

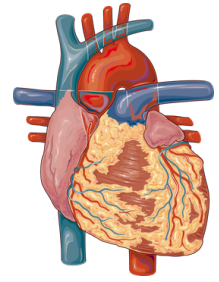
GCSE BIOLOGY

The Heart and Blood Vessels

OCR-style Topic Practice

For OCR Biology A (Gateway Science) J247 and OCR Biology B (Twenty First Century Science) J257

Tier: Mixed demand



Name _____

Date _____

INSTRUCTIONS

- Use black ink. You can use an HB pencil for graphs and diagrams.
- Answer all the questions.
- Write your answer to each question in the space provided.
- Where appropriate, show your working.
- A scientific calculator may be used.

INFORMATION

- The total mark for this paper is **57**.
- The marks for each question are shown in brackets [].
- Questions marked with an asterisk (*) are assessed on the quality of your extended response: your line of reasoning, and how clearly and logically it is set out.

ADVICE

- Read each question carefully before you start your answer.

These are original, independent practice questions written in the style of OCR GCSE Biology. They are not official OCR examination questions and are not endorsed by OCR.

SECTION A

Answer **all** the questions. You should spend approximately 10 minutes on this section. Write your answer to each question in the box provided.

- 1 Which substance is carried dissolved in the plasma, and **not** by red blood cells?

A haemoglobin
B oxygen
C platelets
D urea

Your answer

[1]

- 2 Fig. 2.1 shows a section through the human heart.

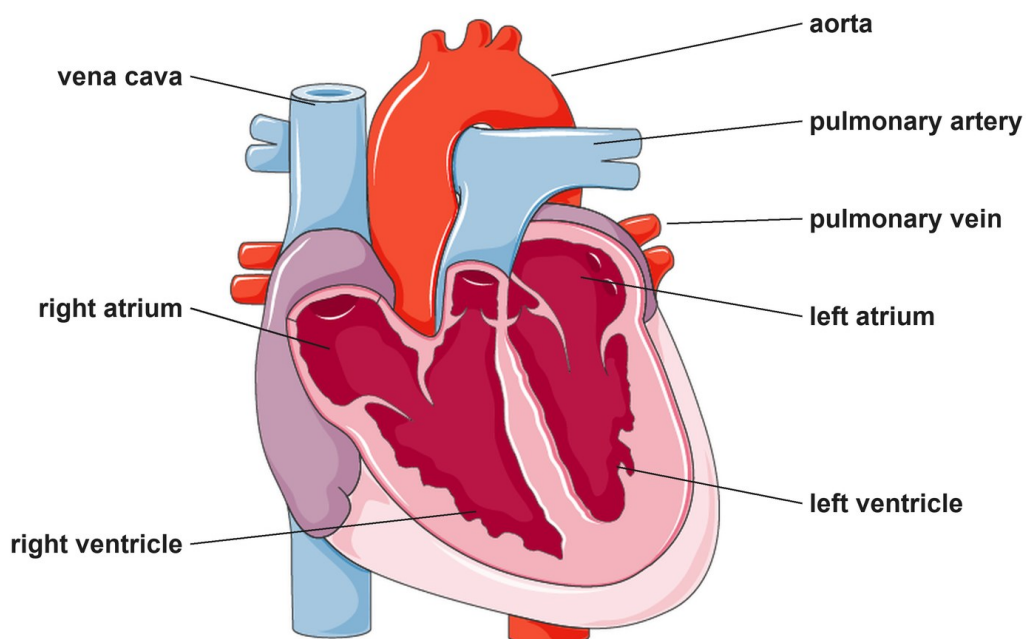


Fig. 2.1

Which sequence shows the route taken by blood that has just been oxygenated in the lungs?

- A pulmonary artery → left atrium → left ventricle → aorta
B pulmonary vein → left atrium → left ventricle → aorta
C pulmonary vein → right atrium → right ventricle → aorta
D vena cava → right atrium → right ventricle → pulmonary artery

Your answer

[1]

3 Which row describes a capillary?

	Wall	Valves
A	one cell thick	absent
B	one cell thick	present
C	thick, with muscle and elastic tissue	absent
D	thin, with little muscle	present

Your answer

[1]

4 A cube has sides of length 5 cm.

What is the surface area : volume ratio of the cube?

