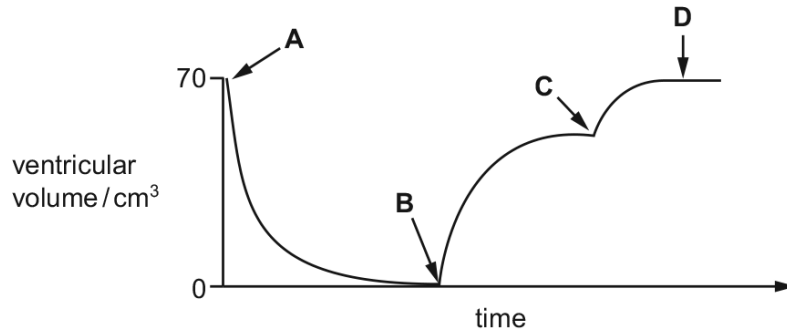
What happens during left ventricular systole?

- A** The atrioventricular node causes the immediate contraction of the ventricle, causing the atrioventricular valve to close.
- B** The Purkyne tissue between the atrium and ventricle causes the ventricle to contract, closing the atrioventricular valve and opening the semilunar valve.
- C** The sinoatrial node causes the atrium to stop contracting and the blood pressure in the ventricle to increase above that in the atrium.
- D** The wave of excitation causes the ventricle to contract so that the blood pressure in the ventricle is higher than in the aorta, opening the semilunar valve.

1267. 9700\_m16\_qp\_12 Q: 31

The graph shows the changes that take place in the volume of the left ventricle during one cardiac cycle.

Which point on the graph represents the start of atrial systole?



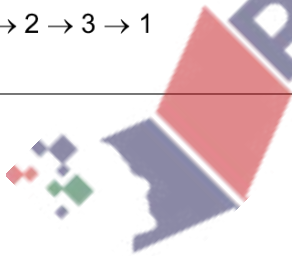
1268. 9700\_m16\_qp\_12 Q: 32

The following tissues carry an electrical impulse during the cardiac cycle.

- 1 atrioventricular node
- 2 muscle wall of atria
- 3 Purkyne tissue
- 4 sinoatrial node

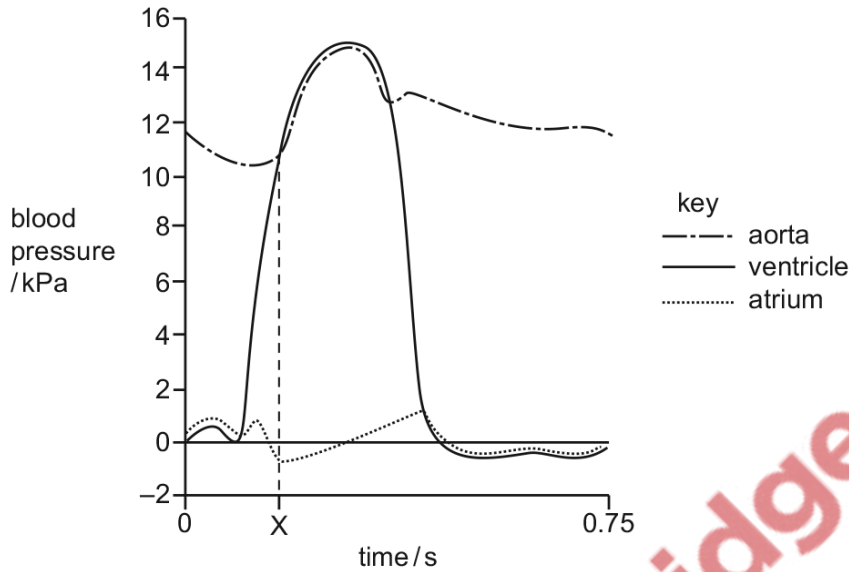
In what order does the electrical impulse travel during the cardiac cycle?

