

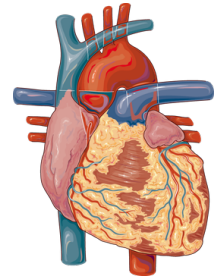
GCSE BIOLOGY

The Heart and Blood Vessels

AQA-style Topic Practice

Based on AQA GCSE Biology (8461)

Tier: Mixed demand



Name _____

Date _____

Instructions

- Use black ink or black ball-point pen.
- Answer all questions in the spaces provided.
- Do all rough work in this booklet.
- In all calculations, show clearly how you work out your answer.

Information

- The marks for questions are shown in brackets.
- The maximum mark for this paper is 59.
- You are expected to use a calculator where appropriate.
- Write clearly, use scientific terms correctly and organise your answers logically.

For marking

Question	Mark
1	
2	
3	
4	
5	
6	
7	
8	
9	
TOTAL	

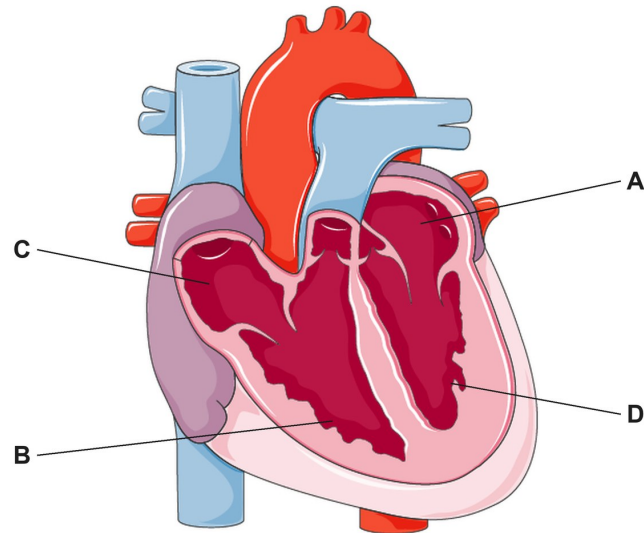
These are original practice questions written in the style of AQA GCSE Biology (8461). They are not official AQA examination questions and are not endorsed by AQA.

Q1.

This question is about the heart.

Figure 1 shows a section through the human heart.

Figure 1



- (a) Which chamber of the heart pumps blood to the lungs?

Tick (✓) **one** box.

A ☐

B ☐

C ☐

D ☐

(1)

- (b) Name the blood vessel that carries blood from the left ventricle to the rest of the body.

(1)

- (c) The natural resting heart rate is controlled by a group of cells called the pacemaker.

Which chamber in Figure 1 contains the pacemaker?

Tick (✓) **one** box.

A ☐

B ☐

C ☐

D ☐

(1)

- (d) Name the blood vessels that supply the heart muscle with oxygenated blood.

(1)

- (e) The wall of chamber D is thicker than the wall of chamber B.

Explain why.

(2)

Q2.

Blood is transported around the body in blood vessels.

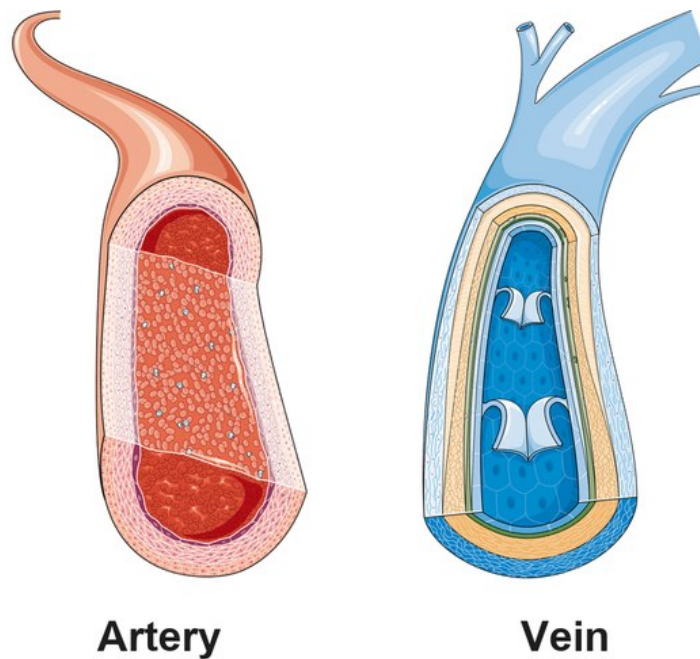
- (a) Draw **one** line from each type of blood vessel to its description.

