Name:	Target Grade:	Actual Grade:

BRIGHT CULTURE

TRANSPORT IN HUMANS
MCQ and STRUCTURED QUESTIONS

READ THESE INSTRUCTIONS FIRST

INSTRUCTIONS TO CANDIDATES

1. Find a quiet, comfortable spot free place from distractions.

2. Spend one minute on each mark.

3. Time yourself for every single question.

4. Every chapter has their own question types. Ensure that you know the different question type for each chapter.

5. Make a conscientious effort to remember your mistakes, especially in terms of answering techniques. E.g Take a picture for the mistakes that you made, keep it in a photo album, and revise it over and over again.

6. Highlight question types that you tend to keep making mistakes and review them nearing exams.

7. Always review the common questions and question type that you tend to make mistakes nearing exams.

8. During exams, classify the question type and recall what you have learnt, how you need to analyse the questions for the different question type, what you need to take note of and answer with the correct answering techniques!

✨ **Wishing you all the best for this test!**

You've got this!

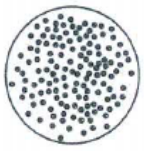
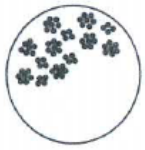
💡 **With lots of love,**
Bright Culture 💛

GOOD LUCK FOR YOUR EXAM!

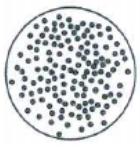
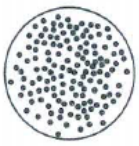
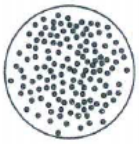
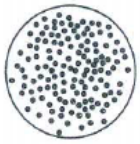
MARKS

TRANPORT IN HUMANS MCQ

1 A sample of blood was taken from Mary and two drops of her blood were put onto a white tile separately. The drops of blood were then tested with serum containing antibodies a and antibodies b respectively. The results of the test are as shown.

	serum with antibodies a	serum with antibodies b
Mary's blood sample		

Mary met with a car accident and 4 of her friends Louis, Stacey, Dion and Felicia are willing to donate their blood to save her. The bloods of her friends were also tested using the same method and the results are shown in the following table.

Mary's friend blood sample	serum with antibodies a	serum with antibodies b
Louis		
Stacey		
Dion		
Felicia		

Who can donate blood to Mary?

A Louis only
B Felicia only
C Louis and Felicia only
D Stacey and Dion only

2 Which blood vessels carry absorbed nutrients and oxygen into the liver?

	carries absorbed nutrients	carries oxygen
A	hepatic vein	hepatic vein
B	hepatic artery	hepatic artery
C	hepatic portal vein	hepatic artery
D	hepatic portal vein	hepatic vein

3 The duration of ventricular diastole and systole for an individual are shown below.

diastole 0.6 seconds

systole 0.4 seconds

What is the heart rate for this individual?

A 50 beats per minute
B 60 beats per minute
C 100 beats per minute
D 150 beats per minute

4 What is the state of the valves in the heart at X?

	left atrio-ventricular valve (bicuspid)	semi-lunar valve (in aorta)
A	closed	closed
B	closed	open
C	open	closed
D	open	open

5 What is the heart rate of the man?

A 75 beats per minute
B 80 beats per minute
C 100 beats per minute
D 120 beats per minute

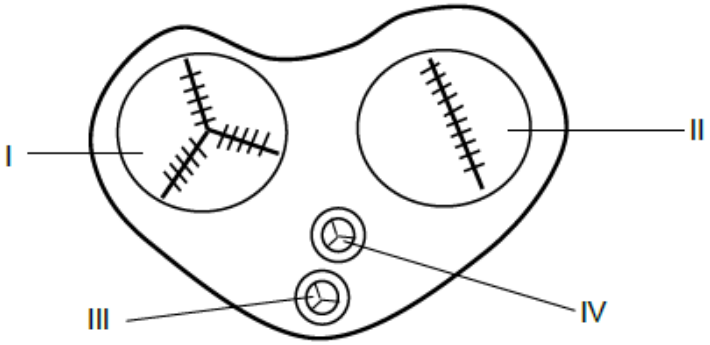
6 The table below shows the contents of the blood samples taken from three different veins found in a human body.

	vein 1	vein 2	vein 3
oxygen/ arbitrary units	95	78	85
carbon dioxide/ arbitrary units	30	50	45
urea/ %	2.5	1.3	5.5

Which of the following shows the correct identities of these veins?

	vein 1	vein 2	vein 3
A	hepatic vein	pulmonary vein	vena cava
B	vena cava	pulmonary vein	hepatic vein
C	pulmonary vein	hepatic vein	vena cava
D	pulmonary vein	vena cava	hepatic vein

7 The diagram below shows the transverse section of a mammalian heart.



Which valve(s) produces a 'dub' sound during ventricular diastole?

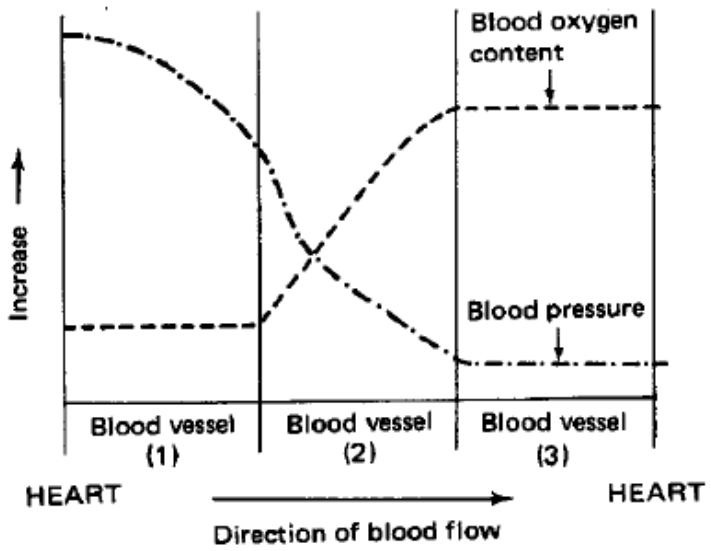
A I only
B I and II only
C II and IV only
D III and IV only

8 A patient, with blood type B, just lost a lot of blood in an accident and a blood transfusion is needed.

Which of the following is correct?

	patient's blood antibody	possible blood groups patient can receive
A	a	O only
B	b	O only
C	a	B or O
D	b	B or O

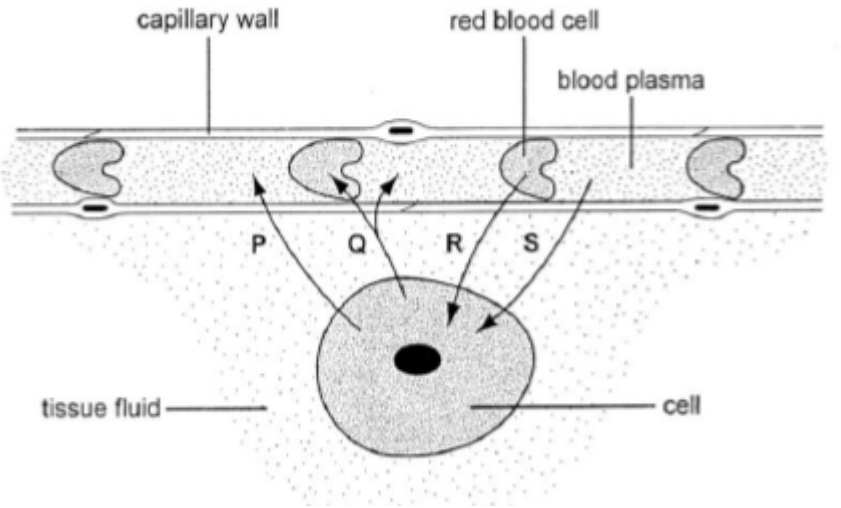
9 The graph below shows the changes in blood oxygen content and blood pressure along blood vessels 1, 2 and 3 that connect the heart and the lungs.



Which blood vessel is represented by 3?

A aorta
B vena cava
C pulmonary artery
D pulmonary

10 The diagram represents the relationship between a respiring cell and a blood capillary. The arrows indicate the direction followed by substances exchanged between the capillary contents and the cell.



What substances could P, Q, R and S represent?

	P	Q	R	S
A	salts	carbon dioxide	glucose	urea
B	oxygen	glucose	urea	water
C	urea	oxygen	carbon dioxide	salts
D	water	carbon dioxide	oxygen	glucose

11 The table below shows the compatibility of blood transfusion for two people.

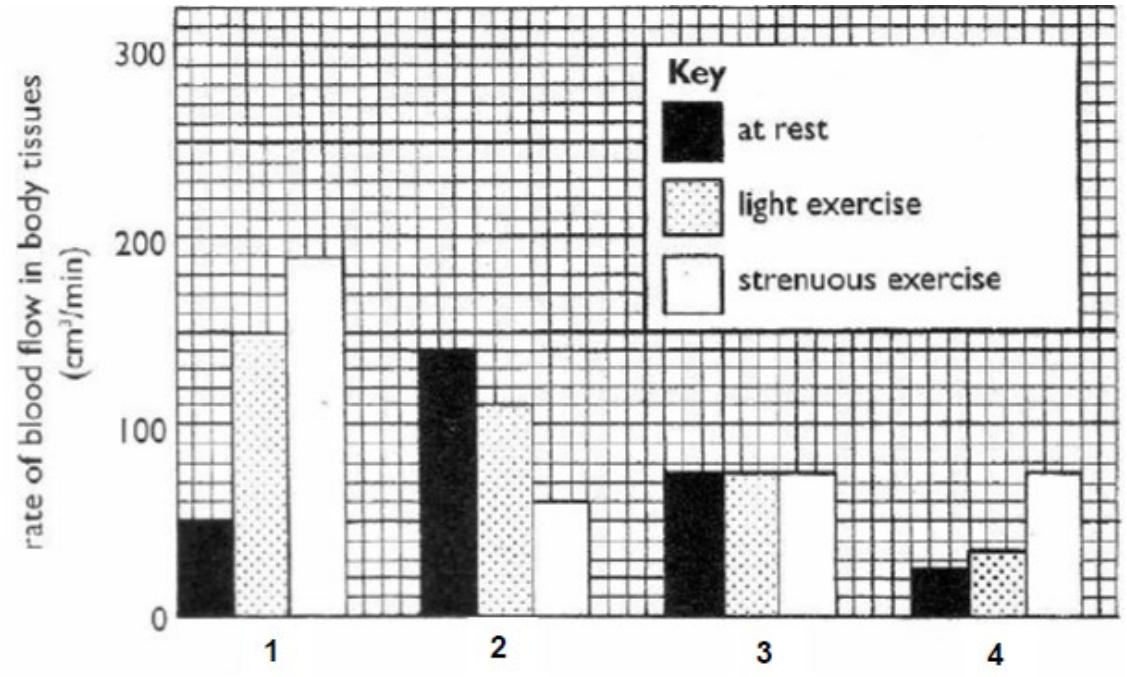
		Blood group of donor	
		A	B
Recipient	Peter	×	×
	Mary	✓	✓

key
✓ = blood can be transfused with no ill effects
× = blood should not be transfused

Which of the following combinations correctly shows the compatibility for blood transfusion between Peter and Mary?

	Peter donating blood to Mary	Mary donating blood to Peter
A	No agglutination	No agglutination
B	Agglutination	Agglutination
C	No agglutination	Agglutination
D	Agglutination	No agglutination

12 The bar chart below shows the rate of blood flow in four various parts of the body when the body is in different states of activity.



