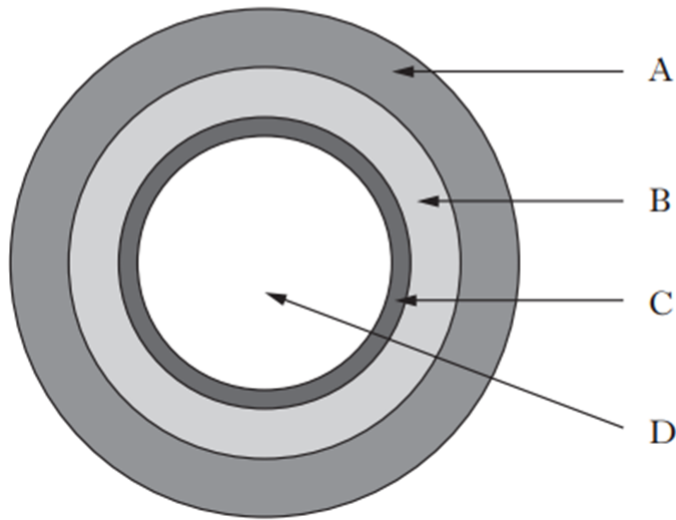


Blood Vessels

1. The diagram below represents a section through an artery.

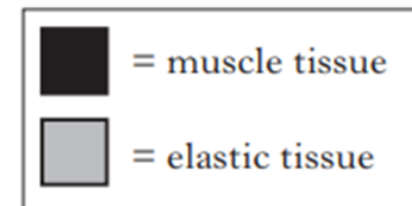
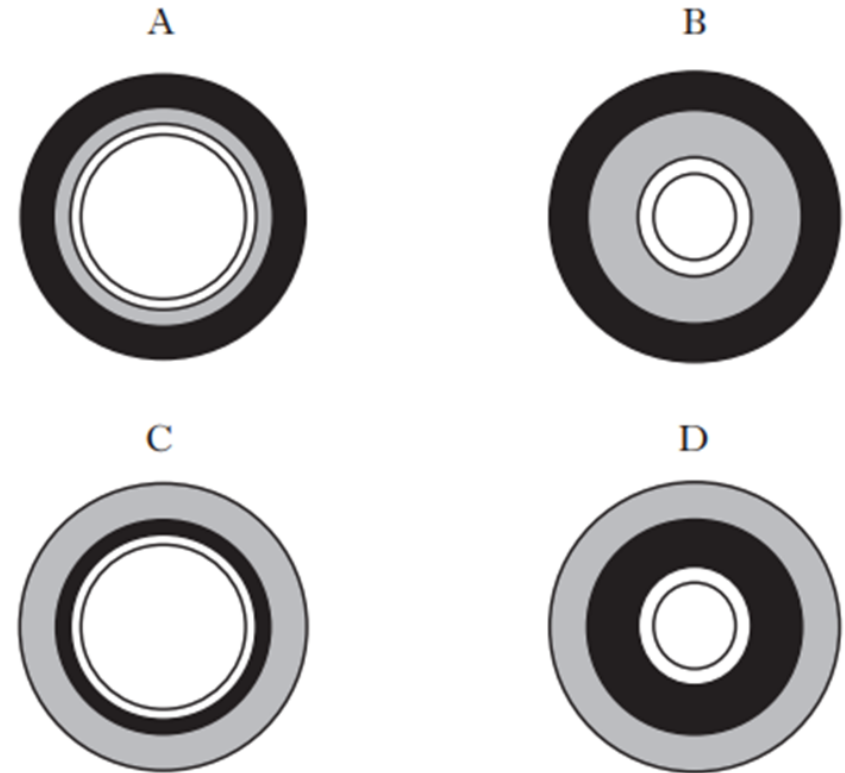
Which label correctly identifies a region containing smooth muscle tissue?



2. Increased blood flow within an artery is the result of smooth muscle

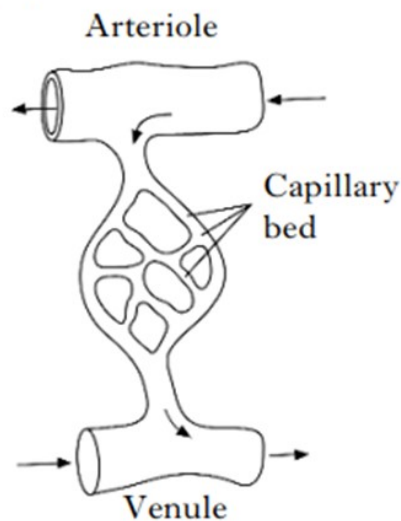
- A relaxation causing vasodilation
- B contraction causing vasodilation
- C relaxation causing vasoconstriction
- D contraction causing vasoconstriction.

3. Which of these cross sections through a blood vessel represents a vein?



Blood Vessels

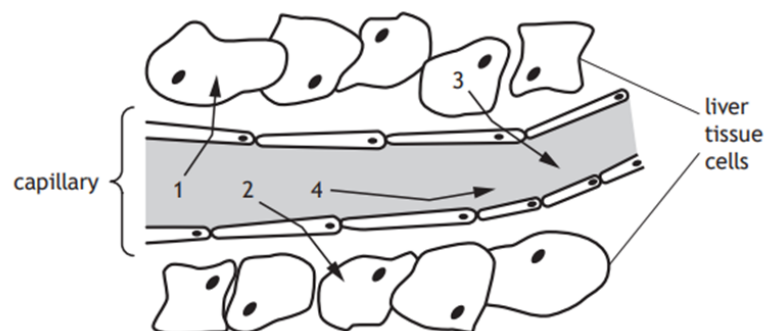
4. The diagram below represents a part of the circulatory system of the skin.



Which line in the table below correctly identifies changes which would take place in the blood as it flows from arteriole to venule?

	<i>Concentration of</i>	
	<i>glucose</i>	CO_2
A	increase	decrease
B	decrease	decrease
C	increase	increase
D	decrease	increase

5. The diagram shows the movement of substances between a capillary and the surrounding liver tissue cells.



Which row in the table identifies the substances in the diagram?

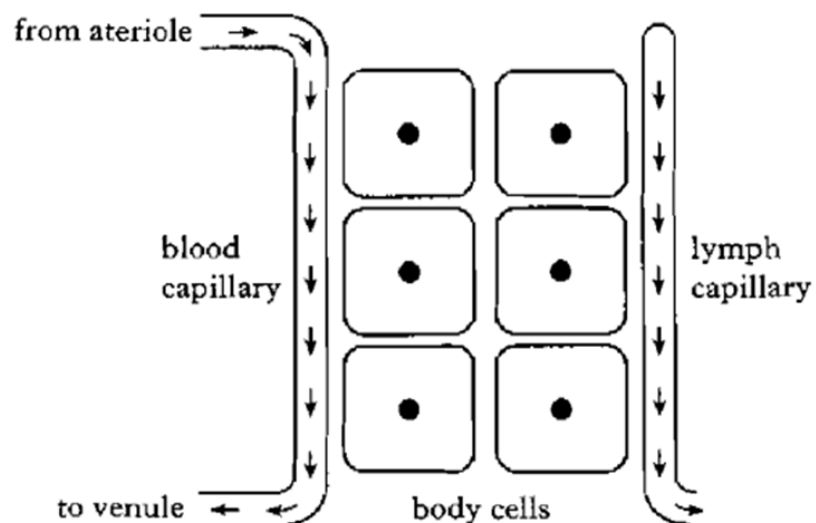
	<i>Substance</i>			
	1	2	3	4
A	glucose	carbon dioxide	oxygen	protein
B	oxygen	glucose	carbon dioxide	protein
C	protein	glucose	oxygen	carbon dioxide
D	protein	oxygen	carbon dioxide	glucose

6. The diffusion pathway of carbon dioxide within body tissues is

- A plasma $\rightarrow$ tissue fluid $\rightarrow$ cell cytoplasm
- B lymph $\rightarrow$ tissue fluid $\rightarrow$ cell cytoplasm
- C cell cytoplasm $\rightarrow$ tissue fluid $\rightarrow$ plasma
- D tissue fluid $\rightarrow$ lymph $\rightarrow$ plasma.