Type of blood vessel	Description
Artery	Carries blood towards the heart at low pressure
Capillary	Carries blood away from the heart at high pressure
Vein	Has a wall that is one cell thick
	Pumps blood around the body

(2)

- (b) Figure 2 shows an artery and a vein.

Figure 2



Explain how the wall of the artery is adapted to carry blood at high pressure.

(3)

- (c) Use Figure 2.

Give **one** structure that the vein has but the artery does not have.

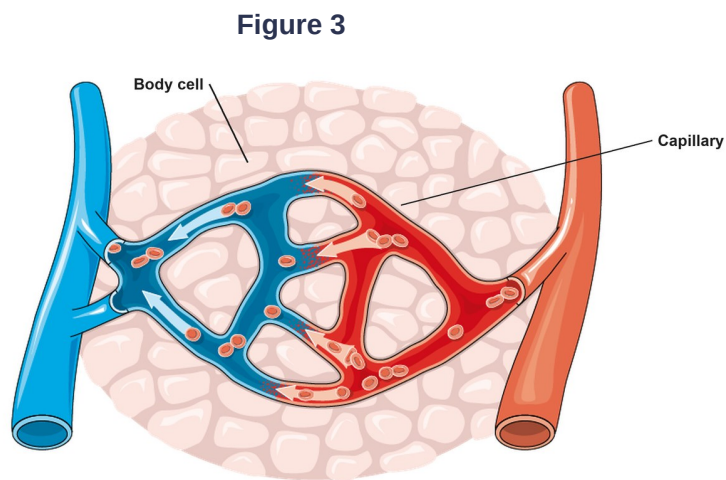
(1)

- (d) Explain why veins need this structure.

(2)

Q3.

Figure 3 shows a capillary and some body cells.



- (a) Name **one** substance that moves from the blood in the capillary into the body cells.

(1)

- (b) Name the process by which this substance moves into the body cells.

(1)

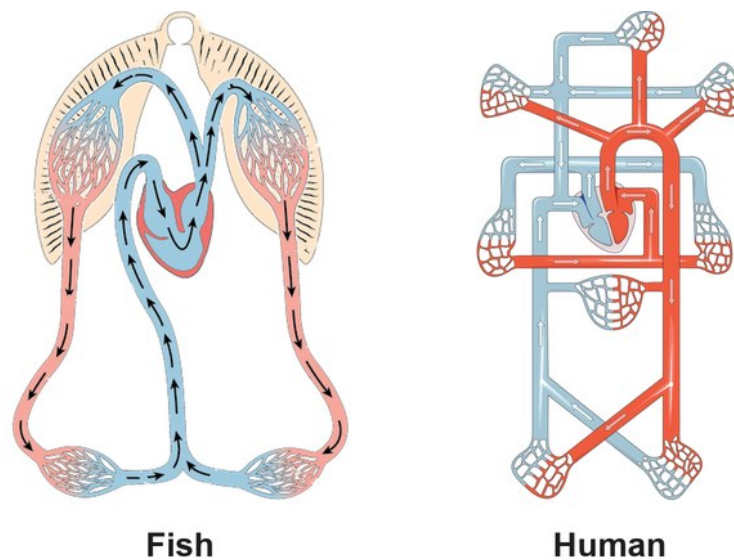
- (c) Explain how the structure of a capillary is adapted for exchanging substances with body cells.

(2)

Q4.

Figure 4 shows the circulatory systems of a fish and a human.

Figure 4



In a fish, blood passes through the heart once for each complete circuit of the body.

- (a) How many times does blood pass through the human heart for each complete circuit of the body?

Tick (✓) **one** box.

Once

☐

Twice

☐

Three times

☐

Four times

☐

(1)

- (b) Explain why the human circulatory system can deliver oxygen to body cells more quickly than the circulatory system of a fish.

(3)

Q5.

Large multicellular organisms need a transport system.

A student used cubes to model organisms of different sizes.

Table 1 shows the student's results.

Table 1

Length of side in cm	Surface area in cm ²	Volume in cm ³	Surface area : volume ratio
1	6	1	6 : 1
2	24	8	3 : 1
3	54	27	

- (a) Calculate the surface area : volume ratio of the 3 cm cube.

Surface area : volume ratio = _____

(2)

- (b) Describe how the surface area : volume ratio changes as the size of the cube increases.

(1)

- (c) Explain why a large multicellular organism needs a transport system.

Use Table 1 in your answer.

(2)

Q6.