Which of the following correctly represents blood flow in the following organs?

	small intestine	heart	pancreas
A	1	4	2
B	2	1	4
C	3	2	1
D	4	3	2

13 The table shows the results of blood transfusions between four individuals, P, Q, R and S.

		recipients			
		P	**Q**	**R**	**S**
donors	**P**		✓	✓	✓
	Q	X		✓	✓
	R	X	X		X
	S	X	✓	✓	

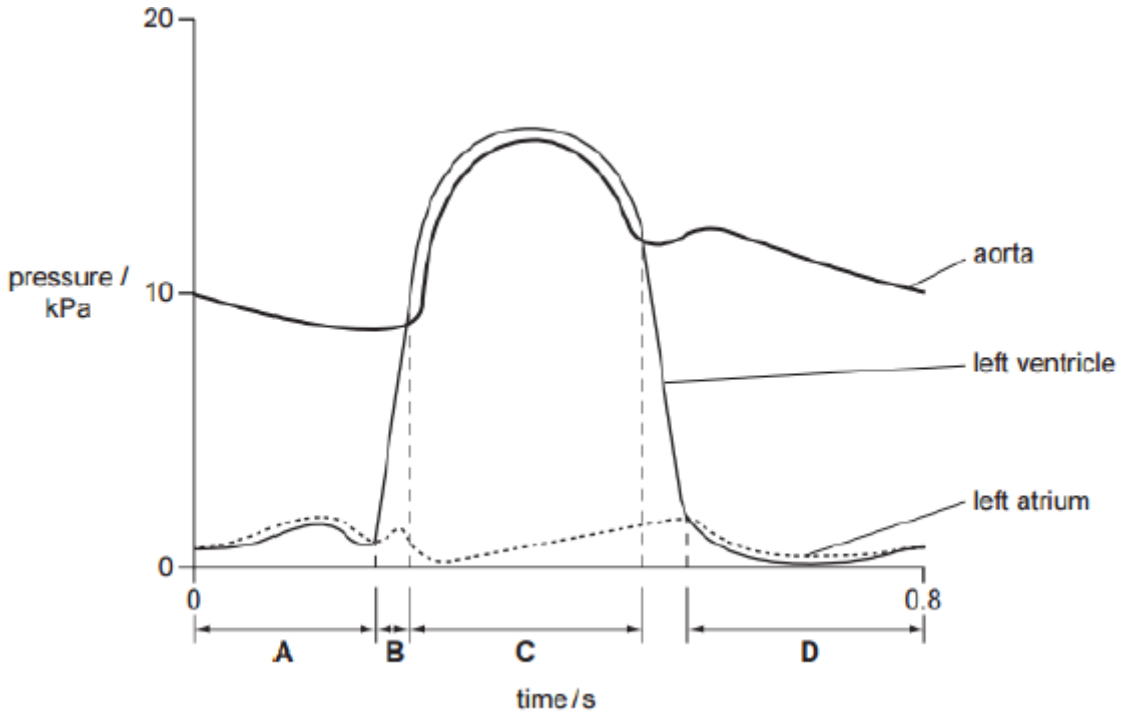
✓ successful transfusion
X unsuccessful transfusion

Which blood groups do the four individuals have?

	P	**Q**	**R**	**S**
A	AB	A	O	B
B	AB	B	O	B
C	O	A	AB	B
D	O	B	AB	B

14 The diagram shows the pressure changes in the left side of the heart during one heartbeat.

During which time period does atrial systole occur?



15 A sample of blood contains extremely high amounts of glucose and amino acids. In addition, the blood also contains slightly higher amounts of carbon dioxide than normal.

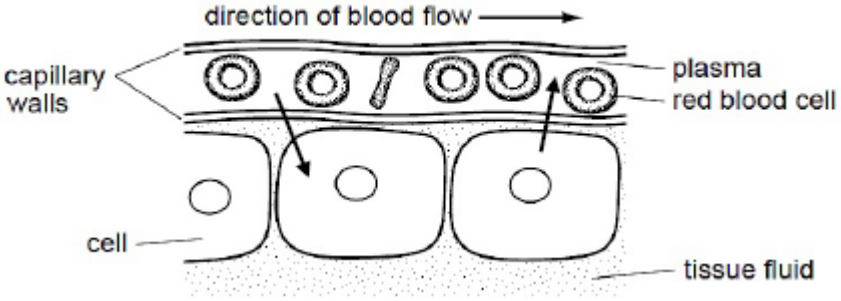
Which blood vessel could the blood sample have been taken from?

A aorta
B hepatic portal vein
C pulmonary vein
D renal artery

16 Which mode of defence in the human body is a chemical barrier for bacteria?

A antibody production
B hairs in the nose
C mucus lining the airways
D skin

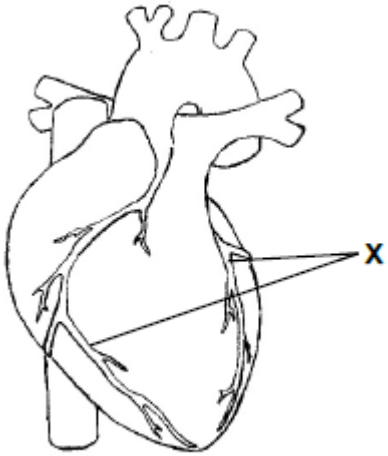
17 The diagram shows a blood capillary close to some tissue cells bathed in tissue fluid. Exchange of substances takes place here.



Which row shows the substances leaving, and returning into blood plasma, and the method of transfer between the two?

	leaving	returning	method of transfer
A	amino acid	carbon dioxide	diffusion
B	amino acid	protein	osmosis
C	red blood cell	red blood cell	diffusion
D	carbon dioxide	oxygen	diffusion

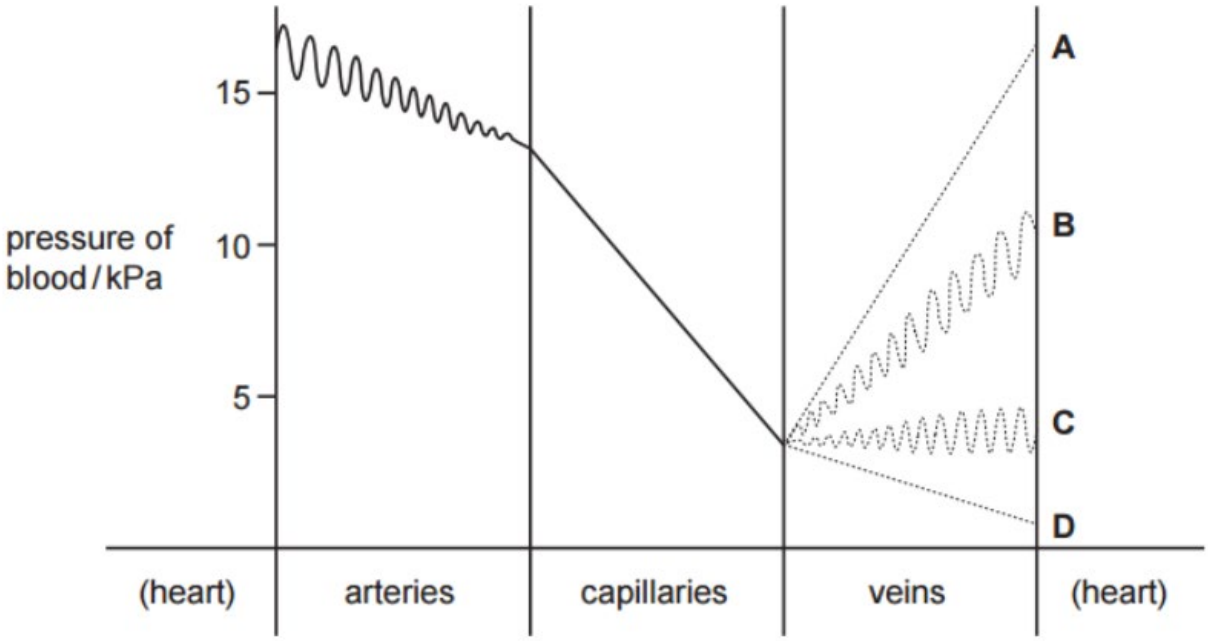
18 The diagram shows the structure of a mammalian heart.



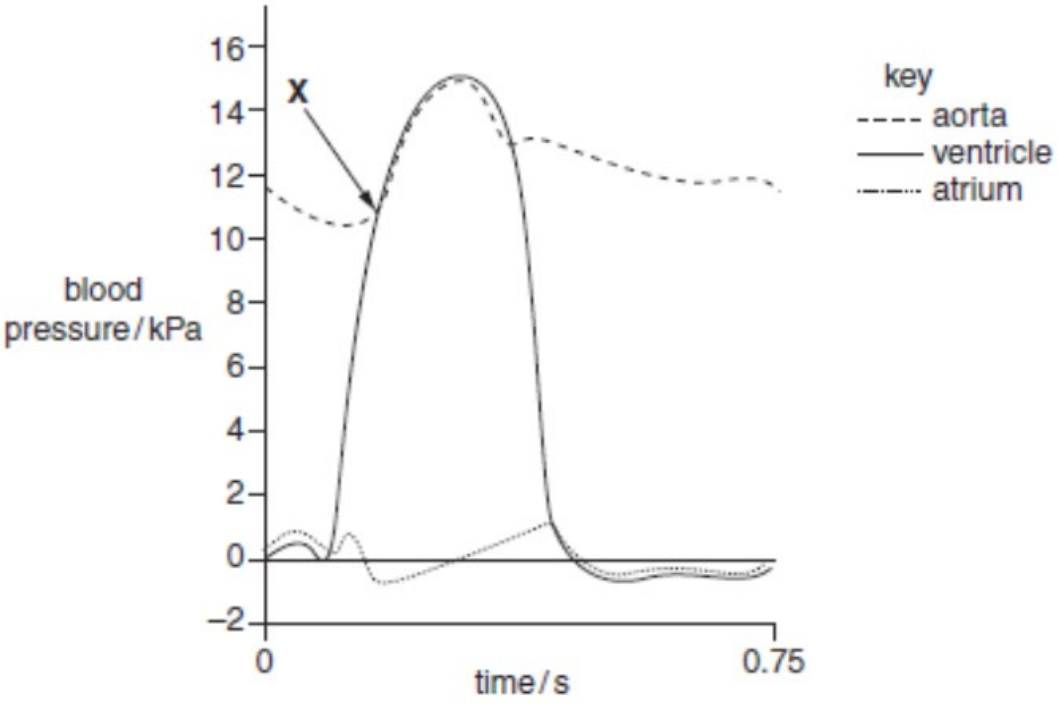
Which correctly identifies structure X?

A coronary arteries
B pulmonary arteries
C pulmonary veins
D vena cava

19 The diagram shows the blood pressure of a person at rest as the blood leaves the heart and passes through arteries and then capillaries. Which line shows the pressure of blood as it flows through veins before returning to the heart?



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



What is happening to the ventricle and aortic semilunar valve at X?

	ventricle	semilunar valve
A	contracting	closing
B	contracting	opening
C	relaxing	closing
D	relaxing	opening

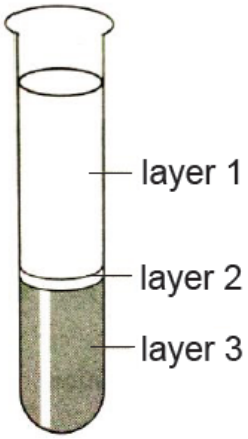
21 The table shows substances that pass between capillaries and tissues in a part of the body.

substance	into the capillaries from the tissues	out of the capillaries into the tissues
oxygen		✓
carbon dioxide	✓	
amino acids		✓
urea	✓	

In which part of the body are these capillaries located?

A kidneys
B liver
C lungs
D small intestine

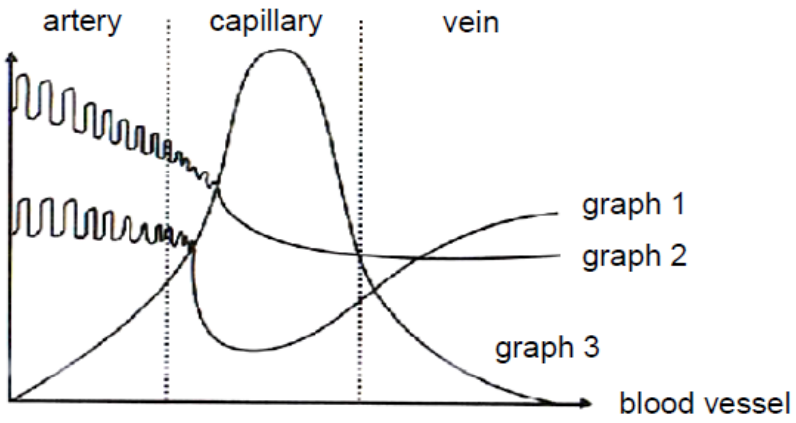
22 The diagram below shows a test tube of blood after it had been spun down for 5 minutes in a process known as centrifugation. In centrifugation, the heavier components sink to the bottom of the test tube while the lighter components rise toward the surface.