- A 1 → 2 → 3 → 4
- B 1 → 4 → 2 → 3
- C 4 → 2 → 1 → 3
- D 4 → 2 → 3 → 1



1269. 9700\_s16\_qp\_11 Q: 29

The graph shows changes in blood pressure during one cardiac cycle.



What is happening at time X?

	aortic semilunar valve	atrium
<b>A</b>	closing	emptying
<b>B</b>	closing	filling
<b>C</b>	opening	emptying
<b>D</b>	opening	filling

1270. 9700\_s16\_qp\_11 Q: 32

Which statement concerning events that occur in the heart is correct?

- A** As the wave of excitation passes through the atrioventricular node there is a time delay before it passes down the conducting fibres in the septum to the ventricles; this allows the atria to fill before ventricular systole.
- B** Contraction of the ventricle muscles following atrial systole causes the ventricular blood pressure to rise above the blood pressure in the atria, closing the atrioventricular valve and preventing backflow.
- C** The band of non-conducting fibres between the atria and ventricles prevents the wave of excitation from the atria reaching the ventricles directly; the wave of excitation passes to the Purkyne fibres and then to the atrioventricular node.
- D** The primary pacemaker, the sinoatrial node in the left atrium, sends out a wave of excitation that spreads across the walls of the atria, resulting in the movement of blood from the atria into the ventricles.

1271. 9700\_s16\_qp\_13 Q: 28

Which events occur during ventricular systole?

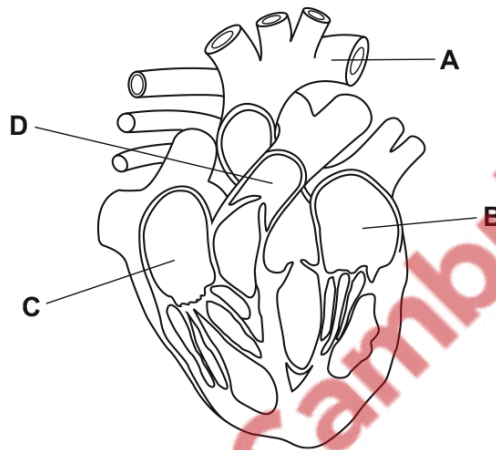
- 1 atrioventricular valves close
- 2 muscle in ventricle walls relaxes
- 3 semilunar valves open

**A** 1, 2 and 3    **B** 1 and 2 only    **C** 1 and 3 only    **D** 2 and 3 only

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1272. 9700\_w16\_qp\_11 Q: 29

The diagram shows a section through the heart.

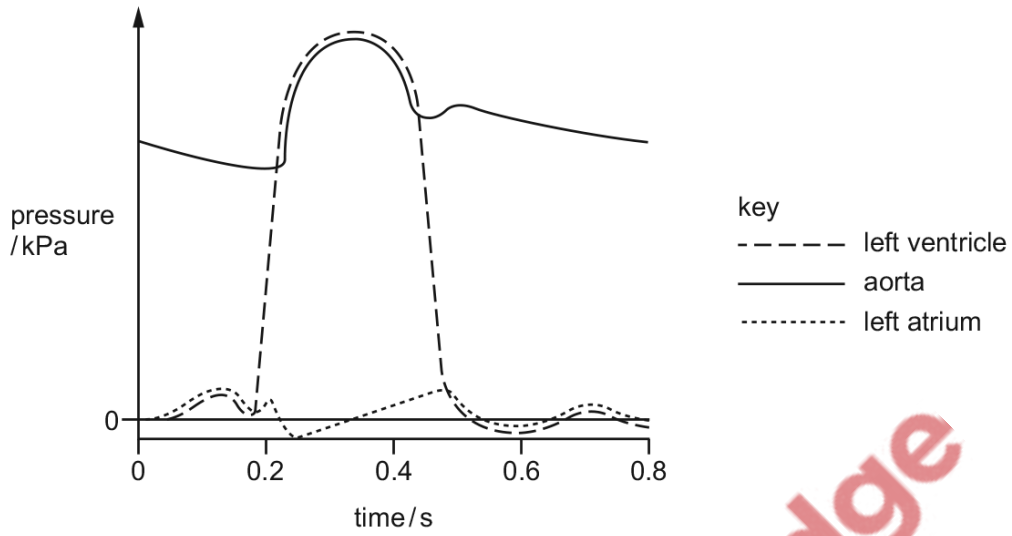


Which label is correct?