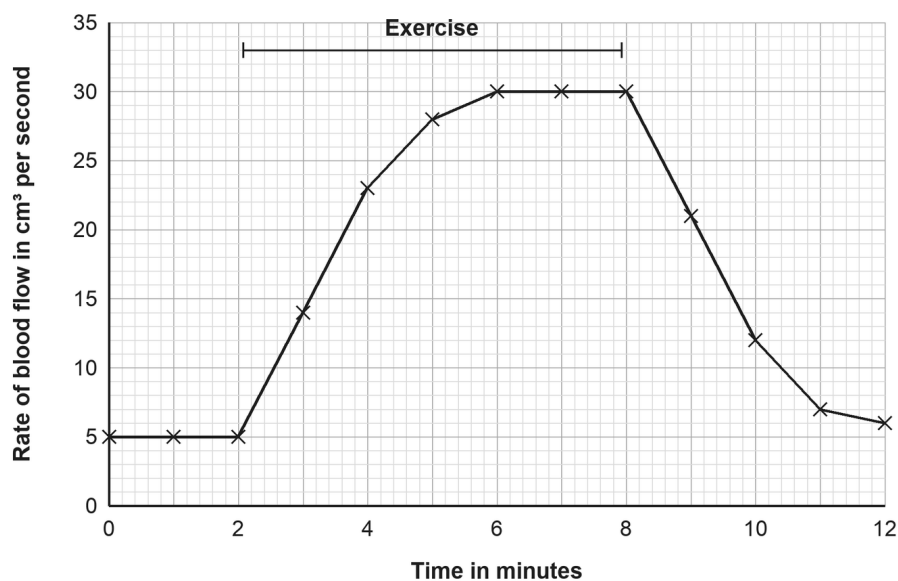
The rate of blood flow is the volume of blood that flows through a blood vessel in one second.

- (a) At rest, 150 cm^3 of blood flowed through an artery in the leg in 30 seconds.

Calculate the rate of blood flow.

Figure 5 shows the rate of blood flow through the same artery before, during and after exercise.

Figure 5



Rate of blood flow = _____ cm^3 per second

(2)

- (b) Give the rate of blood flow at 6 minutes.

Rate of blood flow = _____ cm³ per second

(1)

- (c) Calculate the percentage increase in the rate of blood flow from rest to 6 minutes.

Percentage increase = _____ %

(2)

- (d) Describe how the rate of blood flow changed after the exercise stopped.

Use data from Figure 5.

(2)

- (e) Explain why the rate of blood flow to the leg muscles increased during exercise.

(3)

Q7.

A student investigated how different activities affect her heart rate.

She did each activity for 2 minutes and then measured her heart rate.

She rested until her heart rate returned to its resting rate before the next activity.

She did each activity three times.

Table 2 shows the results.

Table 2

Activity	Trial 1 in beats per minute	Trial 2 in beats per minute	Trial 3 in beats per minute	Mean in beats per minute
Sitting	68	70	69	69
Walking	88	91	88	89
Jogging	121	139	123	X
Running	158	161	161	160

- (a) Give the independent variable in this investigation.

(1)

- (b) Give **one** control variable in this investigation.

(1)

- (c) Identify the anomalous result in Table 2.

(1)

- (d) Calculate value X in Table 2.

Do **not** include the anomalous result in your calculation.

X = _____ beats per minute

(2)

- (e) Describe how the student could measure her heart rate.

(2)

- (f) The student concluded:

'The more intense the activity, the higher my heart rate.'

Do the data in Table 2 support this conclusion?

Give reasons for your answer.

(2)

Q8.

Scientists measured the thickness of the ventricle walls in two groups of adults.

Table 3 shows the results.

Table 3

Group	Number of people	Mean thickness of left ventricle wall in mm	Mean thickness of right ventricle wall in mm
Adults who do not train	40	9.0	3.5
Endurance runners	40	11.7	4.2

- (a) Calculate the percentage increase in the mean thickness of the left ventricle wall of the endurance runners compared with the adults who do not train.

Give your answer to 2 significant figures.

Percentage increase = _____ %

(2)

- (b) Suggest why a thicker left ventricle wall is an advantage to an endurance runner.

(2)

- (c) A scientist concluded that endurance training causes the left ventricle wall to become thicker.

Evaluate this conclusion.

Use information from Table 3.

(3)

Q9.

Deoxygenated blood returns to the heart from the body.

Describe how this blood is transported through the heart and lungs and then to the rest of the body.

In your answer, explain how the structure of the heart is related to its function.

(6)**END OF QUESTIONS**

Mark scheme

Credit any answer that is scientifically correct and has the same meaning as the answer given, unless the extra information says otherwise. Words in brackets are not needed to gain the mark.