- A 0.8 : 1
- B 1.2 : 1
- C 5 : 1
- D 6 : 1

Your answer

[1]

5 Which chamber of the heart receives deoxygenated blood from the body?

- A left atrium
- B left ventricle
- C right atrium
- D right ventricle

Your answer

[1]

6 Why is the wall of the left ventricle thicker than the wall of the right ventricle?

- A It contains more blood.
- B It pumps blood around the whole body, which needs a higher pressure.
- C It pumps blood only to the lungs.
- D It receives blood directly from the body.

Your answer

[1]

SECTION B

Answer **all** the questions.

- 7** The circulatory system links the lungs, the digestive system and the kidneys with every cell in the body.

- (a) Complete the sentences.

Use words from the list.

capillaries	diffusion	kidneys	lungs
plasma	red blood cells	small intestine	

Oxygen enters the blood in the It is carried to body cells by

Dissolved glucose is absorbed into the blood from the and is carried in the

Urea is removed from the blood by the

[3]

- (b) A patient has a lung disease that makes the walls of the alveoli thicker.

Suggest why the patient feels tired, even when resting.

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[3]

- 8 Fig. 8.1 shows an artery and a vein.

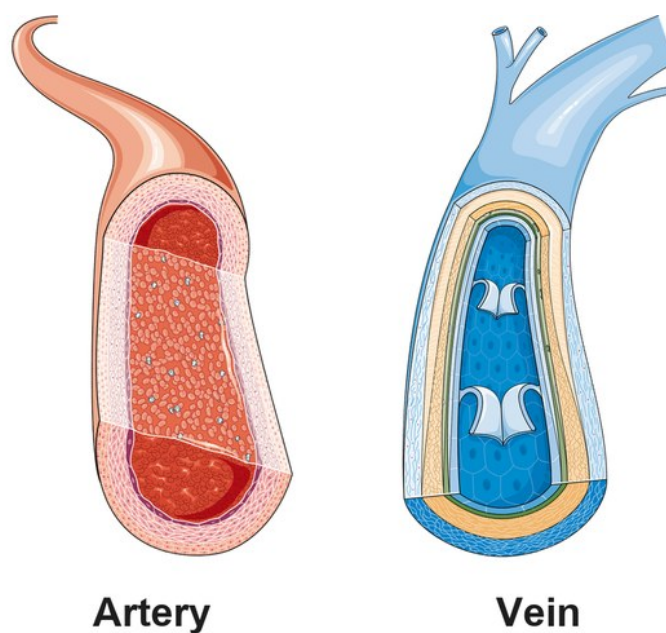


Fig. 8.1

- (a) Compare the structure of an artery with the structure of a vein.

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[3]

- (b) Explain why the wall of an artery contains elastic tissue.

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[2]

- (c) A student observes a vein in her forearm.

She uses a finger to push blood along a short section of the vein towards her heart. The section of vein becomes flat.

When pressure is released at the end nearest the heart, the section does not immediately refill from that direction.

Explain this observation.

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[2]

- 9 The chambers of the heart are full of blood. The cardiac muscle in the heart wall also receives its own blood supply, through small arteries called coronary arteries. The coronary arteries branch off the aorta.

(a) Explain why the cardiac muscle needs a blood supply from the coronary arteries.

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[3]

(b) A student writes:

'The coronary arteries carry blood from the heart to the organs of the body.'

Explain why the student is wrong.

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[2]

- 10 A student investigated how the size of an organism affects the time taken for substances to diffuse into it.

She cut cubes of agar jelly containing a pink indicator. She put each cube into acid. The indicator turns colourless when the acid reaches it.

She timed how long it took for each cube to turn completely colourless.

Table 10.1 shows her results.

Table 10.1

Length of side (cm)	Surface area (cm ²)	Volume (cm ³)	Surface area : volume ratio	Trial 1 (s)	Trial 2 (s)	Trial 3 (s)	Mean time (s)
1	6	1	6 : 1	62	58	60	60
2	24	8	3 : 1	240	236	244	240
3	54	27		538	612	542	

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

.....

.....

Surface area : volume ratio =

[2]

- (b) Identify the anomalous result in Table 10.1.

..... [1]

- (c) Calculate the mean time for the 3 cm cube.

Do **not** include the anomalous result.

