Heart and Circulation (Topic 1): Edexcel SNAB A Level Biology Exam Questions by Topic

19 questions · 44 marks · about 53 minutes. Answer in the spaces, then check the mark schemes at the end.

Question 1 · A level Paper 3 · June 2023 · Q1(a) · 2 marks

1 The heart pumps blood around the circulation system.

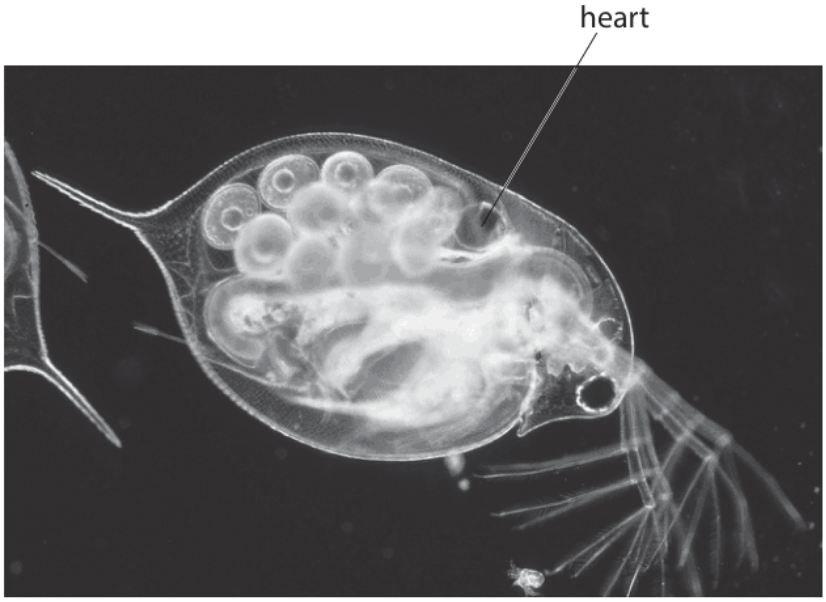
(a) Explain why many animals need a heart **and** circulation system.

(2)

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Question 2 · AS Paper 1 · June 2025 · Q7(a) · 3 marks

7 The photograph shows a *Daphnia* that lives in ponds and streams.



(Source: © MELBA PHOTO AGENCY / Alamy Stock Photo)

magnification ×30

(a) Explain why the *Daphnia* needs a heart.

(3)

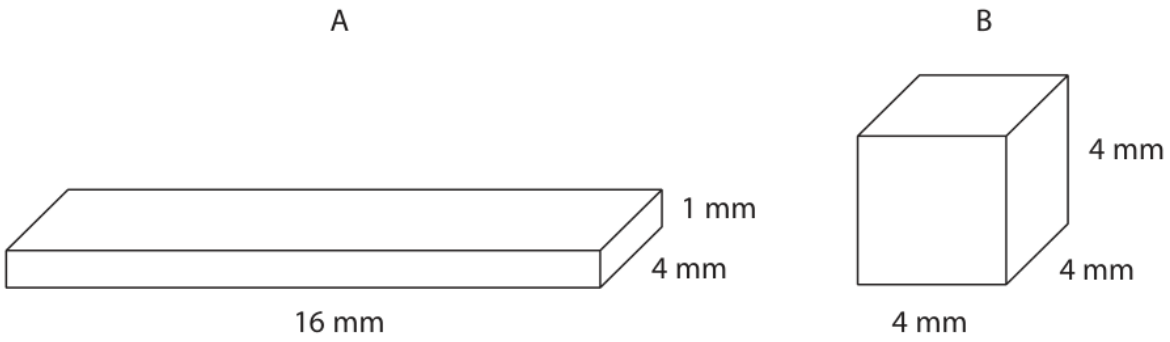
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4 Scientists can use models to explain the need for a circulation system in animals.

(a) The shapes in the diagram represent two different animals that live in water.
The figures represent the height, width and breadth of the animals.