When the blood sample from a patient was centrifuged, it was observed that layer 2 was absent. What is the patient likely to experience as a result of this?

A The patient has lowered ability to fight off infections.
B The patient will experience shortness of breath easily.
C The patient is unable to regulate blood glucose concentration.
D The patient will experience agglutination.

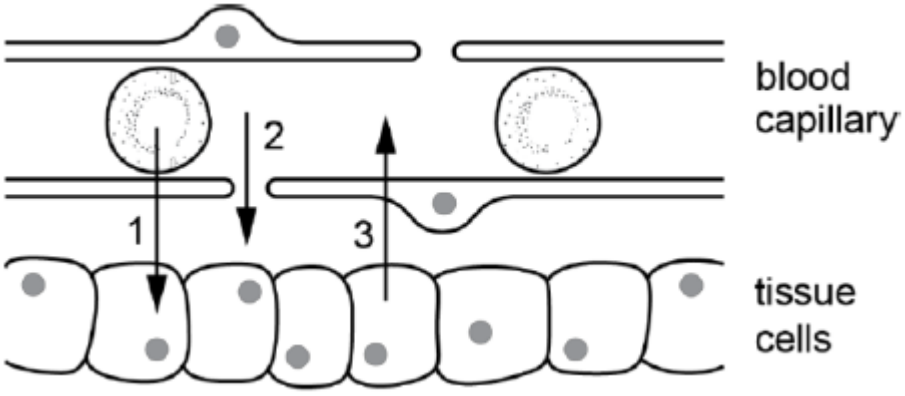
23 The diagram below shows the characteristics of three types of blood vessels in which the blood vessels are represented by three regions as shown below.



Which of the following describes what graphs 1, 2 and 3 represent?

	graph 1	graph 2	graph 3
A	speed of blood flow	total surface area	blood pressure
B	speed of blood flow	blood pressure	total surface area
C	total surface area	blood pressure	speed of blood flow
D	blood pressure	speed of blood flow	total surface area

24 The diagram shows a blood capillary and some tissue cells.



Which row identifies the movement of substances indicated by 1, 2 and 3?

	1	2	3
A	diffusion of glucose	flow of plasma proteins	diffusion of amino acids
B	diffusion of glucose	flow of small solutes	diffusion of carbon dioxide
C	diffusion of oxygen	flow of plasma proteins	diffusion of amino acids
D	diffusion of oxygen	flow of small solutes	diffusion of carbon dioxide

25 Agglutination occurs when red blood cells possessing a particular antigen are exposed to their corresponding antibodies. The results of a blood type test of two blood samples, S1 and S2 exposed to antibodies *a* or *b*, are shown.

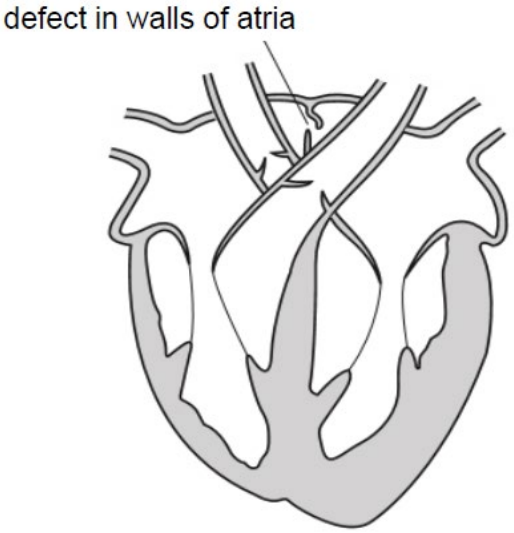
blood samples	exposed to antibody *a*	exposed to antibody *b*	control
S1	○	●	○
S2	○	○	○

key:
○ no agglutination
● agglutination

Which of the following identifies the blood groups of samples S1 and S2?

	S1	S2
A	blood group A	blood group O
B	blood group A	blood group AB
C	blood group B	blood group O
D	blood group B	blood group AB

26 The diagram shows a defect in the walls between the atria.



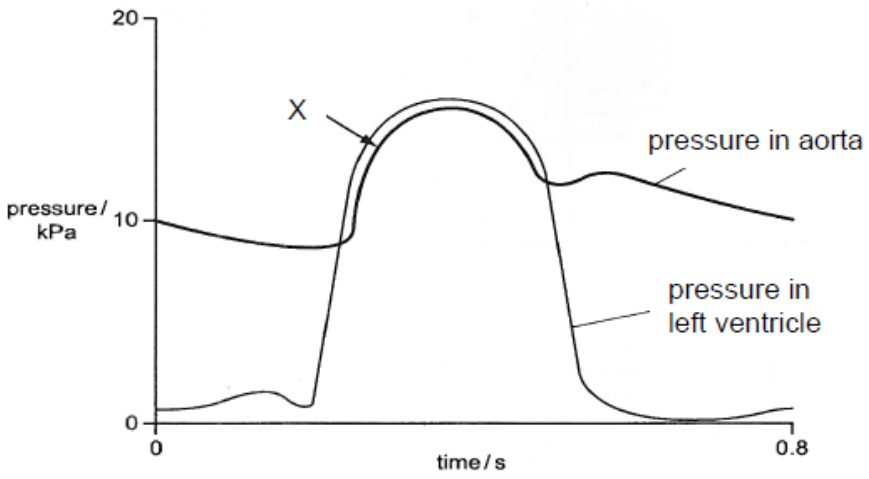
What effect would this defect have on the blood circulatory system?

A delayed ventricular diastole and systole
B heartbeat becomes irregular
C increased blood pressure in the pulmonary artery
D oxygen concentration is lower in the blood flowing out of aorta

27 Coronary heart disease is caused by the partial blockage of the coronary arteries. Which blood flow does this reduce?

A to the cardiac muscles
B to the left atrium
C to the intercostal muscles
D into the right ventricle

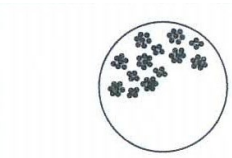
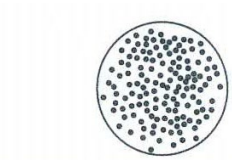
28 The diagram below shows changes in pressure in the aorta and the left ventricle during one cardiac cycle.



What causes the increase in pressure at point X?

A closure of valves in aorta
B closure of valves between left atrium and ventricle
C contraction of left atrium
D contraction of left ventricle

29 A sample of blood is taken from a patient and tested with serum containing antibody a and antibody b. The results of the test are shown below.

	serum with antibodies a	serum with antibodies b
blood sample		

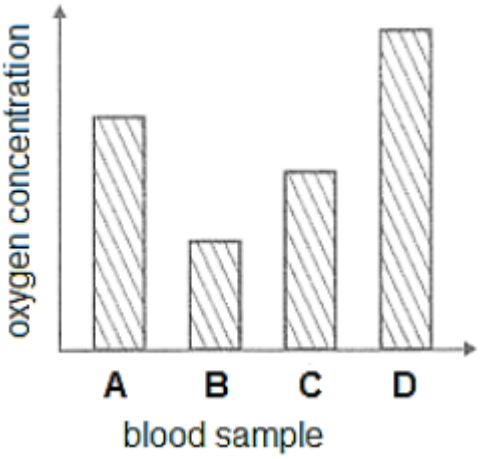
Which of the following is a correct conclusion on the blood type of the patient?

A He can donate blood to another person of blood type AB.
B He can donate blood to another person of blood type O.
C His red blood cells contain antigen B.
D His red blood cells do not contain any antigens

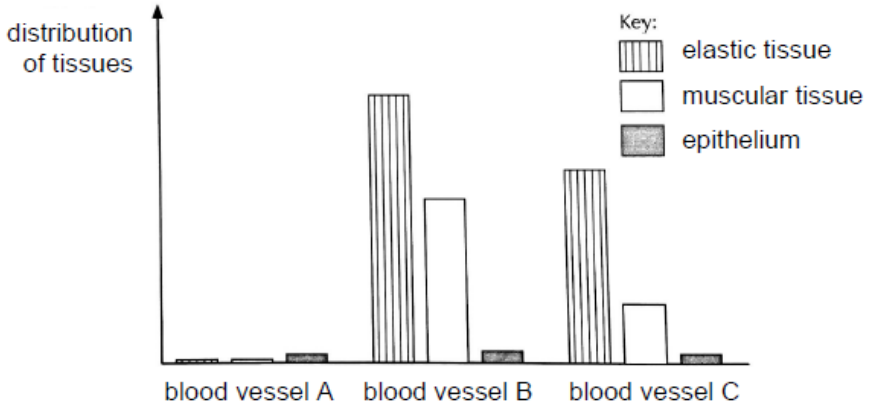
30 When a blood clot forms in response to tissue damage, in which order would the components of the blood be involved?

	first			last
A	fibrin	platelet	red blood cell	fibrinogen
B	fibrinogen	red blood cell	platelet	fibrin
C	platelet	fibrin	fibrinogen	red blood cell
D	platelet	fibrinogen	fibrin	red blood cell

31 The bar chart below shows the concentration of oxygen of four blood samples taken from four different places in the human circulatory system. Which blood sample was most likely taken from the pulmonary artery?



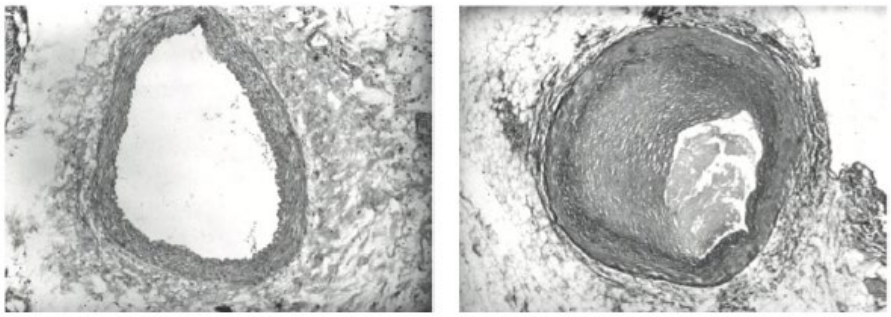
32 The diagram below shows the distribution of tissues in three types of blood vessels.



Which of the following correctly identifies blood vessel A, B and C?

	blood vessel A	blood vessel B	blood vessel C
A	capillary	artery	vein
B	capillary	vein	artery
C	vein	artery	capillary
D	vein	capillary	artery

33 The photomicrographs below show transverse sections of arteries from a non-smoker and a smoker.



non-smoker smoker

From the evidence above, which disease is most likely to occur in the smoker?

A chronic bronchitis
B coronary heart disease
C emphysema
D lung cancer

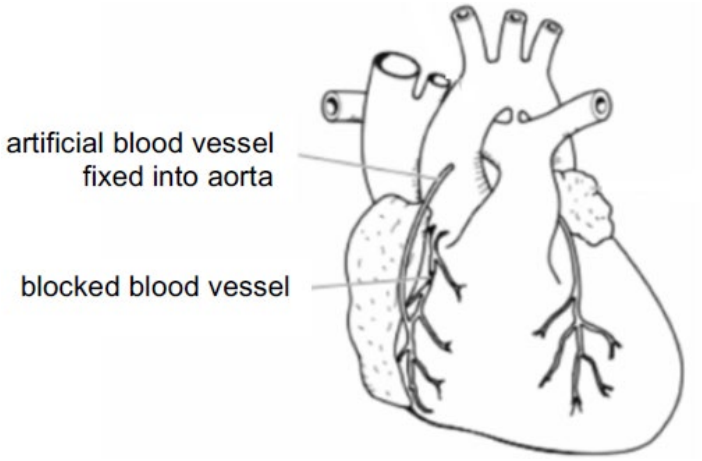
34 Living cells that produce insulin can be injected into the abdomen of patients with diabetes. These cells are placed into jelly capsules, and can replace daily insulin injections for several months. The jelly capsule only allows insulin molecules to leave the capsule, while no molecules or cells can enter the capsule.