Blood Vessels

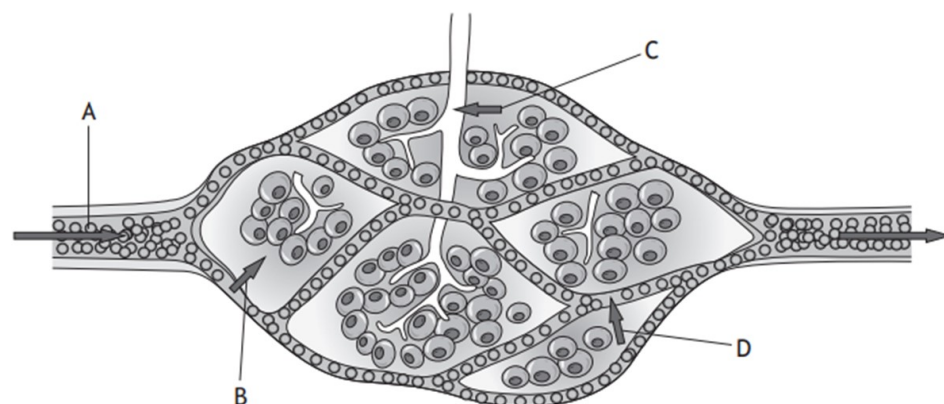
7. The diagram below shows the relationship between blood capillaries, body cells and lymph capillaries.



Which of the following is a correct description of the movement of oxygen to and from the body cells?

- A From body cells to blood and lymph capillaries
- B From blood capillaries to body cells
- C From lymph capillaries to body cells
- D From blood and lymph capillaries to body cells

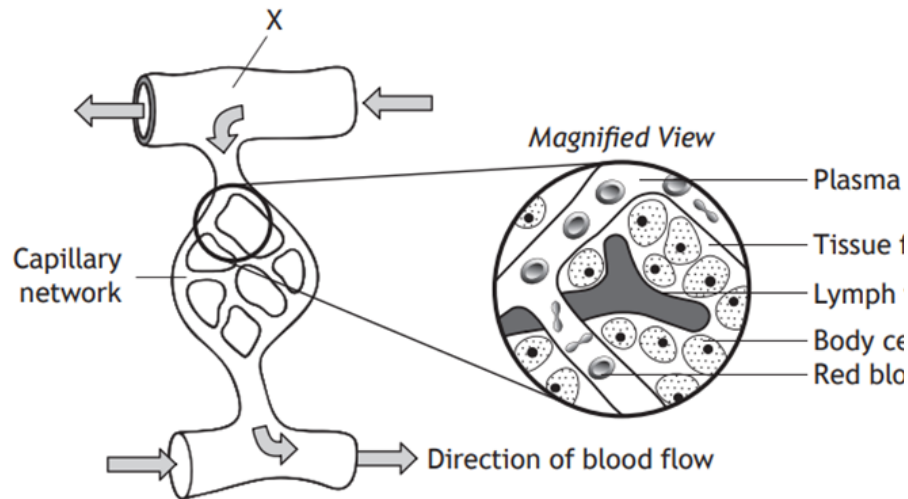
1. The diagram shows a capillary network within a tissue. Which arrow represents pressure filtration of plasma?



Describe the exchange of materials between blood plasma in capillaries and body cells.

Blood Vessels

2.

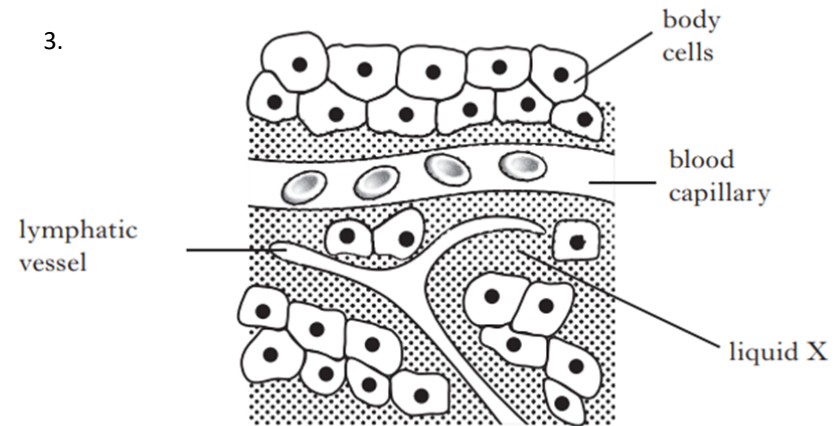


- a) (i) Name the layer of cells which forms the wall of a capillary. 1

- (ii) Describe how substances pass from plasma to tissue fluid. 1

- b) Describe **one** role of the lymph vessel in the diagram.

3.



- (a) (i) Name liquid X.

- (ii) State **one** way in which the composition of this liquid is different from blood plasma.

- (b) Complete the table below by naming **one** substance, apart from carbon dioxide and water, which is passed from the cells in each of the following tissues into blood capillaries.

<i>Tissue</i>	<i>Substance</i>
Interstitial cells	
Pancreas	
Leg muscle (after a sprint)	

- (c) Describe the function of lymphatic vessels.

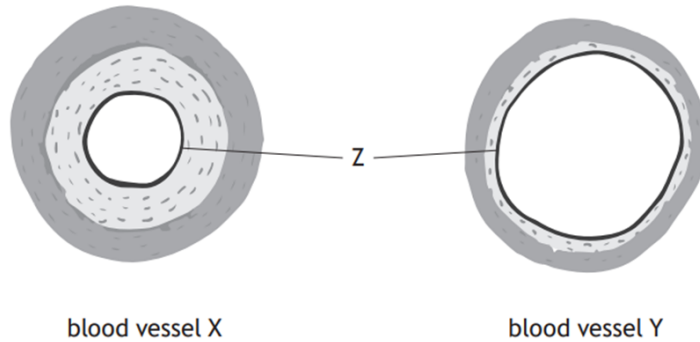
1

2

1

Blood Vessels

4. (a) The diagram shows cross sections through two of these blood vessels.



- (i) Blood vessel X is an artery and Y is a vein.

Describe one feature shown in the diagram that confirms this.

1

- (ii) Name layer Z.

1

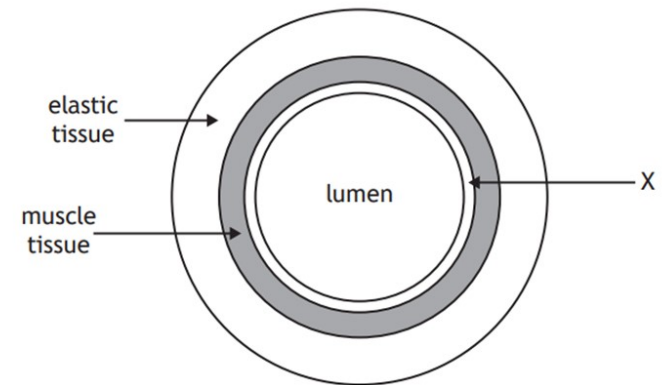
- (b) Describe **one** difference in the structure of arteries and veins.