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Mean time = s [2]

- (d) Describe the relationship between the surface area : volume ratio and the time taken for the cube to turn colourless.

Use data from Table 10.1.

..... [2]

- (e) Use the results to explain why a large multicellular animal needs a transport system.

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..... [3]

- (f) State **one** variable the student should control.

..... [1]

- 11 Scientists measured the thickness of the left ventricle wall in two groups of adults.

Table 11.1 shows their results.

Table 11.1

Group	Number of people	Mean thickness of left ventricle wall (mm)
Rowers	8	12.1
Adults who do no regular exercise	8	9.6

- (a) Calculate the percentage increase in the mean thickness of the left ventricle wall of the rowers compared with the adults who do no regular exercise.

Give your answer to **2** significant figures.

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Percentage increase = % **[2]**

- (b) A newspaper headline says:

'Rowing makes your heart wall thicker.'

Evaluate whether the data in Table 11.1 support this claim.

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 **[3]**

- (c) Suggest **two** ways to improve the study, to find out whether rowing causes the left ventricle wall to become thicker.

1

 2

[2]

- (d) Explain how a thicker left ventricle wall benefits a rower during a race.

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[2]

- 12** In humans, blood flows in the order:

heart → lungs → heart → rest of the body → heart

- (a) Explain why it is an advantage that blood returns to the heart after it passes through the lungs.

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[3]

- (b) Red blood cells contain haemoglobin and have no nucleus.

- (i) State the function of haemoglobin.

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[1]

- (ii) Explain how having no nucleus adapts a red blood cell to its function.

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[1]

- (c) State **two** substances, other than urea, that are transported in the plasma.

1

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2

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[2]

- 13*** A person runs up a steep hill. The muscles in their legs need a rapid supply of oxygen.

Explain how the structures of the heart and the blood vessels allow oxygen to reach the leg muscles quickly.

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[6]

END OF QUESTION PAPER

Mark scheme

Annotations: ✓ = one mark. / separates alternatives. () words not needed for the mark. ALLOW = an acceptable alternative. IGNORE = neither gains nor loses the mark. DO NOT ACCEPT = does not gain the mark. ECF = error carried forward.

Question	Answer	Marks	AO element	Guidance
1	D ✓	1	1.1	
2	B ✓	1	2.1	A: correct side of the heart, but the pulmonary artery carries blood to the lungs C: correct type of route, but the wrong side of the heart
3	A ✓	1	1.1	
4	B ✓	1	2.1	surface area = 150 cm ² , volume = 125 cm ³ , 150 : 125 = 1.2 : 1
5	C ✓	1	1.1	
6	B ✓	1	1.1	
7(a)	lungs, red blood cells, small intestine, plasma, kidneys all five correct ✓✓✓	3	1.1 × 3	3–4 correct = 2 marks 1–2 correct = 1 mark the words must be in this order
7(b)	(thicker walls give a) longer diffusion distance ✓ so less oxygen diffuses into the blood / oxygen diffuses into the blood more slowly ✓ so less aerobic respiration in (body) cells / less energy released ✓	3	2.1 × 3	ALLOW slower gas exchange for the second marking point IGNORE less oxygen breathed in DO NOT ACCEPT energy is made / produced
8(a)	arteries have thicker walls than veins ✓ arteries have more muscle / elastic tissue than veins ✓ arteries have a narrower lumen than veins ✓ veins have valves but arteries do not ✓	3	1.1 × 3	award one mark for each of any three points each point must compare both vessels: a statement about one vessel only does not score ALLOW the converse statements about veins
8(b)	(elastic tissue) stretches (as a surge of blood arrives at high pressure) ✓ (then) recoils, which evens out the pressure / keeps the blood flowing ✓	2	1.1 × 2	IGNORE flexible without reference to stretching or recoil
8(c)	valves in the vein prevent blood flowing backwards ✓ therefore blood cannot flow back from the heart end to refill the emptied section / blood normally flows towards the heart ✓	2	2.2 3.1a	ALLOW valves close for the first marking point DO NOT ACCEPT valves pump blood