Based on the information above, what is an advantage of such a treatment compared to a kidney transplant?

A It increases the chances of finding a kidney donor.
B It increases the need for immunosuppressant drugs.
C It reduces the cost of the treatment.
D It reduces the risk of tissue rejection.

TRANSPORT IN HUMANS STRUCTURED QUESTIONS

1 Fig. 5.1 shows how a blocked blood vessel in the heart can be by-passed using an artificial blood vessel.



(a) Sometimes, instead of an artificial blood vessel being used for the graft, a vein is taken from elsewhere in the patient's body. Suggest and explain one way in which a vein might not be as suitable for carrying blood to the heart muscle.

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……[2]

(b) Fig. 5.2 show the same blood vessel, as in **(a)** but this time the blockage is being treated with the use of a 'stent'.

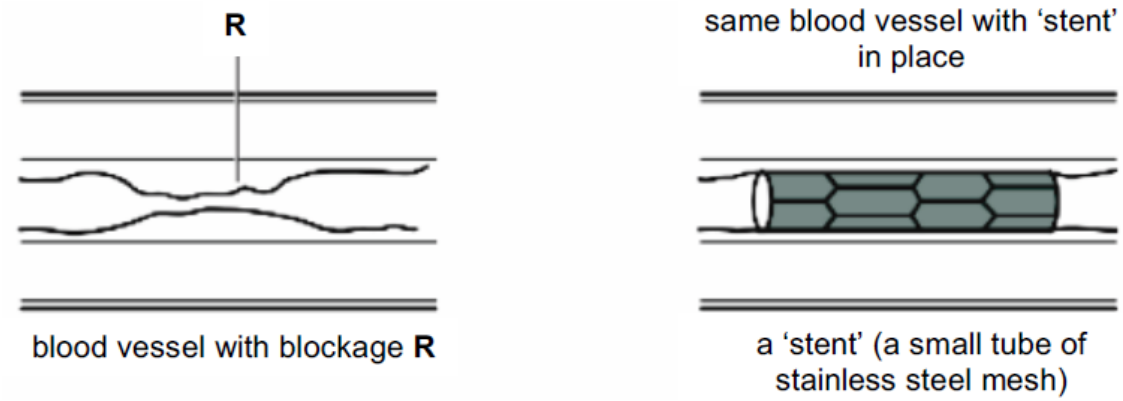

Fig. 5.2

(i) Name one component of the material that is causing the blockage at **R**.

…… [1]

(ii) Suggest and explain why patients are given 'anti-platelet' drugs before inserting the stent.

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…… [2]

[Total: 5]

2 Fig. 10.1 and Fig. 10.2 show graphs of the pulse and breathing rates of two students, E and F, during and after one minute of vigorous exercise.

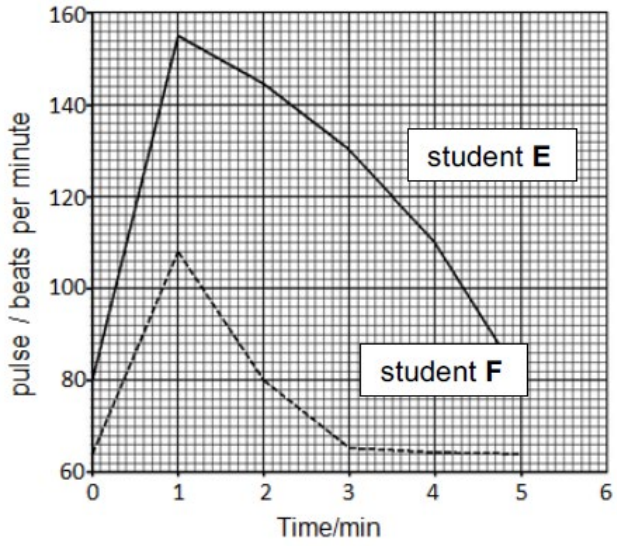

Fig. 10.1

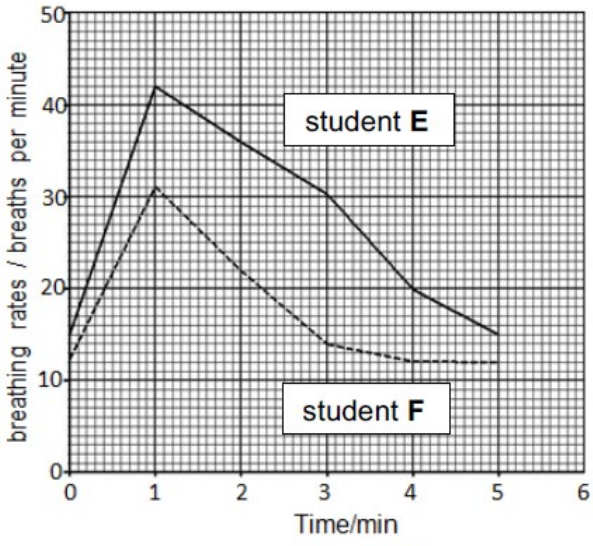

Fig. 10.2

(a) State how long it took for student **F's** pulse and breathing rates to return to original levels after the student had finished exercising.

pulse rate …… breathing rate …… [1]

(b) Using ideas about aerobic respiration, explain why the pulse and breathing rates of both students increase during exercise.

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……[4]

(c) A doctor who is listening to the beating of the heart through a stethoscope hears two sounds as the blood flows through the heart.

From your knowledge of the cardiac cycle, describe and explain the events resulting in the production of the two sounds during ventricular systole and ventricular diastole.

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……[5]

[Total: 10]

3 (a) Warfarin is anticoagulant drug which is commonly used to prevent the formation of blood clots, reducing the risk of a heart attack or deep vein thrombosis.

(i) Describe how a blood clot is formed at the site of an open wound.

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.....[4]

(ii) Explain why blood clots may increase the risk of a heart attack.

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.....[2]

(b) Warfarin is anticoagulant drug which is commonly used to prevent the formation of blood clots, reducing the risk of a heart attack or deep vein thrombosis. Fig. 8.1 shows the relationship between the use of warfarin and amount of vitamin K in the body. Fig. 8.2 shows how vitamin K affects the synthesis of prothrombin in the body.

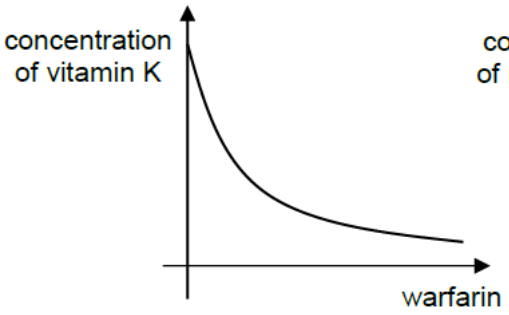

Fig 8.1

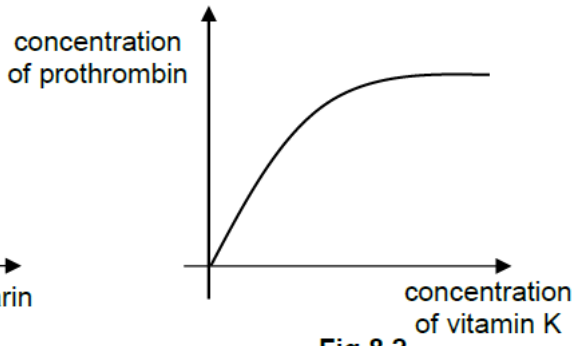

Fig 8.2

(i) Using Fig 8.1, state the effect of the use of warfarin on the concentration of vitamin K in the body.

.....

.....[1]

(ii) Hence, use Fig 8.2 and your answer in **(iii)** to suggest how warfarin may affect blood clotting.

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……[1]

(c) Explain how blood entering the vena cava is pumped to the lungs.

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……[4]

4 Fig. 3.1 shows a vertical section through a human heart and its major blood vessels.

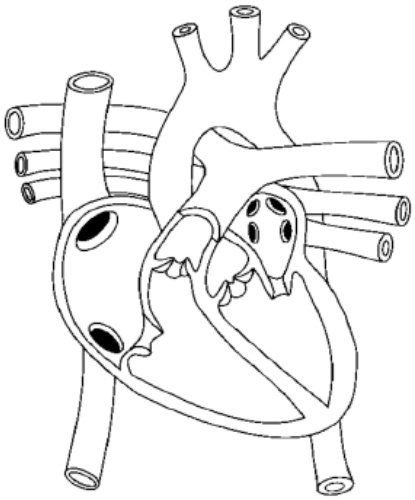

Fig. 3.1

(a) (i) With reference to the key given, draw arrows in Fig. 3.1 to show the flow of oxygenated blood and deoxygenated blood into and out of the heart, through the blood vessels.

Key: oxygenated blood →

deoxygenated blood ⇢

[2]

(ii) On Fig. 3.1, locate and label the bicuspid and tricuspid valves. [2]

(iii) Ventricular septal defect (VSD) is a birth defect in the heart in which a hole is found in the septum which separates the two ventricles.

On Fig. 3.1, mark with an 'X' where VSD is likely to occur. [1]

(b) Fig. 3.2 shows a graph showing how the blood pressure in the pulmonary artery and in the right ventricle changes during one cardiac cycle of a person at rest.

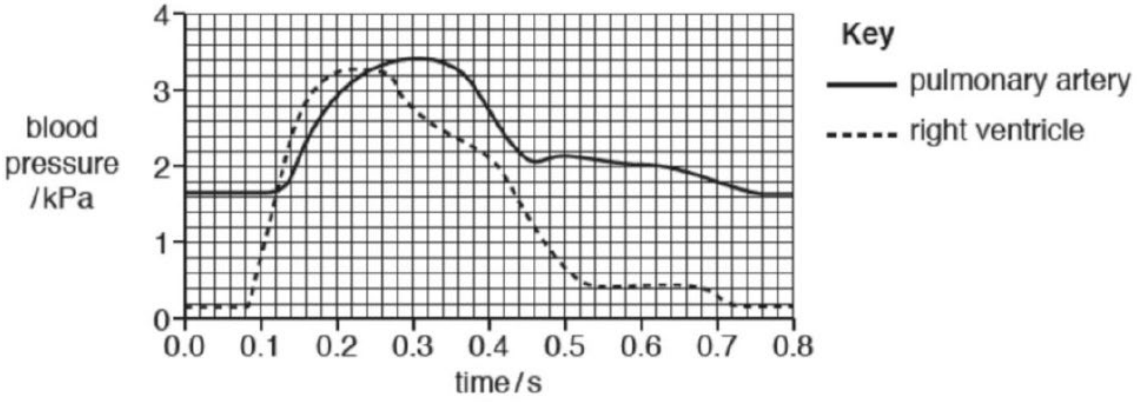

Fig. 3.2

Using Fig. 3.2, state the time at which

(i) the valve between the right ventricle and the pulmonary artery closes

……. [1]

(ii) the ventricle begins to contract

……. [1]

(iii) Fig. 3.2 is compared to another graph showing the blood pressure changes in the left ventricle during the same cardiac cycle.

State and explain one similarity and one difference between the two graphs.

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…… [4]

(iv) Predict how the graph in Fig. 3.2 may change when the same person takes part in a 400m sprint race.

……

…… [2]

[Total: 13]

5 Varicose veins are veins that have become enlarged and swollen. Varicose veins are often found on the leg such as shown in Fig. 4.1.

Fig. 4.1

Fig. 4.2 compares between a normal vein and a varicose vein.