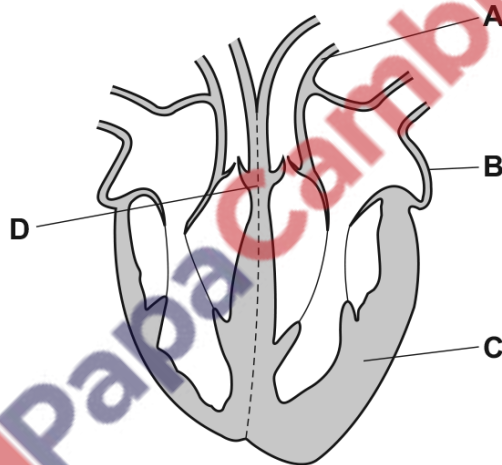
- A** pulmonary artery
- B** left ventricle
- C** right atrium
- D** aorta

1273. 9700\_w16\_qp\_12 Q: 32

The graph shows the pressure in three parts of the heart during one cycle.

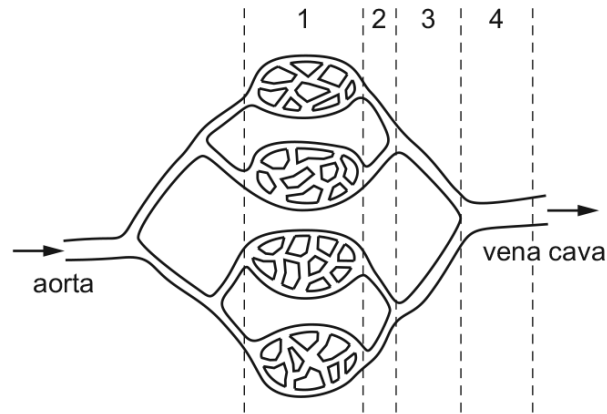


At 0.2 seconds, which part of the heart is responding to the excitatory stimulus?



1274. 9700\_w16\_qp\_12 Q: 33

The diagram shows part of the organisation of the circulation of a mammal.



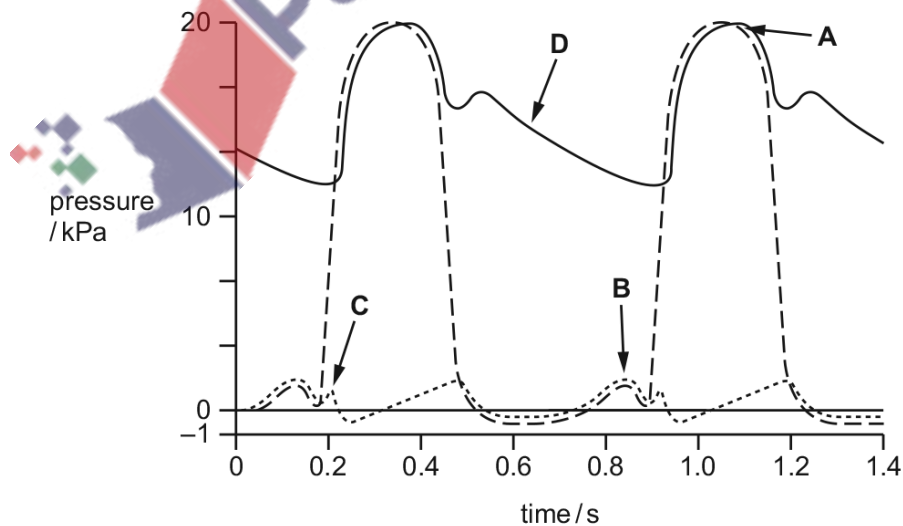
Where are **both** the blood pressure and speed of flow lowest?

	lowest blood pressure	lowest speed of flow
<b>A</b>	1	4
<b>B</b>	2	3
<b>C</b>	3	2
<b>D</b>	4	1

1275. 9700\_w16\_qp\_13 Q: 31

The diagram shows pressure changes during the cardiac cycle.