Determine why animal A does not need a circulation system but animal B does.

(4)



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Question 4 · AS Paper 1 · June 2024 · Q8(c)(i) · 3 marks

(c) The squid is an invertebrate animal that lives in the sea.

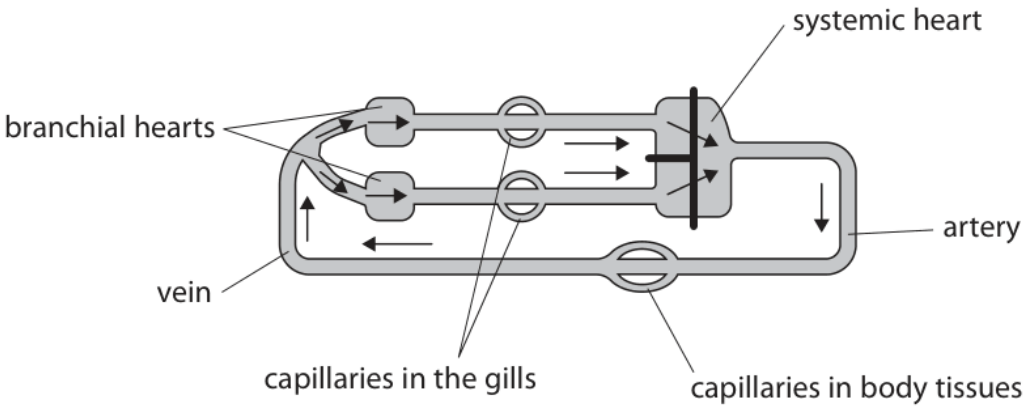
The photograph shows a squid.



(Source: © bonchan/Shutterstock)

The diagram shows the circulatory system of a squid.

The gills contain gas exchange surfaces.



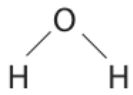
(i) Compare and contrast the circulatory systems of a squid and a human.

(3)

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Question 5 · AS Paper 1 · June 2018 · Q2(a) · 2 marks

2 Water is a polar molecule. The diagram shows a molecule of water.



(a) Complete the diagram to show the dipole nature of this water molecule.

(2)

Question 6 · AS Paper 1 · June 2017 · Q3(a) · 2 marks

3 Blood plasma contains glucose dissolved in water. Glucose is a polar molecule that is taken up by muscle cells and used in the synthesis of glycogen.

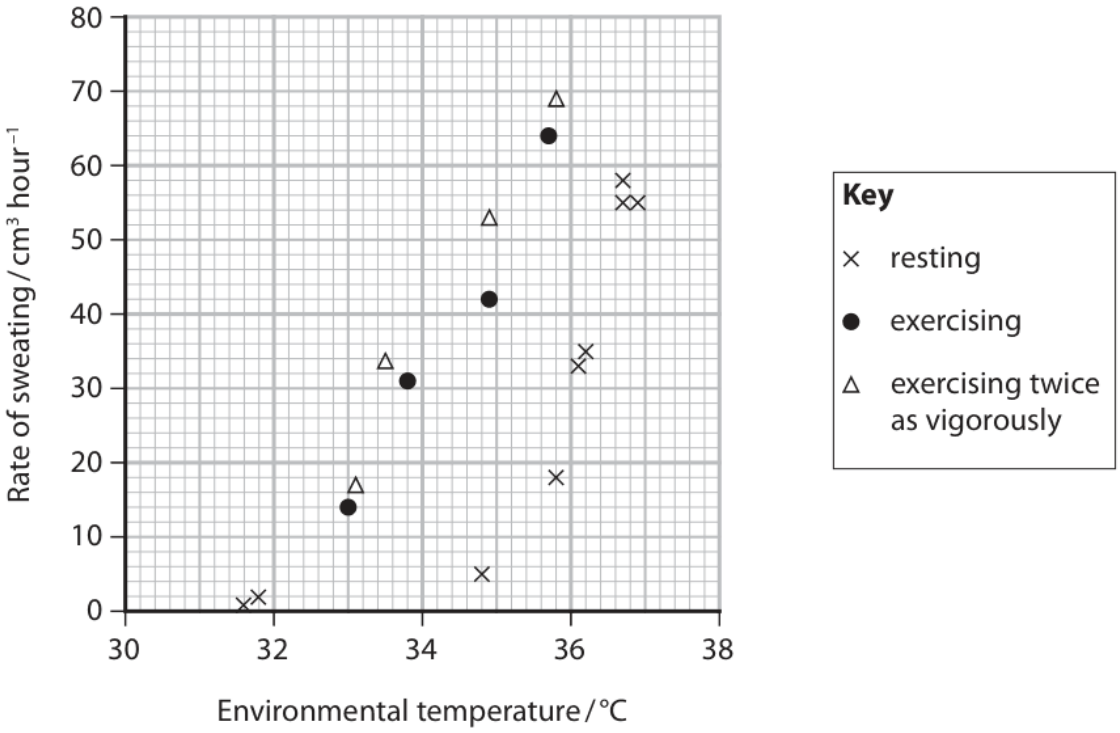
(a) Explain why water is a good solvent.