Question	Answer	Marks	AO element	Guidance
9(a)	cardiac muscle cells respire (aerobically) continuously ✓ so need a supply of oxygen / glucose ✓ the heart wall is too thick for (enough) oxygen to diffuse from the blood in the chambers / the diffusion distance is too long ✓	3	1.1 2.1 ×2	ALLOW muscle contracts all the time, needs energy from respiration, for the first marking point DO NOT ACCEPT energy is made / produced
9(b)	the coronary arteries supply blood to the heart muscle (itself) ✓ blood is pumped to the organs of the body through the aorta / by the (left) ventricle ✓	2	2.1 ×2	the information about the aorta is given in the question
10(a)	54 : 27 ✓ 2 : 1 ✓	2	2.1 ×2	award 2 marks for the correct answer with no working ALLOW 2 for 2 marks
10(b)	612 (s) ✓	1	3.1a	ALLOW 3 cm cube, trial 2
10(c)	(538 + 542) ÷ 2 ✓ 540 (s) ✓	2	2.2 ×2	award 2 marks for the correct answer with no working award 1 mark for 564, where the anomalous result is included
10(d)	as the surface area : volume ratio decreases, the time taken increases ✓ use of data, e.g. 6 : 1 took 60 s but 2 : 1 took 540 s ✓	2	3.1a ×2	ALLOW the converse the second marking point needs values from Table 10.1 ALLOW ECF from (a) and (c)
10(e)	a large animal has a small surface area : volume ratio ✓ so diffusion (from the surface) takes too long to supply all its cells / the diffusion distance to cells in the middle is too great ✓ the results show a smaller ratio gives a longer time (so a transport system is needed to bring substances close to every cell) ✓	3	1.1 2.1 3.2b	the third marking point needs a link to the results ALLOW transport system reduces the diffusion distance for the bracketed idea
10(f)	one from: • concentration of the acid • temperature (of the acid) • volume of acid • type / concentration of indicator (in the agar)	1	3.3a	IGNORE amount of acid
11(a)	(12.1 – 9.6) ÷ 9.6 × 100 ✓ 26 (%) ✓	2	2.1 ×2	award 2 marks for the correct answer with no working award 1 mark for 26.0 or 26.04 (%), the answer not given to 2 significant figures

Question	Answer	Marks	AO element	Guidance
11(b)	three from: - the data support the claim: rowers have a thicker wall (12.1 mm compared with 9.6 mm) ✓ - the data show a correlation, not that rowing causes the difference ✓ - people with thicker heart walls may be more likely to take up rowing ✓ - other factors (e.g. genes, body size) were not controlled ✓ - the sample is small (8 people in each group) ✓ - the wall thickness was not measured before and after the rowers started training ✓	3	3.2a ×3	the three marks must include at least one point that supports and one that limits the claim
11(c)	two from: - measure the same people before and after a period of rowing training ✓ - use a larger number of people ✓ - include a control group who do not train over the same time ✓ - match the groups for age / sex / body size ✓	2	3.3b ×2	IGNORE repeat the study alone
11(d)	more cardiac muscle contracts with greater force / produces a higher pressure ✓ so more blood (containing oxygen) is pumped to the muscles with each beat ✓	2	1.1 2.1	IGNORE stronger heart unless explained
12(a)	blood returns to the heart after gas exchange (in the lungs) ✓ the heart pumps the blood again ✓ so the pressure is increased and blood reaches the body tissues quickly ✓	3	1.1 2.1 ×2	ALLOW the second circuit restores the pressure lost in the lung capillaries IGNORE more efficient unless explained
12(b)(i)	carries / binds oxygen ✓	1	1.1	DO NOT ACCEPT carries blood
12(b)(ii)	more space for haemoglobin, so more oxygen can be carried ✓	1	1.1	the mark needs both ideas
12(c)	two from: - glucose / dissolved food molecules ✓ - carbon dioxide ✓ - hormones ✓ - mineral ions / water ✓ - amino acids ✓	2	1.1 ×2	DO NOT ACCEPT oxygen DO NOT ACCEPT urea (excluded by the question)