1

- (c) Explain why the carbon dioxide concentration of the blood increases as it flows through the brain.

1

- 5.



- (a) Name layer X.

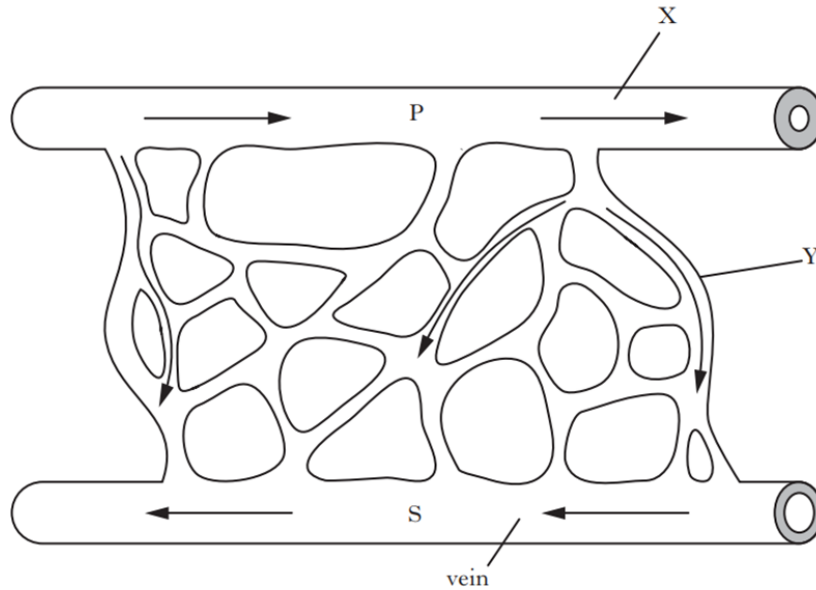
1

- (b) Describe how the presence of muscle tissue in the artery wall helps to control the flow of blood around the body.

1

Blood Vessels

6.



(a) Name the type of blood vessels labelled X and Y.

X _____

Y _____

1

The individual was diagnosed as having high blood pressure.

One of the effects of this was that their ankles regularly swelled up due to a build-up of tissue fluid.

Suggest why there is a link between high blood pressure and the build-up of tissue fluid.

2

Blood Vessel Answers

1. C

2. B

3a (i) 26

(ii) BMI greater than 30

b) Exercise increases energy expenditure/increases respiration rate/uses up (stored) fats.

4a) increase exercise OR reduce sugar/fat n diet

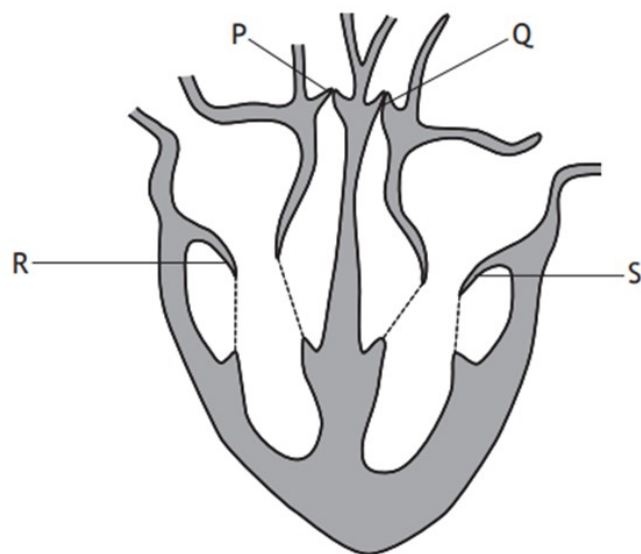
b) Weight divided by height squared.

c) they have a high muscle mass

d) as children get older they choose what to eat/do less exercise

Heart

1. The diagram shows a cross-section of the heart.



Which statement describes the movement of the valves during ventricular systole?

- A Valves P and Q open and valves R and S close.
- B Valves P and R open and valves Q and S close.
- C Valves P and Q close and valves R and S open.
- D Valves P and R close and valves Q and S open.

2. Which of the following statements concerning the function of certain blood vessels is correct?

- A The vena cava carries oxygenated blood from the body to the right atrium.
- B The pulmonary artery carries deoxygenated blood to the lungs from the right ventricle.
- C The pulmonary vein carries oxygenated blood from the lungs to the left ventricle.
- D The aorta carries deoxygenated blood from the body to the left atrium.

3. Which of the following statements refers correctly to the cardiac cycle?

- A During systole the atria contract followed by the ventricles.
- B During systole the ventricles contract followed by the atria.
- C During diastole the atria contract followed by the ventricles.
- D During diastole the ventricles contract followed by the atria.

Heart

4. The duration of the stages in an individual's cardiac cycle are shown in the table.

Stage	Duration (s)
Diastole	0.4
Atrial systole	0.1
Ventricular systole	0.3

What is the heart rate of this individual?

- A 48 beats per minute
 B 75 beats per minute
 C 80 beats per minute
 D 150 beats per minute
5. Measurement of a child's cardiac cycle showed that systole lasted for 0.2 seconds while diastole lasted for 0.4 seconds.

What was the heart rate of this child?

- A 60 beats per minute
 B 75 beats per minute
 C 100 beats per minute
 D 150 beats per minute

6. Mean arterial pressure (MAP) is a measure of blood pressure in the arteries.

Pulse pressure is the difference between systolic and diastolic blood pressure.

MAP is calculated using the following formula:

$$\text{MAP} = \text{diastolic pressure} + \left(\frac{\text{pulse pressure}}{3} \right)$$

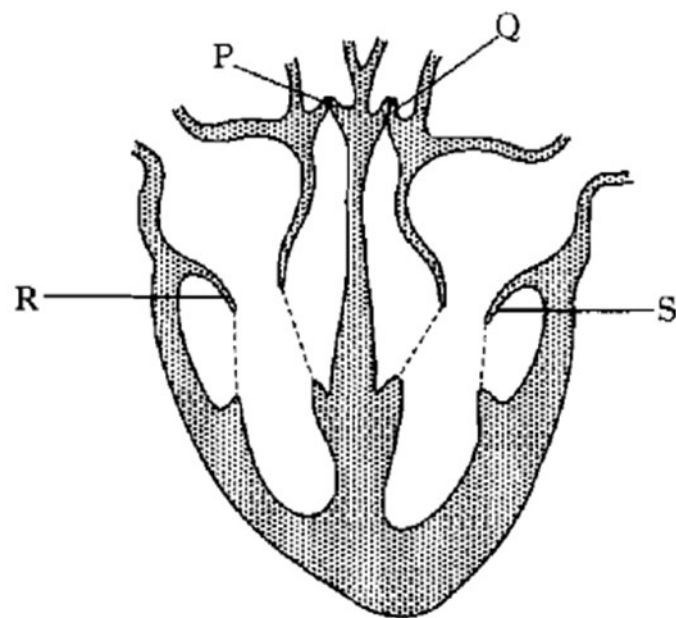
Using this formula, the MAP of an individual with a blood pressure reading of 122/80 mmHg is

- A 42 mmHg
 B 56 mmHg
 C 94 mmHg
 D 136 mmHg.
7. Which line in the table below describes correctly the state of the heart valves during ventricular systole?