Which arrow indicates atrial systole?

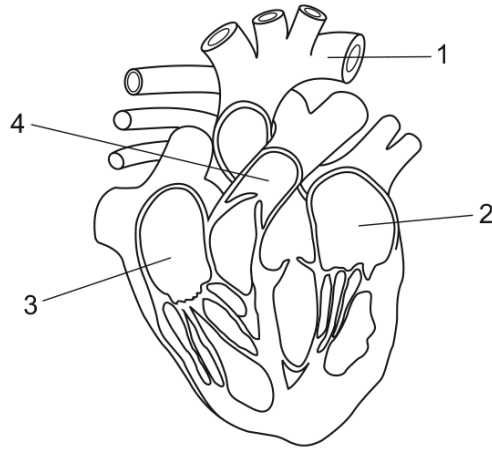




1276. 9700\_s15\_qp\_11 Q: 30

The diagram shows a section through the heart and the associated blood vessels.

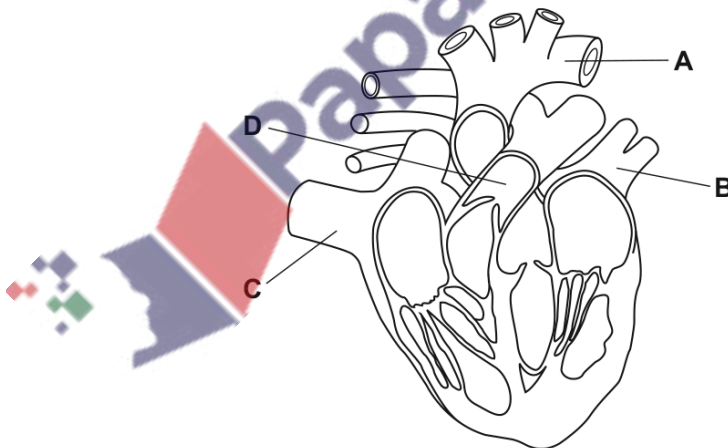
What is correct for the flow of blood through the heart?



- A 1 → 2 → 3 → 4
- B 2 → 1 → 3 → 4
- C 3 → 4 → 1 → 2
- D 4 → 3 → 2 → 1

1277. 9700\_s15\_qp\_12 Q: 28

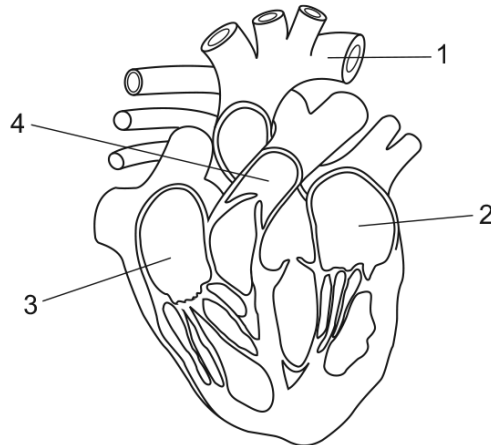
Which structure is correctly identified?