Qu.	Answers	Extra information	Mark	AO / Spec. ref.
1(a)	B	allow right ventricle if more than one box is ticked, award no mark	1	AO1 (1) 4.2.2.2
1(b)	aorta	do not accept artery alone	1	AO1 (1) 4.2.2.2
1(c)	C	allow right atrium if more than one box is ticked, award no mark	1	AO1 (1) 4.2.2.2
1(d)	coronary arteries	allow coronary artery do not accept coronary vein(s)	1	AO1 (1) 4.2.2.2
1(e)	chamber D / the left ventricle pumps blood around the (whole) body, but chamber B / the right ventricle only pumps blood to the lungs so D needs more muscle to produce a higher pressure	allow the lungs are close to the heart for the first marking point ignore pumps harder unless linked to pressure or distance	2	AO1 (2) 4.2.2.2
Total			6	

Qu.	Answers	Extra information	Mark	AO / Spec. ref.
2(a)	Artery → Carries blood away from the heart at high pressure Capillary → Has a wall that is one cell thick Vein → Carries blood towards the heart at low pressure	all three lines correct = 2 marks one or two lines correct = 1 mark more than one line from a type of blood vessel cancels the mark for that vessel	2	AO1 (2) 4.2.2.2
2(b)	thick wall / thick layer of muscle (so the wall) can withstand the high pressure elastic tissue (in the wall) stretches and recoils (as pressure changes)	the second marking point must be linked to the first allow elastic fibres for elastic tissue allow recoil maintains the pressure / evens out the flow for the third marking point ignore strong wall	3	AO1 (3) 4.2.2.2
2(c)	valve(s)	ignore names of valves	1	AO2 (1) 4.2.2.2
2(d)	blood in veins is at low pressure (valves) prevent backflow / keep blood flowing towards the heart	allow blood in veins must flow against gravity for the first marking point do not accept valves pump blood	2	AO1 (1) AO2 (1) 4.2.2.2
Total			8	

Qu.	Answers	Extra information	Mark	AO / Spec. ref.
3(a)	oxygen or glucose	allow sugar for glucose ignore food do not accept carbon dioxide	1	AO1 (1) 4.2.2.2
3(b)	diffusion	ignore osmosis	1	AO1 (1) 4.1.3.1
3(c)	wall is one cell thick so the diffusion distance is short	allow very thin wall for the first marking point allow capillaries form networks, so there is a large surface area, for the second marking point ignore thin alone	2	AO1 (1) AO2 (1) 4.2.2.2
Total			4	

Qu.	Answers	Extra information	Mark	AO / Spec. ref.
4(a)	Twice	if more than one box is ticked, award no mark	1	AO1 (1) 4.2.2.2
4(b)	• blood returns to the heart after the lungs / gas-exchange surface (1) • the blood is pumped again by the heart / left ventricle (1) • therefore the blood reaches the body at a higher pressure / more quickly (1)	allow the human has two circuits / the heart pumps blood separately to the lungs and the body, for the first marking point if clearly explained ignore more efficient unless explained	3	AO2 (3) 4.2.2.2
Total			4	

Qu.	Answers	Extra information	Mark	AO / Spec. ref.
5(a)	54 : 27 2 : 1	award 2 marks for 2 : 1 with no working shown allow 2 (on its own) for 2 marks	2	AO2 (2) 4.1.3.1
5(b)	(as the cube gets bigger) the surface area : volume ratio decreases	ignore surface area increases or volume increases alone	1	AO3 (1) 4.1.3.1
5(c)	a large organism has a small surface area : volume ratio so diffusion across its surface is too slow / cannot supply all its cells, so a transport system is needed	allow cells are too far from the surface for the second marking point the first marking point may be shown by using values from Table 1	2	AO1 (1) AO2 (1) 4.1.3.1
Total			5	

Qu.	Answers	Extra information	Mark	AO / Spec. ref.
6(a)	150 ÷ 30 5 (cm ³ per second)	award 2 marks for the correct answer with no working shown	2	AO2 (2) 4.2.2.2
6(b)	30 (cm ³ per second)		1	AO3 (1) 4.2.2.2
6(c)	(30 – 5) ÷ 5 × 100 500 (%)	award 2 marks for the correct answer with no working shown allow ecf from 6(a) and 6(b) award 1 mark for 600 (%)	2	AO2 (2) 4.2.2.2
6(d)	decreased / fell after 8 minutes from 30 to 6 cm ³ per second (by 12 minutes)	the second marking point needs data from Figure 5 allow fell quickly at first and then more slowly / almost back to the resting rate as an alternative second marking point	2	AO3 (2) 4.2.2.2
6(e)	(muscle cells) respire faster / more (aerobic) respiration so need more oxygen / glucose (increased blood flow) delivers more oxygen / glucose or removes more carbon dioxide	do not accept energy is produced / made ignore more energy needed unless linked to respiration	3	AO1 (1) AO2 (2) 4.2.2.2
Total			10	