	<i>Atrio-ventricular</i>	<i>Semi-lunar</i>
A	open	open
B	closed	closed
C	open	closed
D	closed	open

Heart

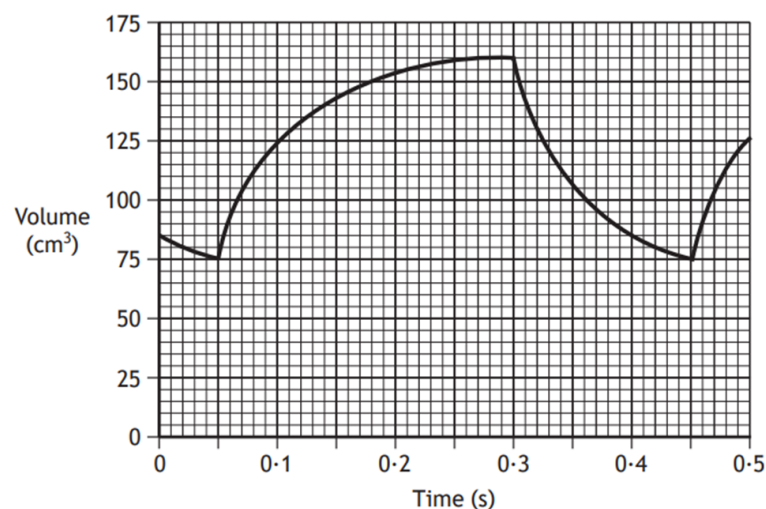
8. The diagram shows a cross-section of the heart.



Which of the following describes correctly the movement of the valves during ventricular systole?

- A Valves P and Q open and valves R and S close
- B Valves P and R open and valves Q and S close
- C Valves P and Q close and valves R and S open
- D Valves P and R close and valves Q and S open

9. The graph shows changes in the volume of blood in the left ventricle of an individual's heart while running.

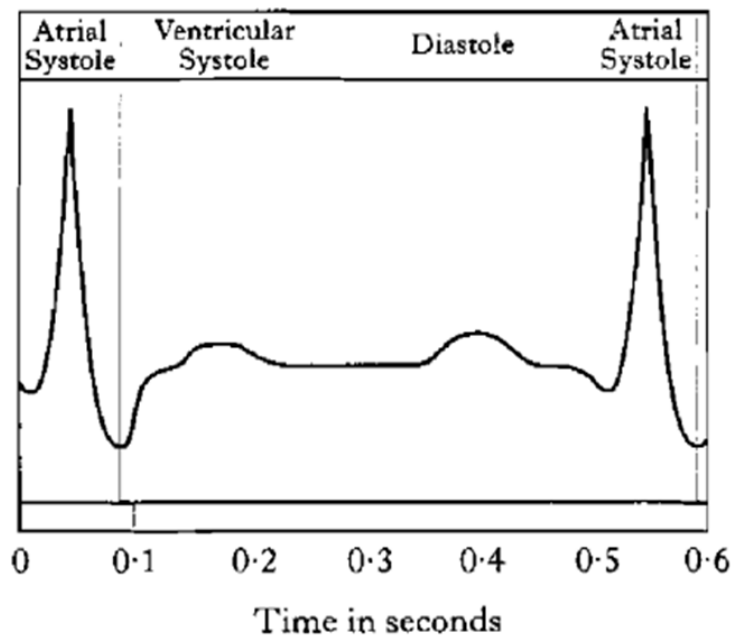


The cardiac output of this individual is

- A 5 100 cm³/min
 - B 10 200 cm³/min
 - C 12 750 cm³/min
 - D 24 000 cm³/min.
10. The main blood vessel supplying the heart muscle itself with oxygenated blood is the
- A coronary vein
 - B coronary artery
 - C pulmonary artery
 - D pulmonary vein.

Heart

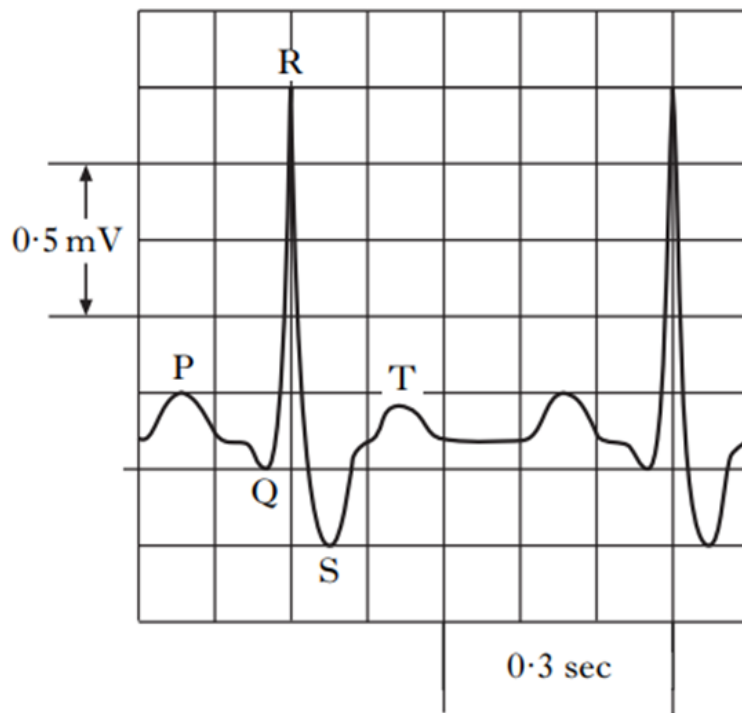
11. The electrocardiogram shown below records the beat of a human heart.



What is the heart rate?

- A 60 beats/minute
- B 70 beats/minute
- C 75 beats/minute
- D 120 beats/minute

12. An ECG trace is shown below.



What is the person's heart rate?

- A 100 beats per minute
- B 120 beats per minute
- C 150 beats per minute
- D 200 beats per minute

Heart

- 13 The diagram below shows a section through the human heart.

What is the correct position of the pacemaker?



14. Which line in the table below identifies correctly an effect of the autonomic nervous system (ANS) on the sinoatrial node (SAN) in the heart?

	Branch of ANS	Chemical released	Rate of impulse generation by SAN
A	sympathetic	acetylcholine	increases
B	sympathetic	noradrenaline	decreases
C	parasympathetic	acetylcholine	decreases
D	parasympathetic	noradrenaline	increases

- 15.

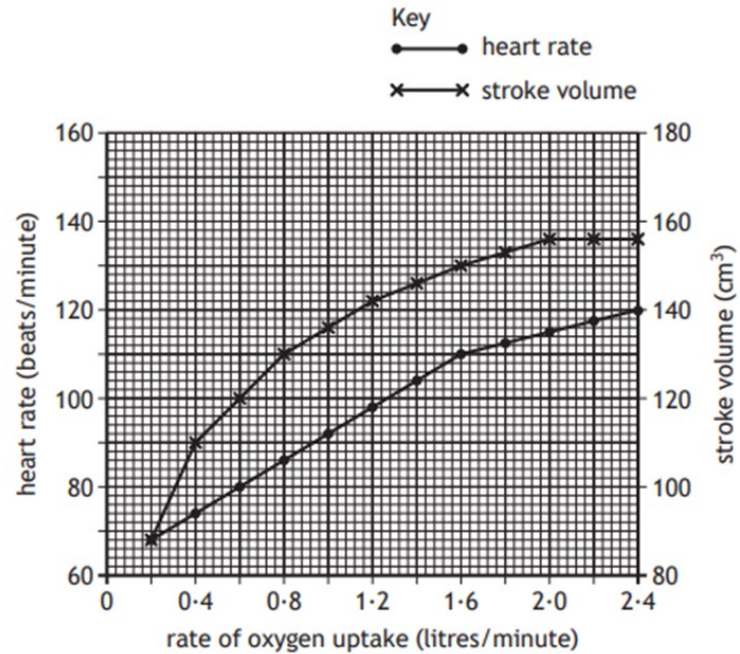


What was the heart rate of this patient?