(2)

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4 The effect of environmental temperature and exercise on the rate of sweating was studied.

The graph shows the results for one person.



(a) Explain the importance of the dipole nature of water in sweating.

(2)

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Question 8 · AS Paper 1 · June 2017 · Q6(a) · 3 marks

6 Atherosclerosis is more likely to occur in arteries due to the higher blood pressure in these blood vessels.

(a) Explain how the structure of an artery wall is adapted both to withstand and to maintain high blood pressure.

(3)

Question 9 · AS Paper 1 · June 2022 · Q6(b)(i) · 2 marks

(b) The aorta of this frog contains a semilunar valve and elastic fibres.

(i) Explain the function of the semilunar valve in the aorta.

(2)

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Question 10 · AS Paper 1 · June 2022 · Q6(b)(ii) · 2 marks

(ii) Explain the function of the elastic fibres in the aorta.

(2)

Question 11 · A level Paper 2 · June 2022 · Q1(a)(i) · 2 marks

1 Blood from the lungs returns to the left side of the heart in the pulmonary vein. The pulmonary vein does not have valves.

(a) (i) Describe how the atrioventricular (AV) valves work during one cardiac cycle.

(2)

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Question 12 · A level Paper 2 · June 2022 · Q1(a)(ii) · 2 marks

(ii) The structure of the pulmonary vein is different from the structure of the pulmonary artery.
Explain how this difference is related to the function of the pulmonary vein.

(2)