Qu.	Answers	Extra information	Mark	AO / Spec. ref.
7(a)	(type of) activity	allow intensity of exercise ignore heart rate	1	AO3 (1) WS 2.2
7(b)	any one from: - time spent doing each activity / 2 minutes - resting until heart rate returns to resting rate - same person	ignore same activity	1	AO3 (1) WS 2.2
7(c)	139	allow jogging, trial 2	1	AO3 (1) WS 3.7
7(d)	$(121 + 123) \div 2$ 122 (beats per minute)	award 2 marks for the correct answer with no working shown award 1 mark for 128, where the anomalous result has been included	2	AO2 (2) WS 3.3
7(e)	find the pulse (in the wrist or neck) using fingers count the number of beats in 60 seconds	allow count beats in 15 seconds and multiply by 4 (or equivalent) allow use a heart rate monitor for the first marking point ignore use a stopwatch alone	2	AO1 (2) WS 2.2
7(f)	yes, because the mean heart rate increases as the activity becomes more intense use of data, e.g. from 69 (sitting) to 160 (running) beats per minute	allow a limitation as an alternative second marking point, e.g. only one person was tested so the conclusion may not apply to other people	2	AO3 (2) WS 3.5
Total			9	

Qu.	Answers	Extra information	Mark	AO / Spec. ref.
8(a)	$(11.7 - 9.0) \div 9.0 \times 100$ = 30 (%)	award 2 marks for the correct answer with no working shown award 1 mark for a correct calculation method with an arithmetic error	2	AO2 (2) 4.2.2.2
8(b)	more (cardiac) muscle, so contracts with more force / produces a higher pressure so more blood (containing oxygen) is pumped to the muscles (with each beat)	ignore stronger heart unless explained	2	AO2 (2) 4.2.2.2
8(c)	any three from: - the data support the conclusion: runners have a thicker left ventricle wall (11.7 mm compared with 9.0 mm) - the samples are large enough to be reliable (40 people in each group) - but the data show a correlation, not that training causes the difference - people with a thicker wall may be more likely to become endurance runners - the wall was not measured before and after training - other factors, e.g. genetics or body size, were not controlled	a judgement is not needed for full marks, but at least one point must question the conclusion ignore sample too small	3	AO3 (3) 4.2.2.2
Total			7	

Question 9 is marked by levels of response. Decide which level best describes the answer, then award a mark within the level.

Level	Marks	Description
Level 3	5–6	A detailed and coherent description of the route of blood through the heart and lungs, in the correct order, including the chambers and blood vessels. It clearly explains how structures of the heart relate to their functions.
Level 2	3–4	A mostly correct description of the route, with some explanation of how the structure of the heart relates to its function. Some steps may be missing or out of order.
Level 1	1–2	Simple statements about the heart, blood vessels or the route of blood, with little or no explanation.
	0	No relevant content.

Qu.	Answers	Extra information	Mark	AO / Spec. ref.
9	Indicative content: • blood enters the right atrium through the vena cava • blood passes to the right ventricle • the right ventricle pumps blood through the pulmonary artery to the lungs • in the lungs the blood gains oxygen and loses carbon dioxide • oxygenated blood returns through the pulmonary vein to the left atrium • blood passes to the left ventricle • the left ventricle pumps blood through the aorta to the rest of the body • valves prevent backflow, so blood flows in one direction • atria have thin walls because they pump blood only to the ventricles • ventricles have thick muscular walls to pump blood out of the heart • the left ventricle wall is thicker because it pumps blood around the whole body • the septum keeps oxygenated and deoxygenated blood separate • coronary arteries supply the heart muscle with oxygen	the indicative content is not a checklist; credit other relevant, correct points to reach Level 3, the route must be in the correct order and linked to explanation names of individual heart valves are not required	6	AO1 (4) AO2 (2) 4.2.2.2
Total			6	

Assessment objectives in this paper

Assessment objective	Marks
AO1 knowledge and understanding	24 (41%)
AO2 applying knowledge and understanding	23 (39%)
AO3 analysing, interpreting and evaluating	12 (20%)
Total	59