- A 42 beats per minute
- B 72 beats per minute
- C 86 beats per minute
- D 120 beats per minute

Heart

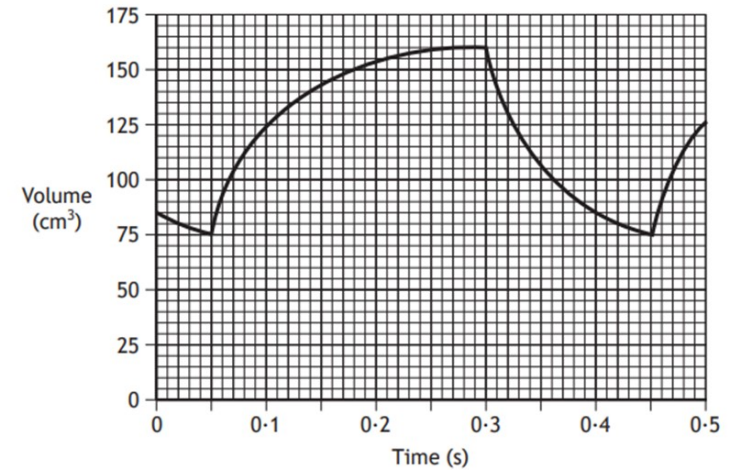
16. The graph shows how increasing oxygen uptake affects heart rate and stroke volume.



What is the cardiac output when the rate of oxygen uptake is 0.6 litres/minute?

- A 1.50 cm³/min
- B 8000 cm³/min
- C 9600 cm³/min
- D 10 000 cm³/min

17. The graph shows changes in the volume of blood in the left ventricle of an individual's heart while running.



The cardiac output of this individual is

- A 5 100 cm³/min
- B 10 200 cm³/min
- C 12 750 cm³/min
- D 24 000 cm³/min.

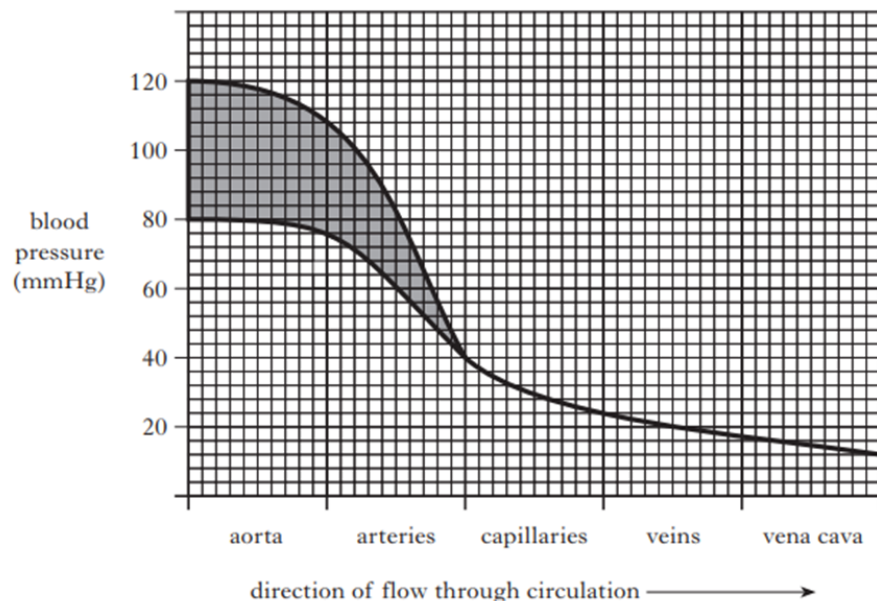
18. Which row in the table shows how the autonomic nervous system controls an increase in heart rate?

	Branch of autonomic nervous system	Neurotransmitter
A	sympathetic	acetylcholine
B	parasympathetic	noradrenaline
C	sympathetic	noradrenaline
D	parasympathetic	acetylcholine

Heart

The difference between systolic and diastolic blood pressure is often referred to as pulse pressure.

19. The graph below shows the changes in blood pressure as blood flows through the circulatory system of an individual.



The maximum pulse pressure shown in the graph is

- A 40 mmHg
B 80 mmHg
C 100 mmHg
D 120 mmHg.

The increase in an athlete's heart rate and breathing rate during a race involves:

20. A sympathetic neurons of the autonomic nervous system
B parasympathetic neurons of the somatic nervous system
C sympathetic neurons of the somatic nervous system
D parasympathetic neurons of the autonomic nervous system.

21. Cardiac output is calculated using the following formula:

$$\text{Cardiac output} = \text{Heart Rate} \times \text{Stroke Volume}$$

The table below shows the heart rate and cardiac output of four individuals.

<i>Individual</i>	<i>Heart Rate (bpm)</i>	<i>Cardiac Output (L/min)</i>
A	60	5.8
B	68	6.1
C	72	7.2
D	78	7.6

Which individual has the greatest stroke volume?

22. During a competition, a trained athlete can increase his cardiac output by 7 times.

If an athlete has a resting heart rate of 60 beats/min and a resting stroke volume of $70 \text{ cm}^3/\text{beat}$, his maximum cardiac output is

- A $8.2 \text{ cm}^3/\text{min}$
B $4200 \text{ cm}^3/\text{min}$
C $29400 \text{ cm}^3/\text{min}$
D $36000 \text{ cm}^3/\text{min}$.

Heart

23. Which row in the table shows the typical blood pressure in a blood vessel of a young adult during the cardiac cycle?

	Blood pressure (mmHg)	Blood vessel	Cardiac cycle stage
A	80	vein	diastole
B	80	artery	systole
C	120	vein	diastole
D	120	artery	systole

24. A study was carried out into the effect of caffeine on blood pressure. The blood pressure of four individuals was measured before and after consumption of a drink containing caffeine. The results are shown in the table.

Individual	Initial blood pressure (mmHg)	Final blood pressure (mmHg)
1	120/75	146/97
2	115/79	132/99
3	127/86	159/100
4	118/80	139/96

The average increase in systolic blood pressure was

- A 18
B 24
C 72
D 96.

1. The picture shows a man having his blood pressure measured.



- (a) A blood pressure reading consists of a high systolic value and a lower diastolic value.

Explain the difference between these two values.

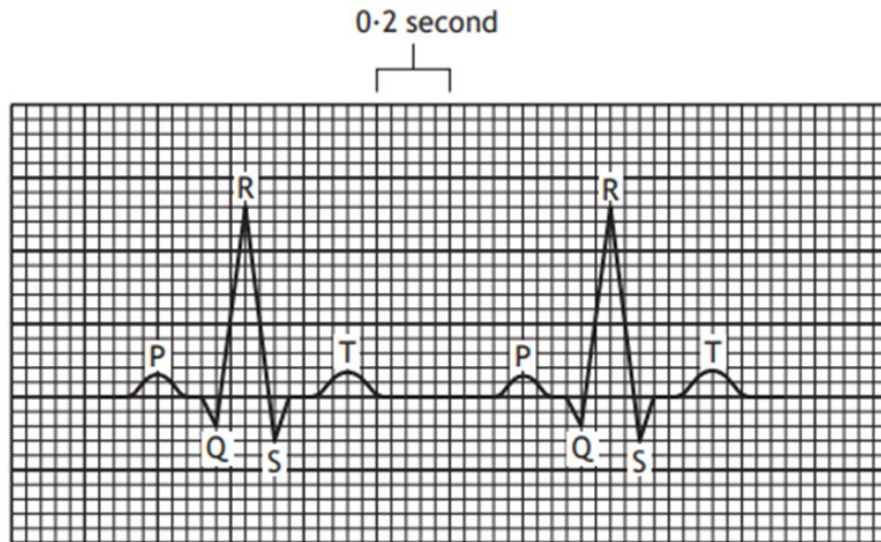
1

- (b) Suggest a reason why the pulse in the man's left wrist stops when the cuff is inflated.