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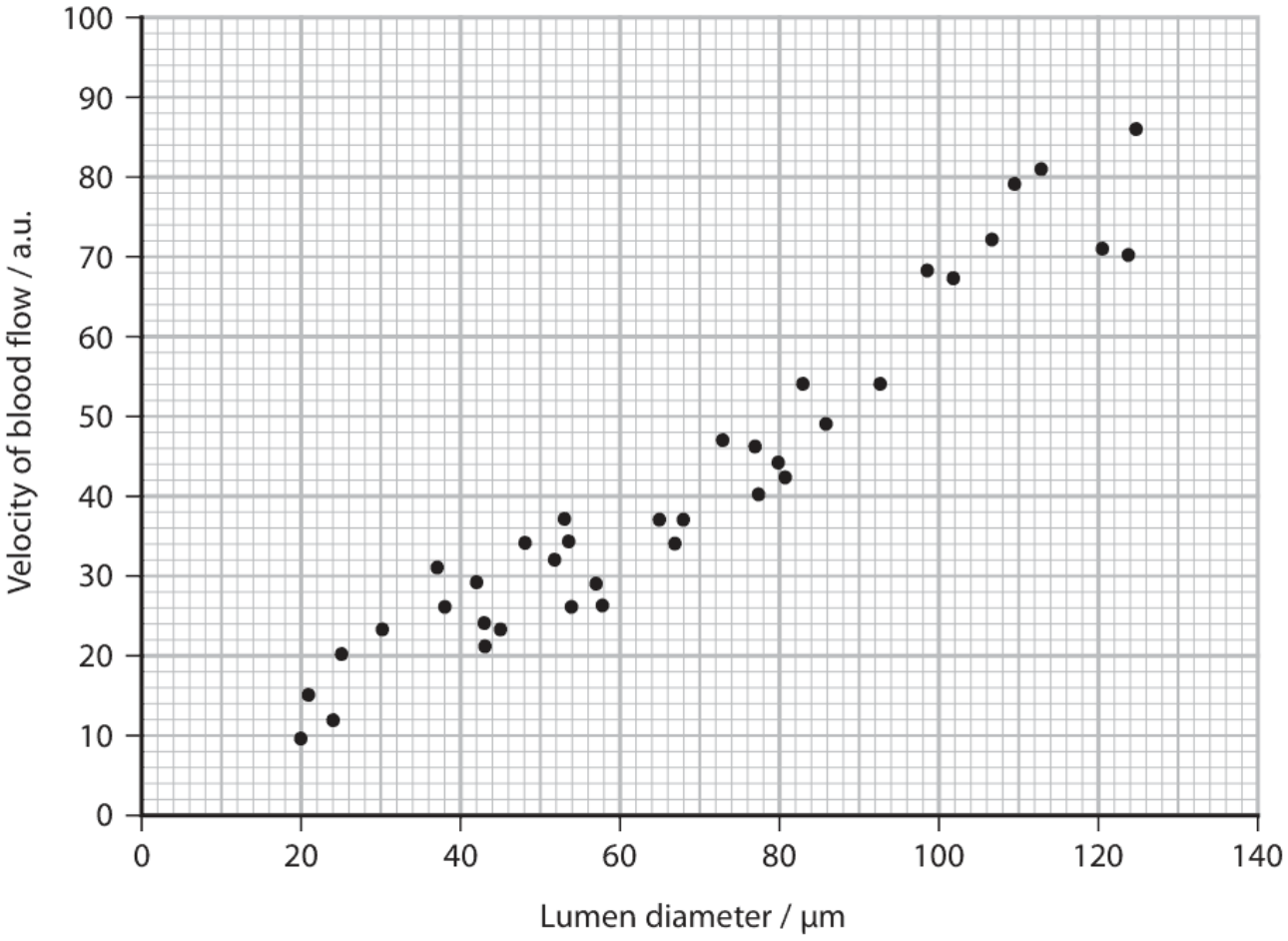
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Question 13 · information from earlier in the question

1 The diameter of the inside of a blood vessel (lumen diameter) affects the speed of blood flow.

The graph shows the relationship between the lumen diameter of blood vessels and the velocity of blood flow.



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Question 13 · A level Paper 3 · October 2020 · Q1(c) · 2 marks

(c) Explain the importance of the relationship, shown in the graph, to capillary function.

(2)

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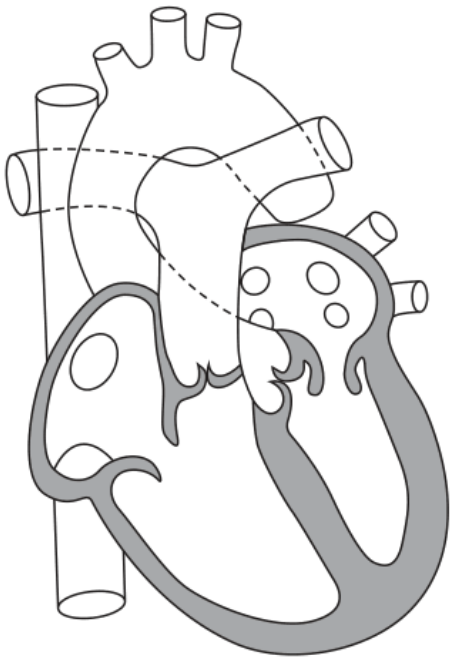
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Question 14 · AS Paper 1 · November 2021 · Q1(a)(i) · 2 marks

1 The diagram shows the internal structure of a human heart.



(a) (i) Draw arrows to show the route blood would take as it returns from the body, enters the heart and is then pumped to the lungs.