Question	Answer	Marks	AO element	Guidance
13*	Level 3 (5–6 marks) A detailed explanation that links structures of both the heart and the blood vessels to the rapid delivery of oxygen to the muscles. There is a well-developed line of reasoning which is clear and logically structured. The information presented is relevant and substantiated. Level 2 (3–4 marks) An explanation that links some structures of the heart or the blood vessels to the delivery of oxygen. There is a line of reasoning presented with some structure. The information presented is relevant and supported by some evidence. Level 1 (1–2 marks) Some relevant structures of the heart or blood vessels are named or described, with little explanation. The information is basic and communicated in an unstructured way. 0 marks No response or no response worthy of credit.	6	1.1 ×3 2.1 ×3	Indicative scientific points may include: AO1.1 knowledge • ventricles have thick walls of cardiac muscle • the left ventricle has the thickest wall • valves stop blood flowing backwards • arteries have thick, muscular, elastic walls • capillary walls are one cell thick AO2.1 application • the left ventricle contracts with great force, so oxygenated blood leaves at high pressure and reaches the legs quickly • one-way flow means all the blood pumped moves towards the muscles • the septum keeps oxygenated blood separate, so the blood reaching the legs is fully oxygenated • elastic artery walls recoil, keeping the blood moving between beats • capillaries give a short diffusion distance, so oxygen passes quickly into the muscle cells The indicative points are not a checklist. Credit other relevant, correct points. A list of disconnected structures should not reach Level 3.

Specification coverage

The questions in this paper have been mapped to relevant content and/or assessment skills in both OCR Biology A (Gateway Science) J247 and OCR Biology B (Twenty First Century Science) J257. For teachers; not part of the student paper.

Question	Gateway J247	Twenty First Century J257	AO	Marks
1	B2.2e	B5.1.6	AO1.1	1
Question 1 total				1
2	B2.2c, B2.2d	B5.1.3, B5.1.4	AO2.1	1
Question 2 total				1
3	B2.2d	B5.1.5	AO1.1	1
Question 3 total				1
4	B2.2a, BM2.2i	B5.1.8	AO2.1	1
Question 4 total				1
5	B2.2d	B5.1.4	AO1.1	1
Question 5 total				1
6	B2.2d	B5.1.4	AO1.1	1
Question 6 total				1
7(a)	B2.2b, B2.2c, B2.2e, B3.3g	B5.1.1, B5.1.3	AO1.1 ×3	3
7(b)	B2.1a, B2.2c	B5.1.2, B5.1.3	AO2.1 ×3	3
Question 7 total				6
8(a)	B2.2d	B5.1.5	AO1.1 ×3	3
8(b)	B2.2d	B5.1.5	AO1.1 ×2	2
8(c)	B2.2d	B5.1.5	AO2.2, AO3.1a	2
Question 8 total				7
9(a)	B2.2d	B5.1.4	AO1.1, AO2.1 ×2	3
9(b)	B2.2c, B2.2d	B5.1.3, B5.1.4	AO2.1 ×2	2
Question 9 total				5
10(a)	B2.2a, BM2.2i	B5.1.8	AO2.1 ×2	2
10(b)	WS1.3f	laS2.9	AO3.1a	1
10(c)	WS1.3c	laS2.8	AO2.2 ×2	2
10(d)	WS1.3e	laS2.8	AO3.1a ×2	2
10(e)	B2.2a	B5.1.7	AO1.1, AO2.1, AO3.2b	3
10(f)	WS1.2b	laS1.4	AO3.3a	1
Question 10 total				11
11(a)	WS1.4f	laS2.6	AO2.1 ×2	2
11(b)	WS1.3f, WS1.3g	laS3.1b, laS1.5	AO3.2a ×3	3

Question	Gateway J247	Twenty First Century J257	AO	Marks
11(c)	WS1.2e	laS1.5, laS2.10	AO3.3b ×2	2
11(d)	B2.2d	B5.1.4	AO1.1, AO2.1	2
Question 11 total				9
12(a)	B2.2c	B5.1.3	AO1.1, AO2.1 ×2	3
12(b)(i)	B2.2e	B5.1.6	AO1.1	1
12(b)(ii)	B2.2e	B5.1.6	AO1.1	1
12(c)	B2.2b, B2.2e	B5.1.1, B5.1.6	AO1.1 ×2	2
Question 12 total				7
13	B2.2c, B2.2d	B5.1.3, B5.1.4, B5.1.5	AO1.1 ×3, AO2.1 ×3	6
Question 13 total				6
Paper total				57

Assessment objectives in this paper

Assessment objective	Marks
AO1 knowledge and understanding	23 (40%)
AO2 applying knowledge and understanding	23 (40%)
AO3 analysing, interpreting and evaluating	11 (19%)
Total	57