1

Heart

2. The diagram shows an electrocardiogram (ECG) of an individual's heart.



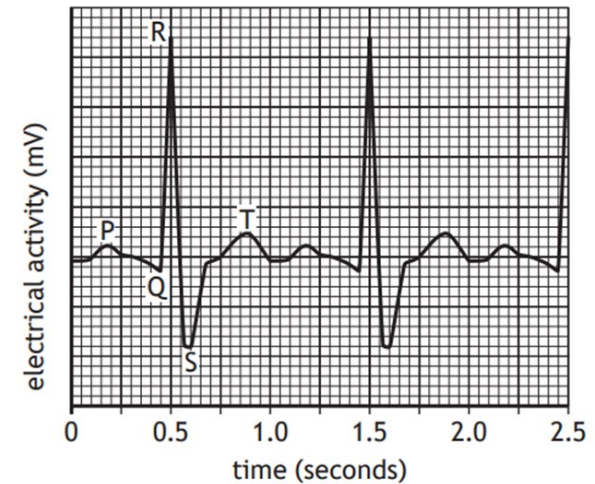
- (i) Use the diagram to calculate the individual's heart rate.

Space for calculation

_____ beats/min

- (ii) Describe what happens in the heart between points Q and S.

3. Graph 2



- (i) Describe what happens to the heart as a result of the electrical activity between Q and S.

1

- (c) Babies with a VSD sometimes have irregular heart rhythms. This can be detected by recording the electrical activity from the heart.

- (i) Name the chamber of the heart in which this electrical activity originates.

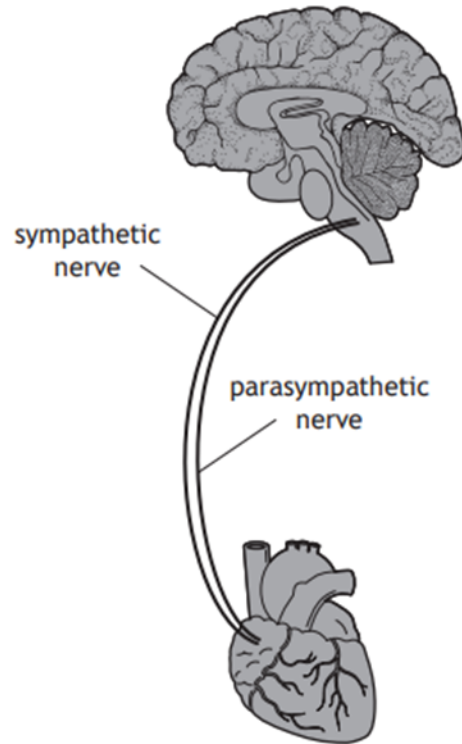
- (ii) Name the type of graph that displays such patterns of electrical activity.

1

1

Heart

4. The diagram represents part of the autonomic nervous system which links the brain to the heart.



- (a) Name the parts of the brain and heart which are linked by the nerve: shown in the diagram.

Brain _____

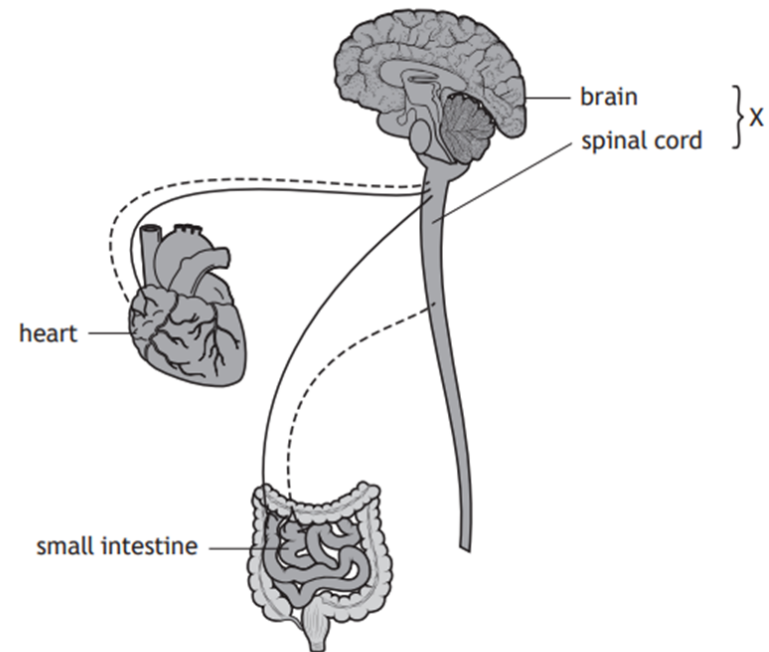
Heart _____

5.

Key

----- sympathetic neuron

———— parasympathetic neuron



- (a) Name the system identified by X.

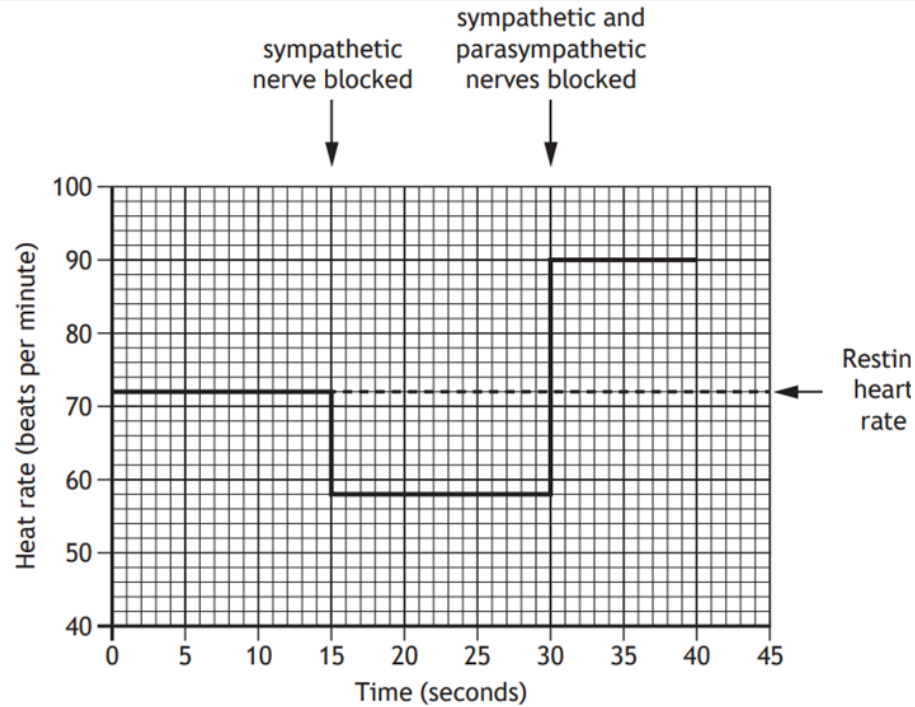
1

- (b) (i) State the term that describes the opposing effect of the sympathetic and parasympathetic nervous systems on body organs.