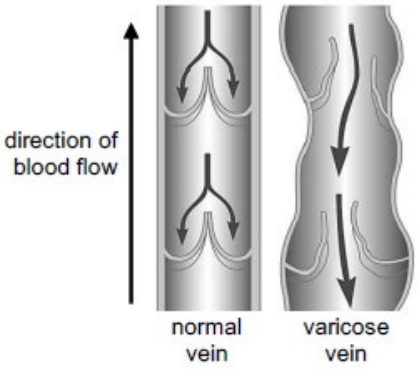

Fig. 4.2

(a) By comparing both veins in Fig. 4.2, explain why varicose veins can become enlarged as seen in Fig. 4.1.

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.....[2]

(b) Suggest why this condition does not often occur in arteries.

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.....[2]

(c) The blood flow in varicose veins may slow down, causing blood clots to form. Outline the process of blood clotting.

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.....[3]

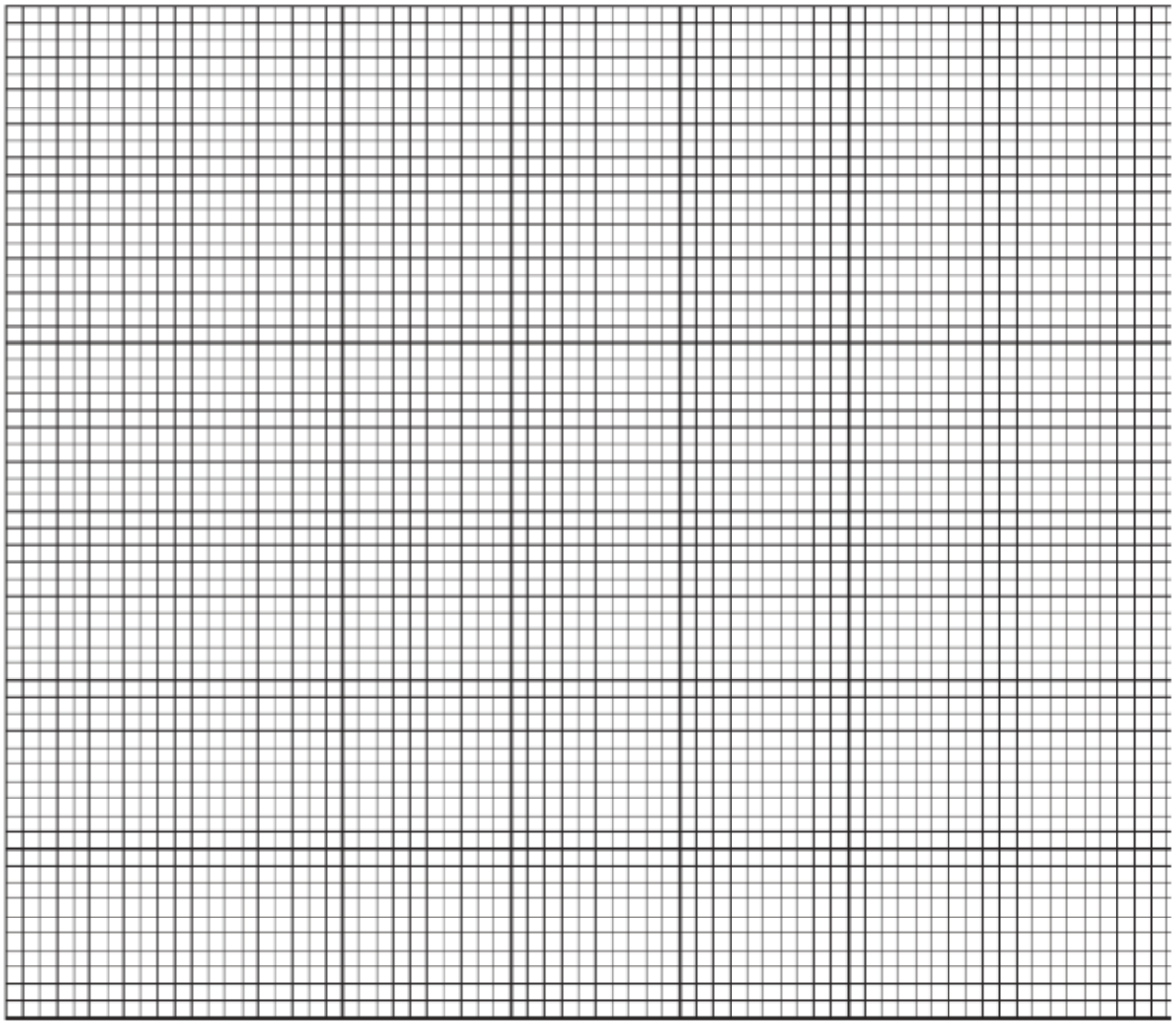
[Total: 7]

6 Table 3.1 shows the results of an investigation on the time it took for blood to clot over a range of temperatures .

Table 3.1

temperature / °C	5	15	25	35	45
time for blood to clot / s	46	34	26	16	25

(a) Plot the data on the grid [4]



(b) State the relationship between temperature and the time it takes for blood to clot as shown in Table 3.1 [2]

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.....[2]

(c) State the optimum temperature for blood clotting based on the data in Table 3.1.

..... [1]

[Total: 7]

7 Fig. 6.1(a) and Fig. 6.1(b) show the graphs of the pulse and breathing rates of two students, E and F, during and after one minute of vigorous exercise.

Key: --------- student E - - - - - student F

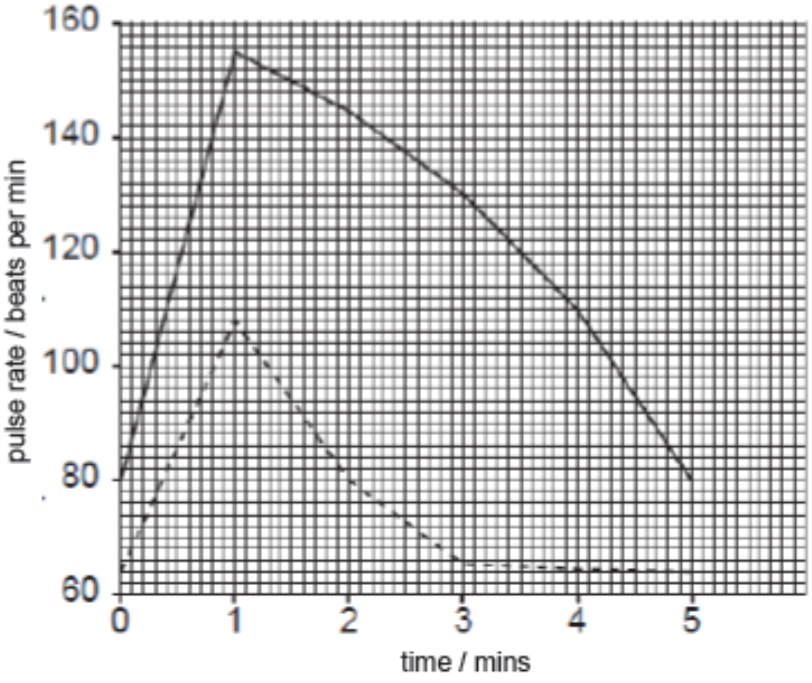

Fig. 6.1 (a)

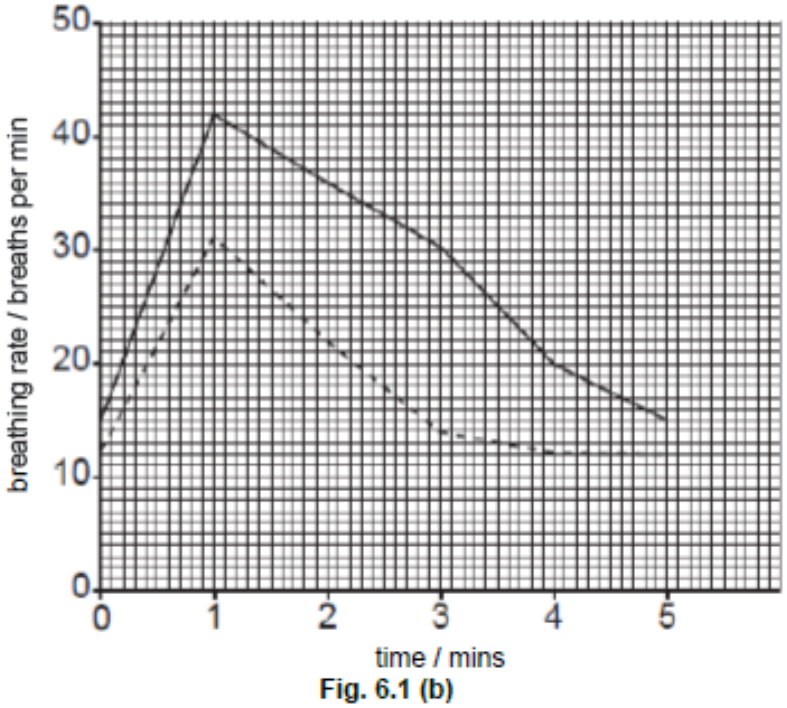

Fig. 6.1 (b)

(a) **(i)** State how long it took for the pulse and breathing rates of student **E** to return to their original levels after the student had finished exercising.

pulse rate …… breathing rate ……
[2]

(ii) Explain why the pulse and breathing rates of both students increased during exercise. [4]

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.....[4]

(b) Suggest two possible reasons for the difference in the effect of vigorous exercise on these two students. [2]

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.....[4]

(c) Explain the similar trend in breathing rate for both students in Fig 6.1(b).

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..... [2]

[Total: 10]

8 In the 1980s, rat population in the United States was successfully controlled by a poison known as warafin. Warafin is a compound that works against vitamin K and prevents vitamin K from being used properly by animals. Fig. 5.1 below describes the importance of vitamin K in many animals.

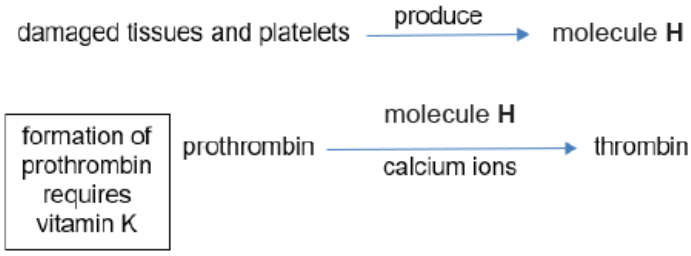

Fig. 5.1

(a) With reference to Fig. 5.1, explain why warafin was able to control the rat population in the 1980s.

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……

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…… [3]

(b) Identify molecule **H**.

…… [1]

9 Fig. 6.1 shows some of the pressure and volume changes that take place in the left side of the heart during part of a cardiac cycle.

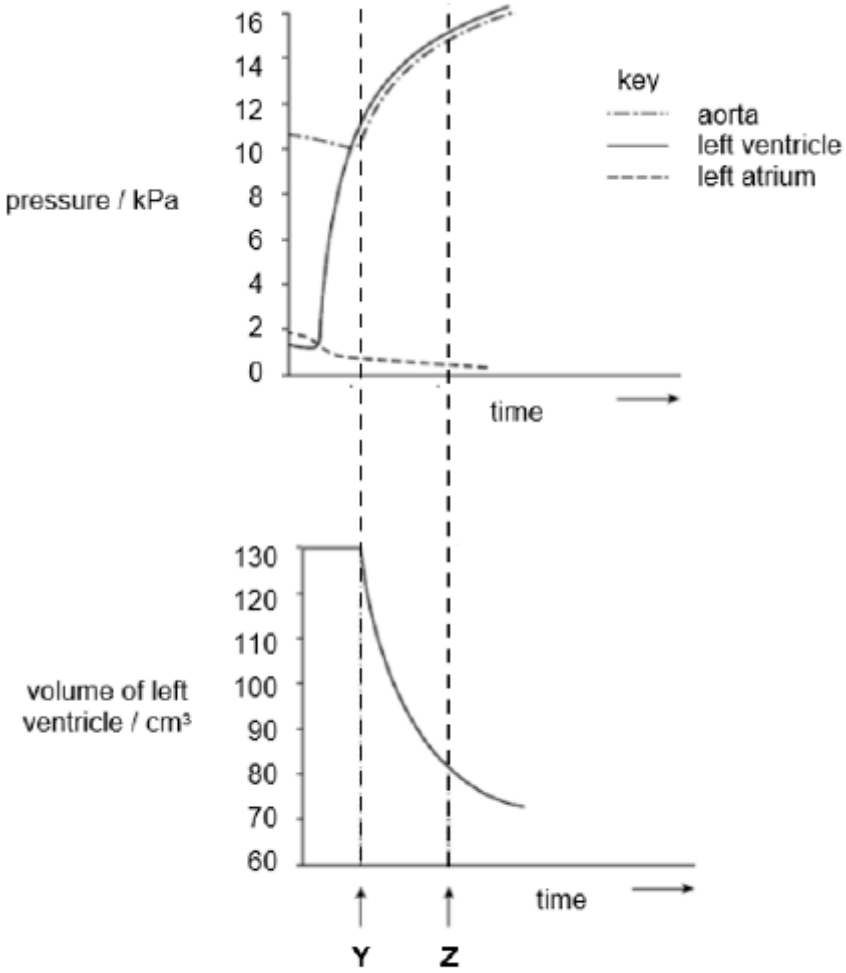

Fig. 6.1

Using information from **both** graphs in Fig. 6.1, describe the events that produce the changes in the volume of the left ventricle between times **Y** and **Z**.