- A aorta
- B pulmonary artery
- C pulmonary vein
- D vena cava

1278. 9700\_s15\_qp\_13 Q: 29

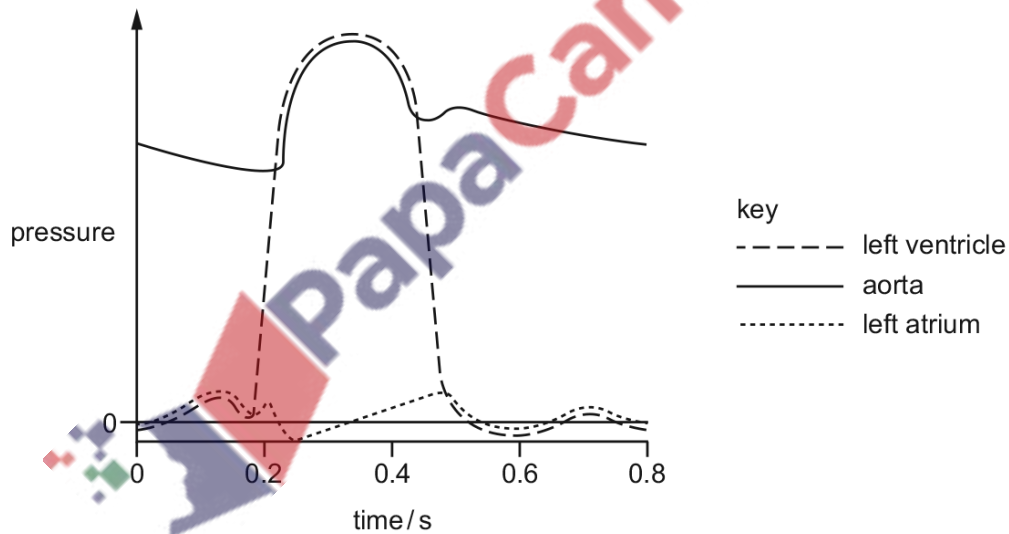
Which structures transport deoxygenated blood?



- A** 1 and 2      **B** 2 and 4      **C** 3 and 4      **D** 3 only

1279. 9700\_w15\_qp\_11 Q: 30

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

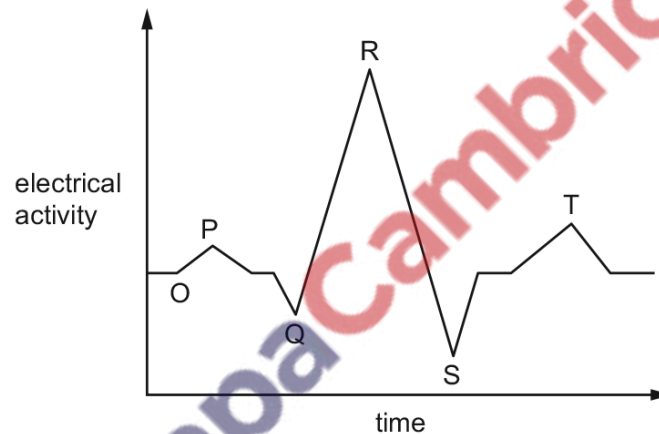
1280. 9700\_w15\_qp\_12 Q: 29

What happens to the atrioventricular valves and to the semilunar valves during atrial systole and ventricular systole?

	atrial systole		ventricular systole	
	atrioventricular valves	semilunar valves	atrioventricular valves	semilunar valves
<b>A</b>	open	closed	closed	open
<b>B</b>	open	closed	open	open
<b>C</b>	closed	open	closed	closed
<b>D</b>	closed	open	open	closed

1281. 9700\_w15\_qp\_13 Q: 29

The diagram shows the electrical activity in cardiac muscle during one heart beat.



What is happening at each of the labelled stages in the cardiac cycle?

	O	P	QRS	T
<b>A</b>	atria contract	atrio-ventricular valve opens	atria relax	ventricles contract
<b>B</b>	impulse leaves AVN	ventricles contract	atria relax	atrio-ventricular valve closes
<b>C</b>	impulse leaves SAN	atria contract	ventricles contract	ventricles relax
<b>D</b>	ventricles relax	atria contract	atrio-ventricular valve closes	ventricles relax