1

Heart

6.



b) Explain why the heart continues to contract when both nerves are blocked.

1

c) The parasympathetic nerve has a greater effect on the resting heart rate than the sympathetic nerve.

Use information from the graph to justify this statement.

1

a) Explain how the sympathetic and parasympathetic nerves control heart rate.

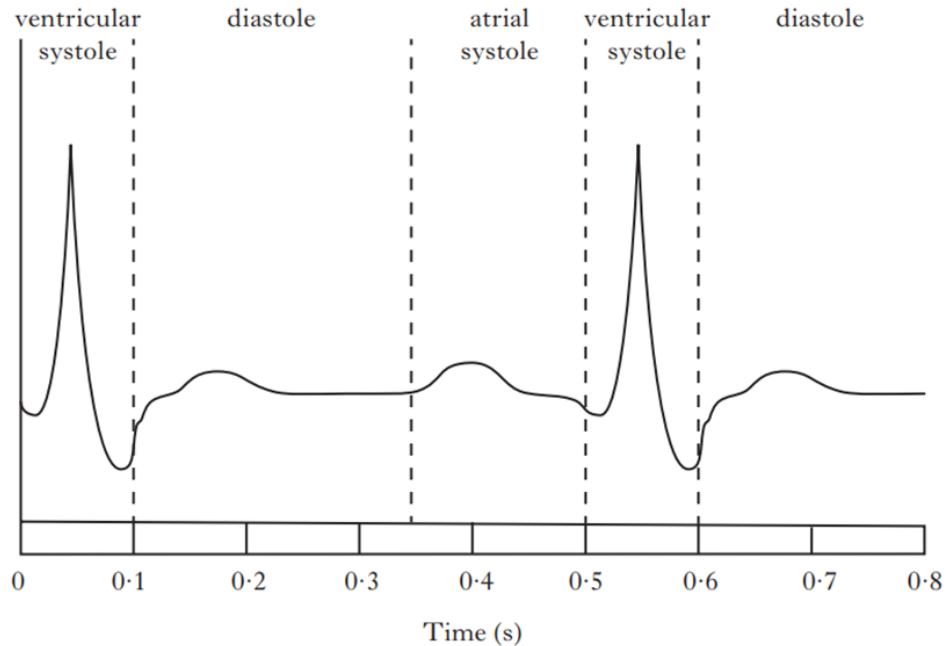
d) When the individual's blood pressure was measured an hour after exercise, a reading of 140/90 mmHg was recorded.

Describe what the first figure in a blood pressure reading represents.

1

Heart

7.



(a) Calculate the heart rate of this individual.

Space for calculation

_____ bpm

(b) Complete the following sentence by underlining one option from each pair of options shown in **bold**.

During the diastolic stage of the cardiac cycle, the atrial muscles are **contracted** / **relaxed** and the ventricular muscles are **contracted** / **relaxed**.

(c) Name the valves which will be open and closed in the left side of the heart during ventricular systole.

Open _____ Closed _____

(d) Predict how this individual's ECG trace would change under the influence of the parasympathetic nervous system.

e) When this man exercises, the volume of blood leaving his heart increases significantly.

Describe how the nervous system and hormones cause this increase.

1

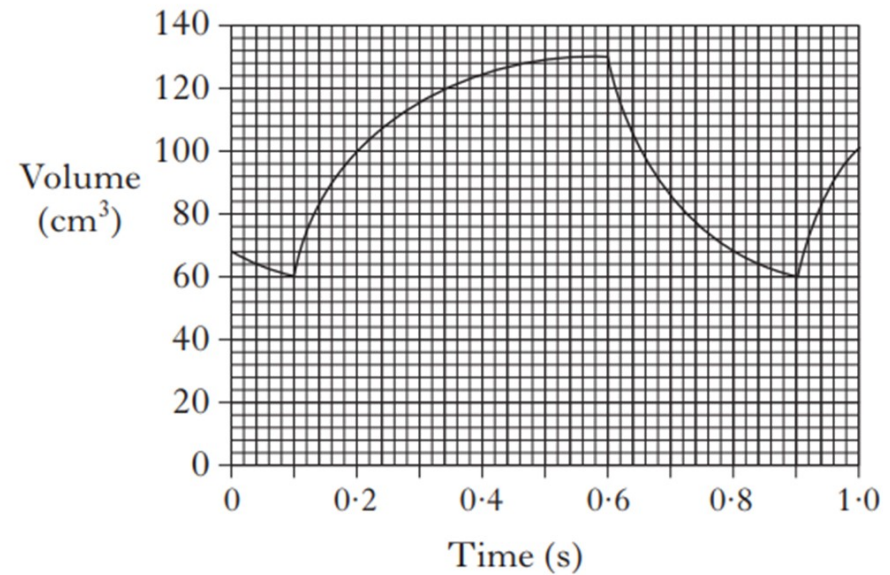
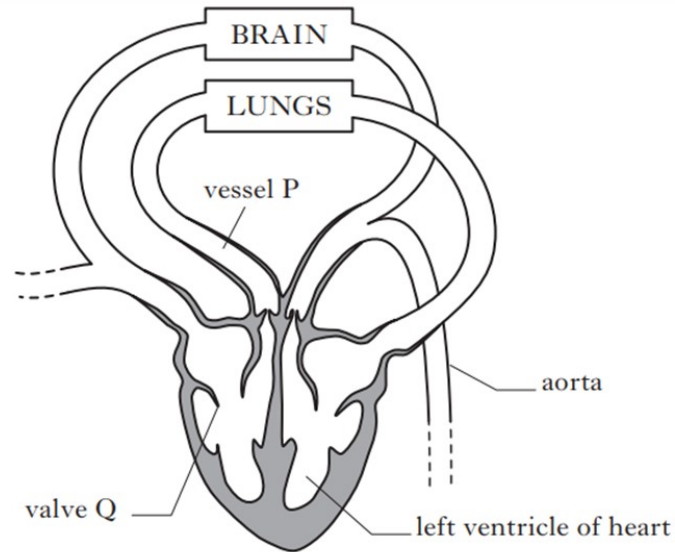
1

1

3

Heart

8.



- (a) State whether blood vessel P is the pulmonary artery or the pulmonary vein.
Give a reason for your answer.

Name of P _____

Reason _____

- c) Calculate the volume of blood leaving this man's left ventricle every minute.

Space for calculation

_____ cm³ **1**

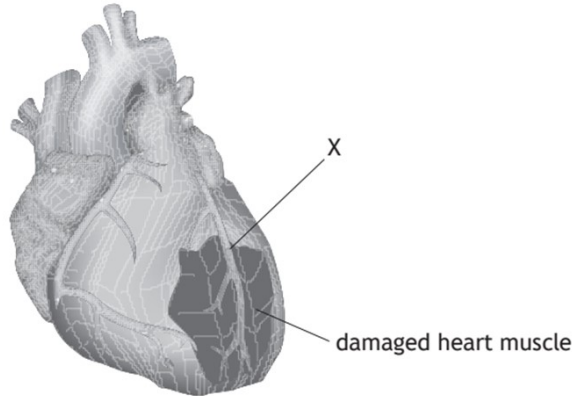
- b) Name valve Q and describe its function within the heart.

Name _____

Function _____

Heart

9. The diagram shows muscle damage in the heart of an individual who has had a heart attack.



- (a) (i) Name blood vessel X.