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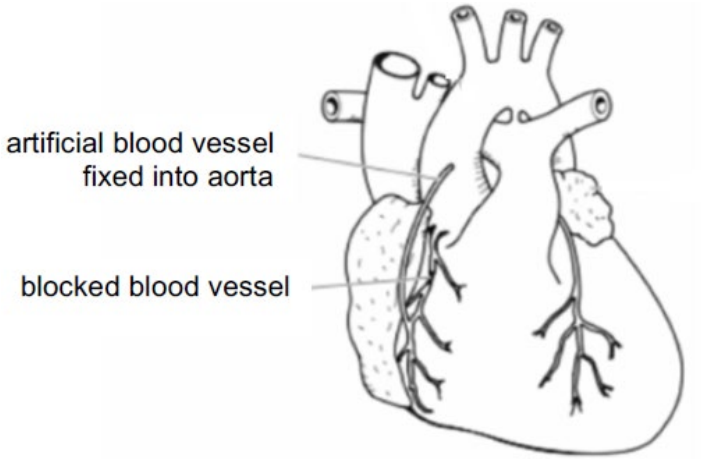
…… [4]

ANSWERS FOR TRANSPORT IN HUMANS MCQ

Q1: C	Q11: C	Q21: B	Q31: B
Q2: C	Q12: B	Q22: A	Q32: A
Q3: B	Q13: D	Q23: B	Q33: B
Q4: B	Q14: A	Q24: D	Q34: D
Q5: A	Q15: B	Q25: C	
Q6: D	Q16: A	Q26: D	
Q7: D	Q17: A	Q27: A	
Q8: C	Q18: A	Q28: D	
Q9: D	Q19: D	Q29: A	
Q10: D	Q20: B	Q30: D	

ANSWERS FOR TRANSPORT IN HUMANS STRUCTURED QUESTIONS

1 Fig. 5.1 shows how a blocked blood vessel in the heart can be by-passed using an artificial blood vessel.



(a) Sometimes, instead of an artificial blood vessel being used for the graft, a vein is taken from elsewhere in the patient's body. Suggest and explain one way in which a vein might not be as suitable for carrying blood to the heart muscle.

• Presence of semi-lunar valves that may block the flow of blood if inserted wrongly [1]

• veins are less muscular, high pressure of blood from aorta may burst the vein / may not withstand high blood pressure in aorta [1] [2]

(b) Fig. 5.2 show the same blood vessel, as in **(a)** but this time the blockage is being treated with the use of a 'stent'.

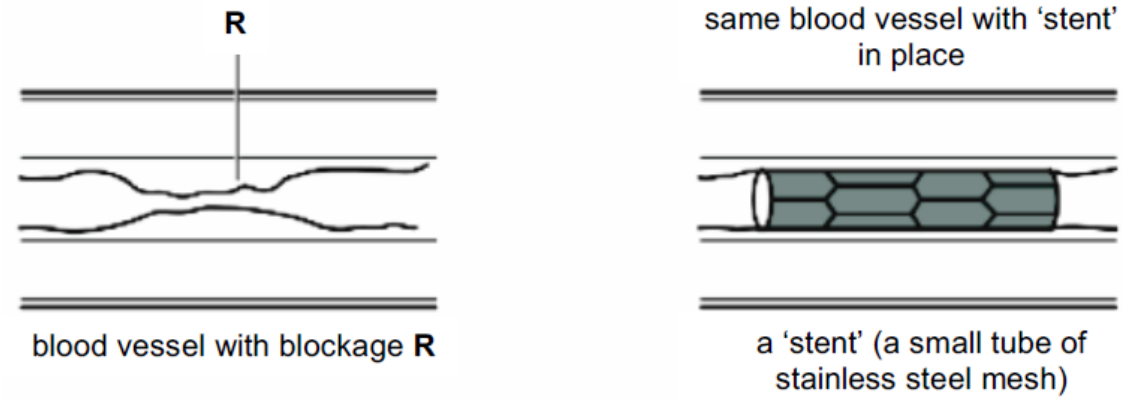


Fig. 5.2

(i) Name one component of the material that is causing the blockage at **R**.

• fatty deposit/plaque/cholesterol [1]

(ii) Suggest and explain why patients are given 'anti-platelet' drugs before inserting the stent.

• During surgery, any cut will cause the platelets to release enzymes that converts soluble fibrinogen to insoluble fibrin / platelets adhere to platelets causing the blood to clot[1]

• the drugs will prevent clotting from taking place so that blood can flow smoothly [1] through the vessel [2]

[Total: 5]

2 Fig. 10.1 and Fig. 10.2 show graphs of the pulse and breathing rates of two students, E and F, during and after one minute of vigorous exercise.

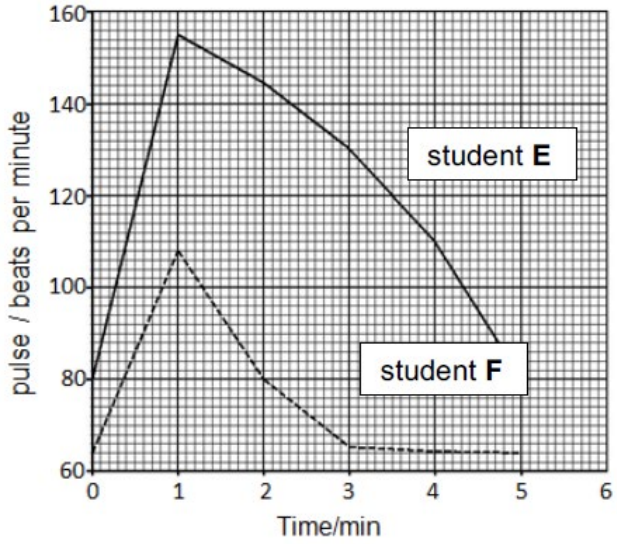


Fig. 10.1

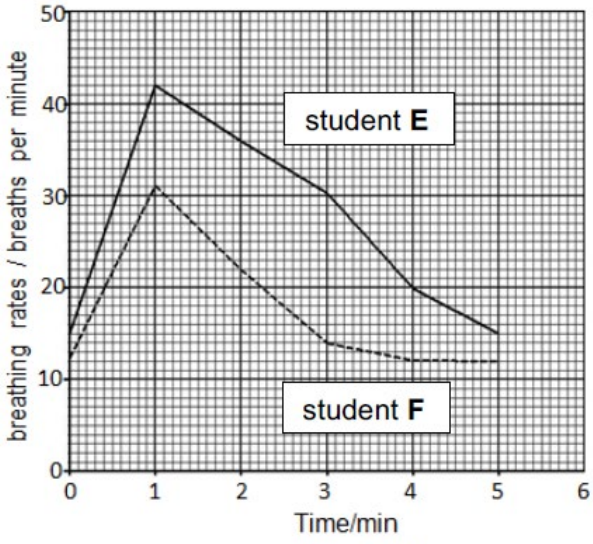


Fig. 10.2

(a) State how long it took for student **F's** pulse and breathing rates to return to original levels after the student had finished exercising.

pulse rate 2 min breathing rate 3 mins [1]

(b) Using ideas about aerobic respiration, explain why the pulse and breathing rates of both students increase during exercise.

• increased vigorous muscular contractions / increased energy demand
• Increased aerobic respiration (in muscle cells) to meet energy demand;
• More oxygen and glucose supplied to muscle cells for more aerobic respiration to take place
• more / faster blood flow (to muscle cells);
• to remove more CO2/ lactic acid (from muscle cells) [any 4]

[4]

(c) A doctor who is listening to the beating of the heart through a stethoscope hears two sounds as the blood flows through the heart.

From your knowledge of the cardiac cycle, describe and explain the events resulting in the production of the two sounds during ventricular systole and ventricular diastole.

During ventricular systole,
• pressure in ventricles increase to be higher than the pressure in atrium [1] and causes bicuspid and tricuspid valves (atrioventricular valves) to be forced close[1] /to prevent backflow of blood into atria [1]
• This produces a (loud) 'lub' sound;

During ventricular diastole
• decrease in pressure in the ventricles as ventricles relax. The pressure in ventricle is lower than pressure in aorta. [1]causes the semi-lunar valves in the pulmonary artery and aorta to be forced close[1]
• to prevent backflow of blood from the aorta and pulmonary artery into the ventricles.
• This produces a (soft) 'dub' sound [5]

[Total: 10]

3 (a) Warfarin is anticoagulant drug which is commonly used to prevent the formation of blood clots, reducing the risk of a heart attack or deep vein thrombosis.

(i) Describe how a blood clot is formed at the site of an open wound.

Damaged tissue and platelets release thrombokinase;

Thrombokinase converts inactive prothrombin to active thrombin; in presence of Ca2+ ions;

Thrombin converts soluble fibrinogen into insoluble fibrin threads which form a mesh blood clot [4]

(ii) Explain why blood clots may increase the risk of a heart attack.

Block the flow of blood and oxygen (and glucose) from coronary arteries;

to cardiac tissues in causing tissue death/ as respiration cannot take place to release energy for heart to pump blood/ heart cannot pump blood. [2]

(b) Warfarin is anticoagulant drug which is commonly used to prevent the formation of blood clots, reducing the risk of a heart attack or deep vein thrombosis. Fig. 8.1 shows the relationship between the use of warfarin and amount of vitamin K in the body. Fig. 8.2 shows how vitamin K affects the synthesis of prothrombin in the body.

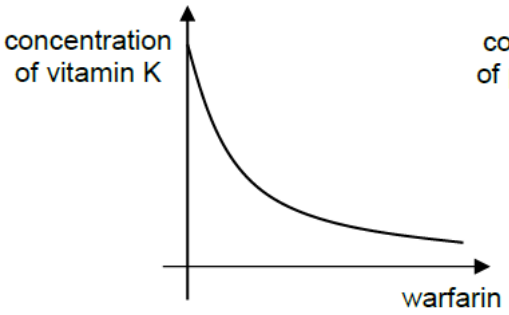


Fig 8.1

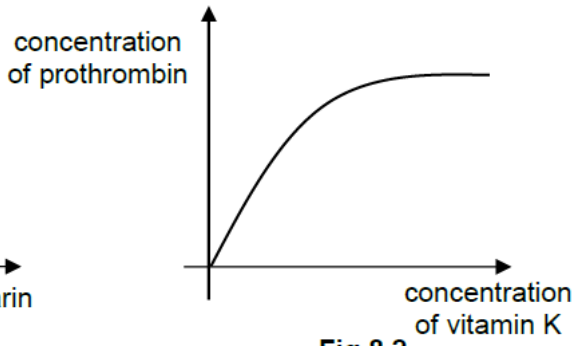


Fig 8.2

(i) Using Fig 8.1, state the effect of the use of warfarin on the concentration of vitamin K in the body.

As warfarin increases, vitamin K decreases [1]

(ii) Hence, use Fig 8.2 and your answer in **(iii)** to suggest how warfarin may affect blood clotting.

Less prothrombin can be produced, hence reducing rate of blood clotting [1]

(c) Explain how blood entering the vena cava is pumped to the lungs.

As right atrium contracts, tricuspid valves forced open as blood flows into right ventricle;
As right ventricle contracts, tricuspid valves forced shut; and semi-lunar valves in pulmonary artery are forced open;
Semi-lunar valves forced shut to prevent backflow of blood
Note:

- Must mention ventricle/ atrium contract
- Deduct 1 mark overall for no mention of 'forced' open/shut at least once
- Note: vena cava/vessels DO NOT pump blood [4]

4 Fig. 3.1 shows a vertical section through a human heart and its major blood vessels.

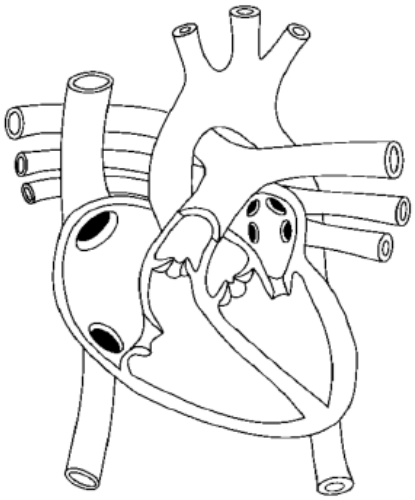


Fig. 3.1

(a) (i) With reference to the key given, draw arrows in Fig. 3.1 to show the flow of oxygenated blood and deoxygenated blood into and out of the heart, through the blood vessels.

Key: oxygenated blood →

deoxygenated blood ⇢

1 for correct trace of oxygenated blood through the left side of the heart;

1 for correct trace of deoxygenated blood through the right side of the heart;

Arrows must show clearly the entry into correct blood vessels (veins), pass through the correct route through the heart, and exit from the correct blood vessels (arteries)

[2]

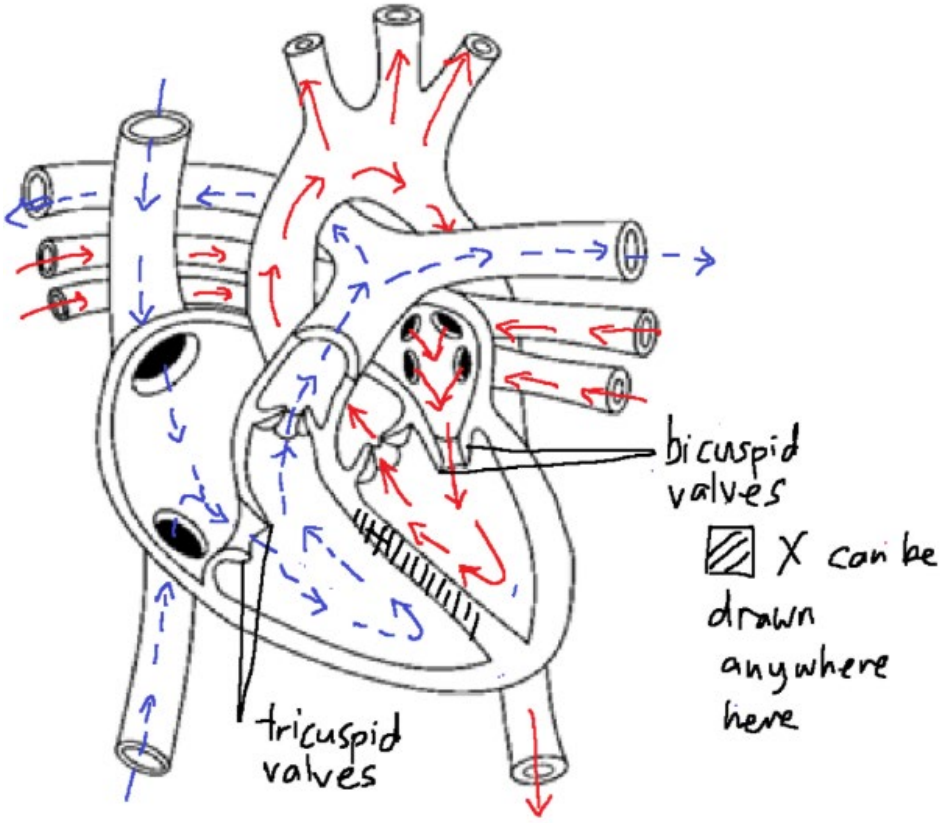
(ii) On Fig. 3.1, locate and label the bicuspid and tricuspid valves. [2]

1 for correct label of bicuspid valves (left side)

1 for correct label of tricuspid valves (right side)

(iii) Ventricular septal defect (VSD) is a birth defect in the heart in which a hole is found in the septum which separates the two ventricles.

On Fig. 3.1, mark with an 'X' where VSD is likely to occur. [1]



(b) Fig. 3.2 shows a graph showing how the blood pressure in the pulmonary artery and in the right ventricle changes during one cardiac cycle of a person at rest.

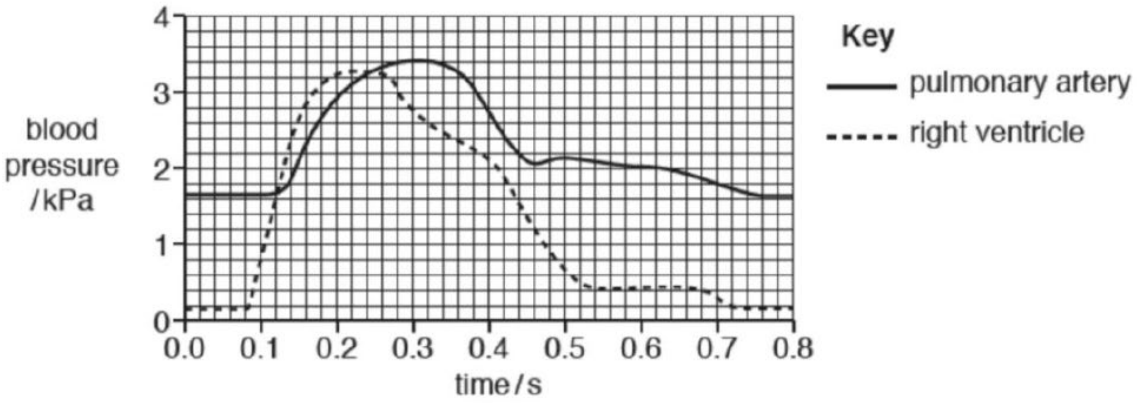


Fig. 3.2

Using Fig. 3.2, state the time at which

(i) the valve between the right ventricle and the pulmonary artery closes

0.24 or 0.25s;

-1/2 m for missing unit

(R: 0.26s – read the graph carefully!) [1]

(ii) the ventricle begins to contract

0.08 or 0.09s; [1]

(iii) Fig. 3.2 is compared to another graph showing the blood pressure changes in the left ventricle during the same cardiac cycle.

State and explain one similarity and one difference between the two graphs.

Similarity

- Describe:

graphs increase and decrease in pressure at the same time / follow a similar trend

(R: graphs are similar / identical – without reference to which part)

Explain:

- Events in the cardiac cycle are coordinated / muscles in the left and right side or walls of the heart contract and relax at the same time

Difference

- Describe:

The systolic blood pressure generated by the left ventricle is higher

- Explain:

Muscles in the wall of left ventricles are thicker, generating a greater force to pump blood at a higher pressure over a longer distance to whole body, [4]

(iv) Predict how the graph in Fig. 3.2 may change when the same person takes part in a 400m sprint race.

Systolic blood pressure in the right ventricle + pulmonary artery will increase;

Time taken for one cardiac cycle will decrease / Frequency of one cardiac cycle will increase;

(R: graph looks narrow / higher / occur faster / pressure remains high) [2]

[Total: 13]

5 Varicose veins are veins that have become enlarged and swollen. Varicose veins are often found on the leg such as shown in Fig. 4.1.

Fig. 4.1

Fig. 4.2 compares between a normal vein and a varicose vein.

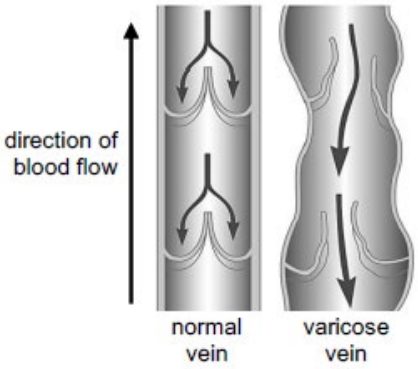


Fig. 4.2

(a) By comparing both veins in Fig. 4.2, explain why varicose veins can become enlarged as seen in Fig. 4.1.

valves cannot close fully [A: damaged], causing backflow of blood;
accumulation of blood causes swelling; [2]

(b) Suggest why this condition does not often occur in arteries.

max 2:

arteries carry blood that comes from the heart at high pressure / stretching and recoiling

of artery walls propel blood forward;

allowing blood to flow in one direction;

prevent blood from accumulating; [2]

(c) The blood flow in varicose veins may slow down, causing blood clots to form. Outline the process of blood clotting.

max 3:
damaged tissues and platelets releases enzyme;
thrombokinase activates prothrombin in blood to thrombin;
in the presence of calcium ions;
enzyme converts the soluble fibrinogen to insoluble fibrin;
fibrin threads form a mesh and trap blood cells, forming a clot; [3]

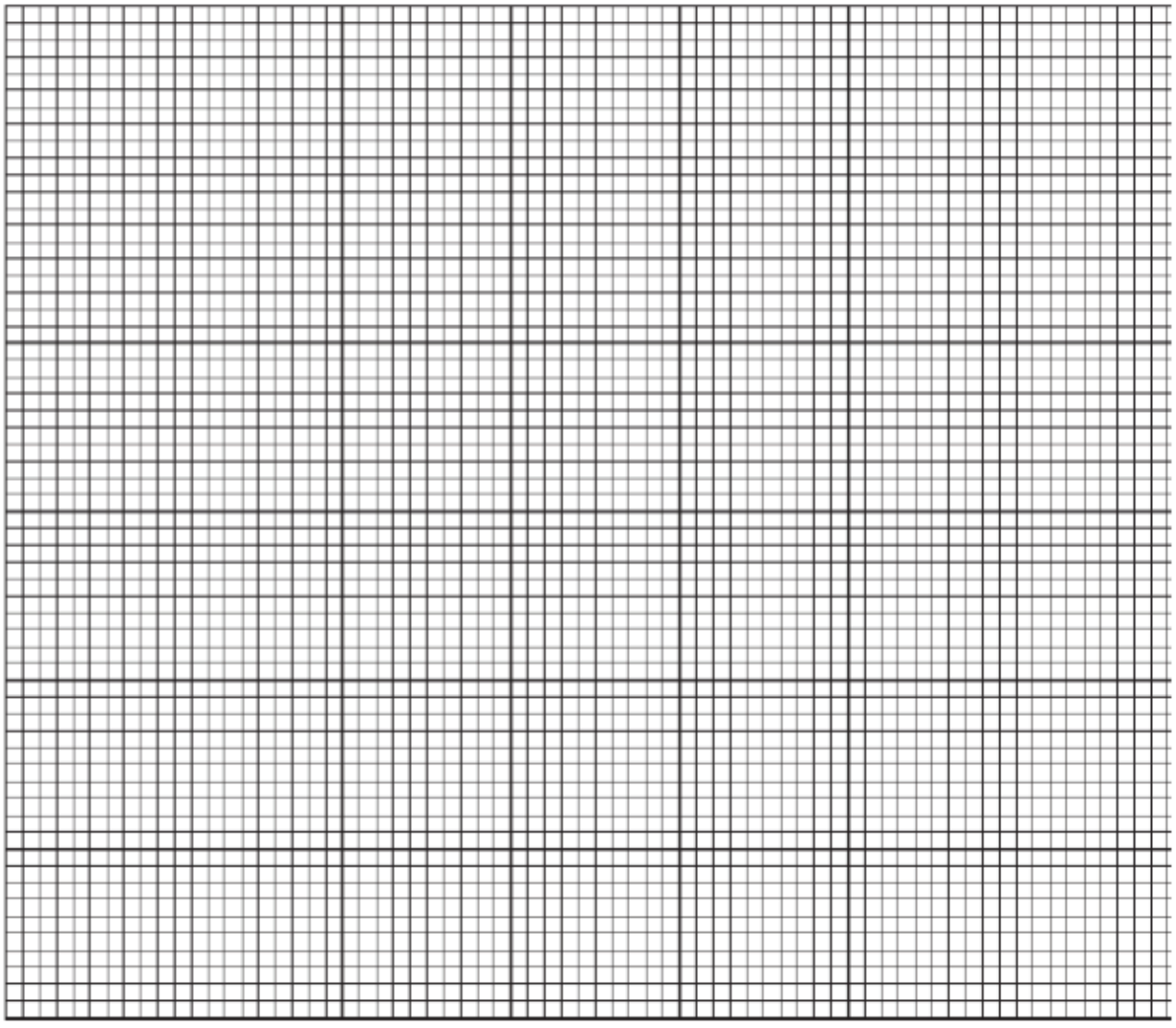
[Total: 7]