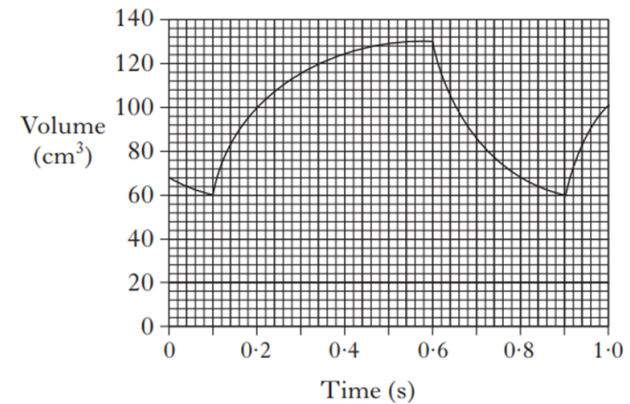
- (ii) Explain how the formation of a thrombus in blood vessel X results in heart muscle damage.

10. Sympathetic and parasympathetic nerves regulate heart rate.

- (a) Name the part of the brain that regulates the heart rate.

- (b) The sympathetic and parasympathetic nerves work antagonistically. Explain what this statement means.

8. The graph below shows changes in the volume of blood in the left ventricle of a man's heart.



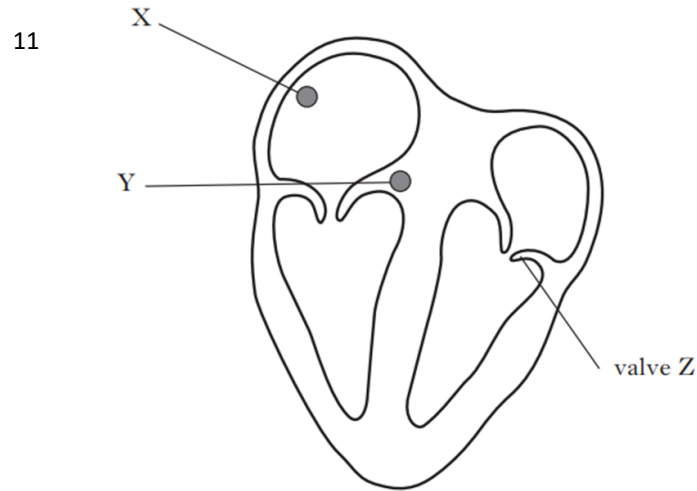
- (a) How long does ventricular systole last?

_____ s 1

- (b) (i) What is the heart rate of this man?

_____ beats per minute 1

Heart



(a) (i) Name structures X and Y.

X _____

Y _____

(ii) Electrical impulses travel from X to Y.

What is happening to the heart during this time?

1

1

1

(iii) **Draw** arrows on the diagram to show the pathway taken by electrical impulses produced by structure Y.

(b) (i) Name valve Z.

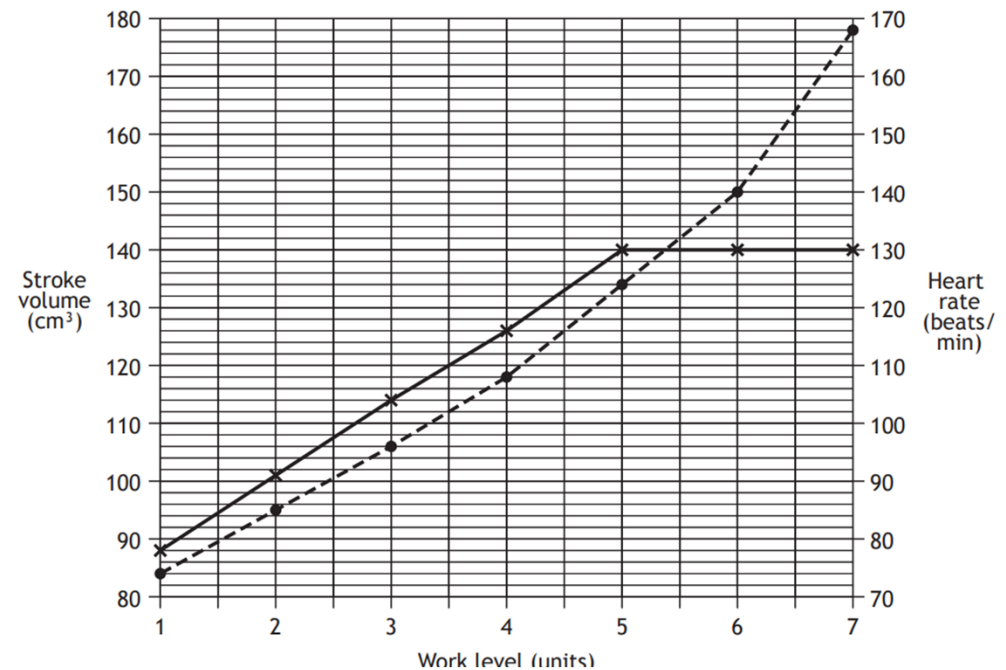
1

(ii) During which stage of the cardiac cycle is valve Z closed?

1

12

× — × stroke volume - volume of blood pumped out per heartbeat
 ● - - - ● heart rate - beats of heart per minute



Calculate the cyclist's cardiac output when his work level was 6 units.

1

(ii) During exercise, stimulation by sympathetic neurons increases heart rate and causes vasoconstriction of arteries in the small intestine.

Explain the importance of increased heart rate and vasoconstriction of arteries in the small intestine during exercise.

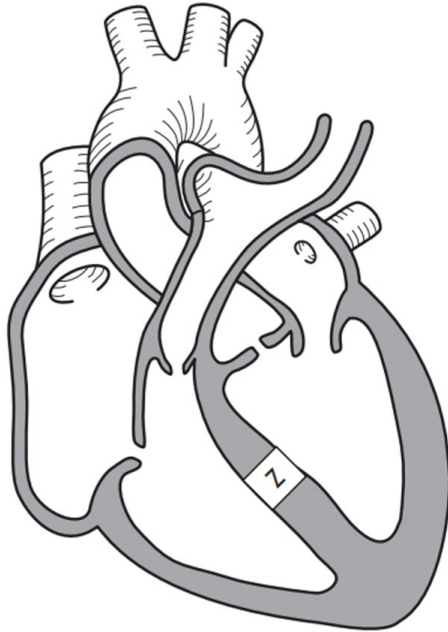
2

Increased heart rate _____

Vasoconstriction of arteries in small intestine _____

Heart

13.



- c) Babies with a VSD often have a lower stroke volume than babies who have a normal heart structure.

Despite this, both groups of babies often have similar cardiac outputs.

Suggest how babies with a VSD are able to achieve a similar cardiac output to babies with a normal heart structure.

1

- (a) On the diagram, **label** the pulmonary artery with the letter P.

1

- (b) Sometimes babies can be born with a ventricular septal defect (VSD) in which a "hole" occurs at point Z in the heart.

Explain how the presence of this hole would affect the oxygen concentration of the blood leaving the heart through the aorta.

2

Heart

14

Treadmill gradient	Heart rate (beats/min)	Stroke volume (cm ³)	Cardiac output (litres/min)
0	100	86	8.6
2	109	90	9.8
4	124	100	12.4
6	151	110	16.6
8	174	100	17.4
10	185		17.6

- a) Calculate the stroke volume when the treadmill gradient was set at 10.

1

Space for calculation

_____ cm³

- b) Suggest why stroke volume was observed to decrease after treadmill gradient 6.

1