6 Table 3.1 shows the results of an investigation on the time it took for blood to clot over a range of temperatures .

Table 3.1

temperature / °C	5	15	25	35	45
time for blood to clot / s	46	34	26	16	25

(a) Plot the data on the grid [4]



- All data points correctly plotted;
- Axes correctly labelled with units;
- Best fit line drawn;
- Appropriate scale used;

(b) State the relationship between temperature and the time it takes for blood to clot as shown in Table 3.1 [2]

- Higher the temperature, the faster the clotting of blood until 35 ℃;
- After 35 ℃, the time taken for blood clot increases; [2]

(c) State the optimum temperature for blood clotting based on the data in Table 3.1.

- **35 ℃;** [1]

[Total: 7]

7 Fig. 6.1(a) and Fig. 6.1(b) show the graphs of the pulse and breathing rates of two students, E and F, during and after one minute of vigorous exercise.

Key: ---------- student E - - - - - student F

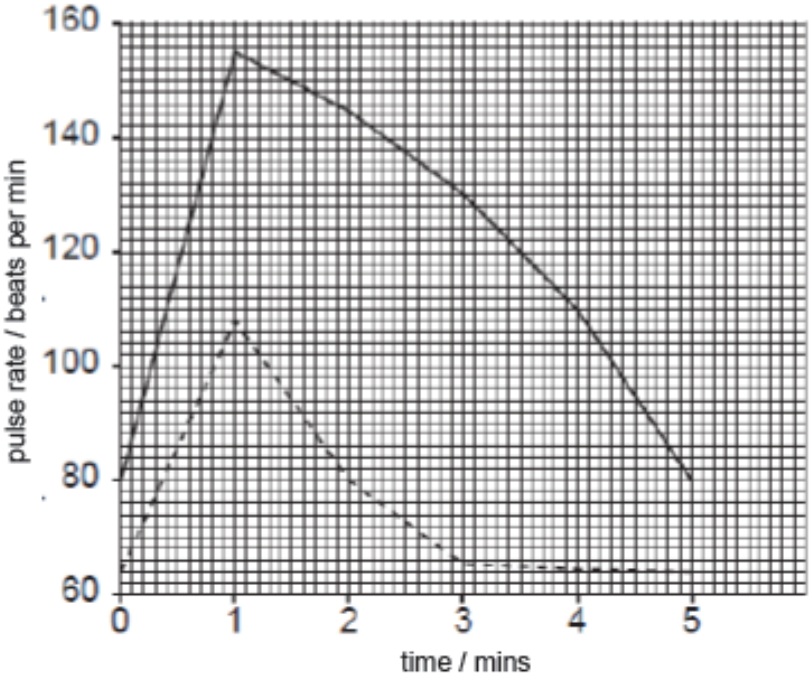


Fig. 6.1 (a)

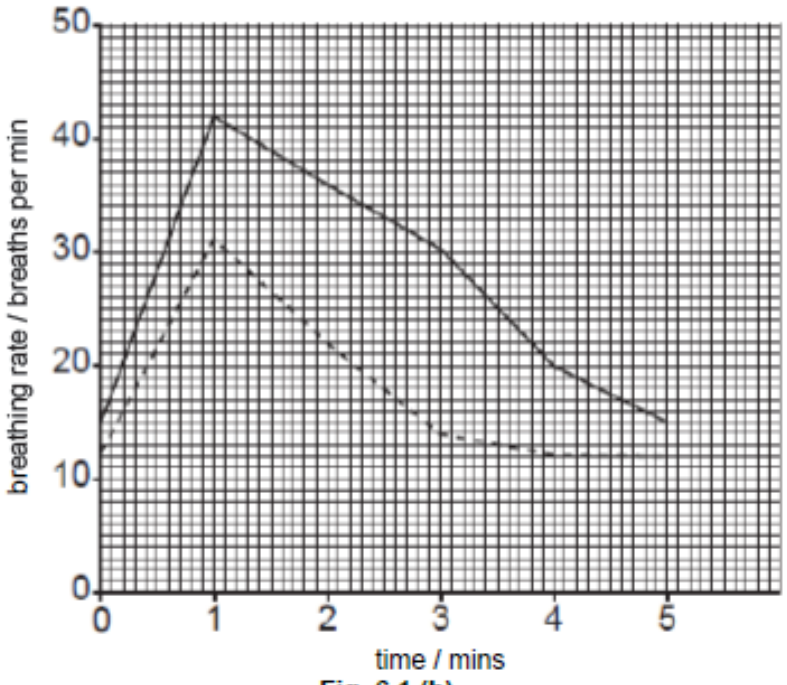


Fig. 6.1 (b)

(a) **(i)** State how long it took for the pulse and breathing rates of student **E** to return to their original levels after the student had finished exercising.

pulse rate 4 mins breathing rate 4 mins

[2]

(ii) Explain why the pulse and breathing rates of both students increased during exercise. [4]

Any four from:
• demand for energy / oxygen increases for respiration;
• for faster contraction of muscles;
• (faster pulse rate) faster blood flow to supply glucose;
• (faster breathing rate) increase oxygen supply
• release of more energy;
• (faster breathing rate) faster removal of carbon dioxide;
• (faster pulse rate) faster removal of lactic acid / to remove CO2; [4]

(b) Suggest two possible reasons for the difference in the effect of vigorous exercise on these two students. [2]

Any two from:
• Student F is fitter than student E;
• (student F) more developed muscles / better breakdown of lactic acid;
• (student F) more efficient circulation;
• (student F) more efficient lungs / respiratory system;
• student F exercised less rigorously than student E;
• (student F) has more haemoglobin / red blood cells;
• Student E was a smoker / has emphysema;
• Student E was obese / overweight;
• Student E suffered from asthma / bronchitis / heart problems / lung infection AW;

[4]

(c) Explain the similar trend in breathing rate for both students in Fig 6.1(b).

• The rapid increase in breathing rate is to provide sufficient oxygen for aerobic respiration during the 1 minute of vigorous exercise;

• The gradual decrease in breathing rate in the next 4 minutes is to continue the supply of oxygen to repay oxygen debt incurred during anaerobic respiration / AW;

[2]

[Total: 10]

8 In the 1980s, rat population in the United States was successfully controlled by a poison known as warafin. Warafin is a compound that works against vitamin K and prevents vitamin K from being used properly by animals. Fig. 5.1 below describes the importance of vitamin K in many animals.

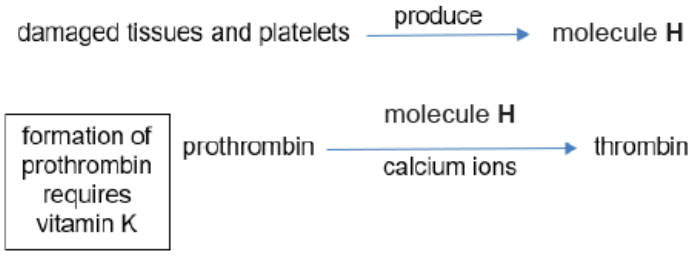


Fig. 5.1

(a) With reference to Fig. 5.1, explain why warafin was able to control the rat population in the 1980s.

Warafin will prevent prothrombin from forming in rats, as Vitamin K is needed for the formation of prothrombin;

There is no thrombin available to catalyse the conversion of soluble fibrinogen in blood to insoluble fibrin threads;

The rat's blood cannot clot / will likely bleed to death / excessive blood loss in the event of any injury;

Reject: leads to excessive blood flow [3]

(b) Identify molecule **H**.

Thrombokinase; [1]

9 Fig. 6.1 shows some of the pressure and volume changes that take place in the left side of the heart during part of a cardiac cycle.

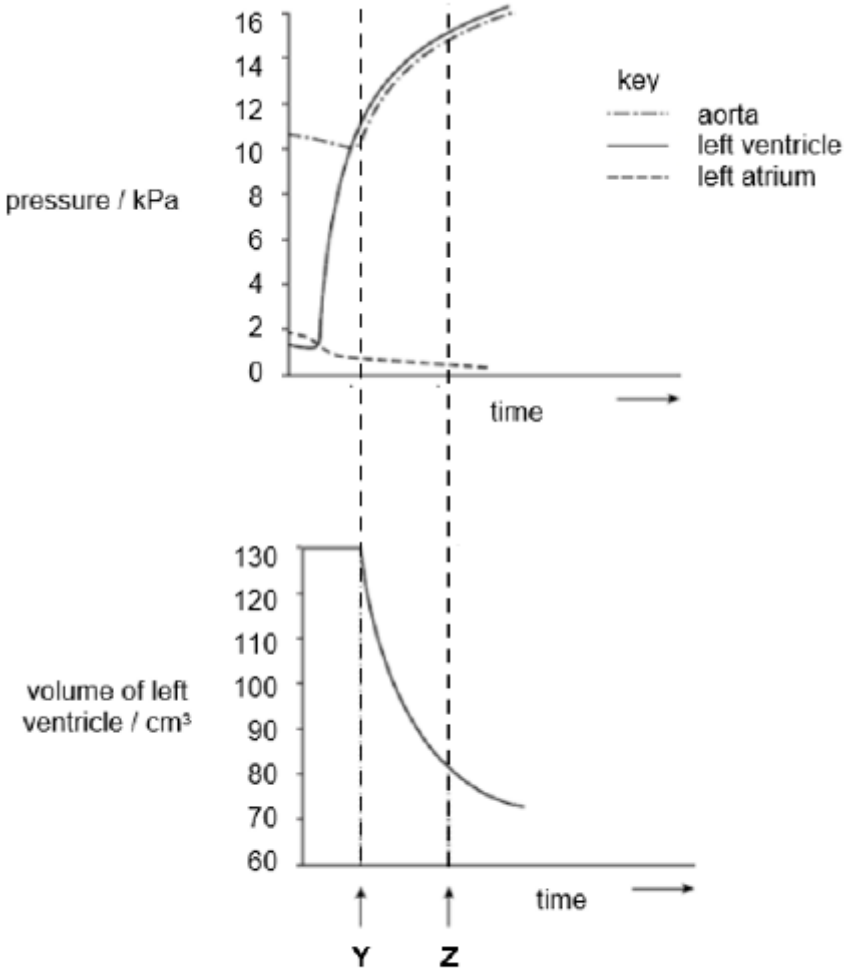


Fig. 6.1

Using information from **both** graphs in Fig. 6.1, describe the events that produce the changes in the volume of the left ventricle between times **Y** and **Z**.

During Y to Z, ventricular systole was occurring;

The muscles of the ventricle was contracting;

causing the pressure to increase from 10kPA to 15kPa;

Thus causing the volume of the left ventricle to decrease from 130 cm3 to 80 cm3;

Blood leaves the left ventricle and enters the aorta;

Any 4 points [4]