(2)

Question 15 · AS Paper 1 · November 2021 · Q1(a)(ii) · 1 mark

(ii) State which stage of the cardiac cycle is shown in the diagram.

(1)

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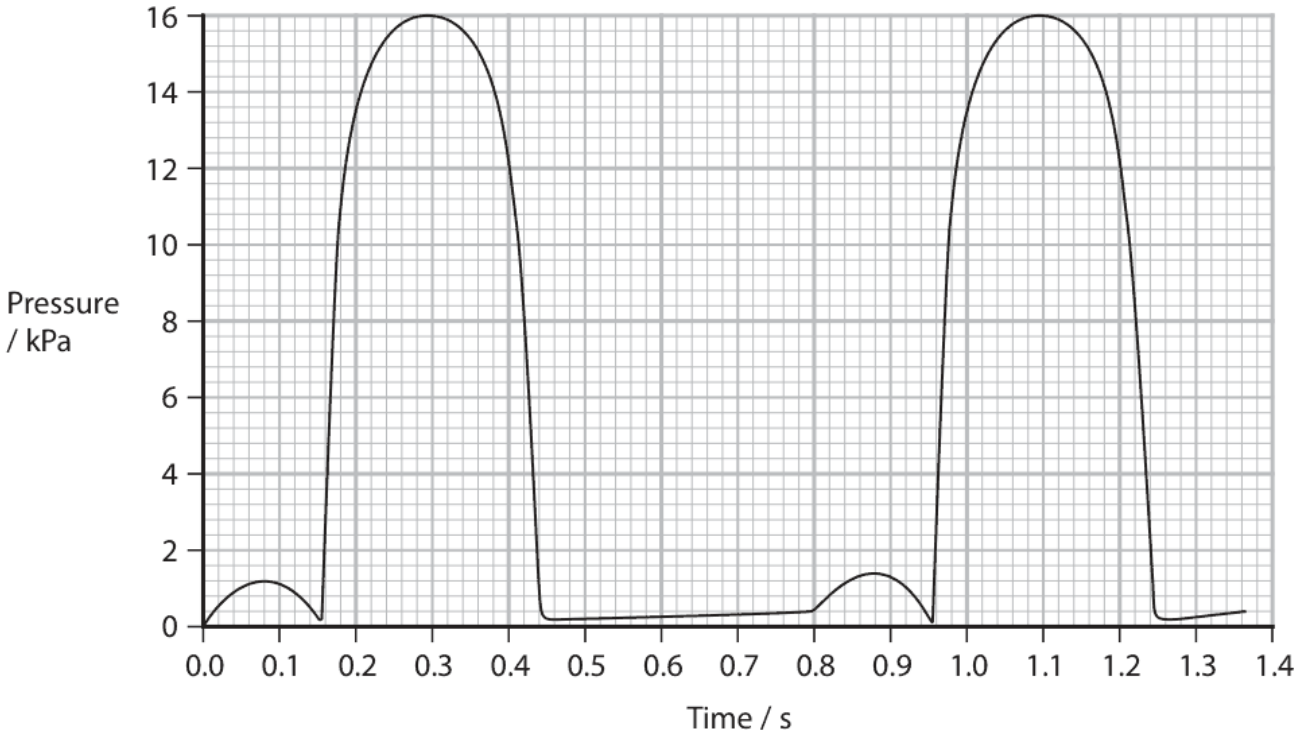
Question 16 · AS Paper 1 · June 2023 · Q2(a)(iii) · 2 marks

(iii) Describe what happens during diastole.

(2)

Question 17 · AS Paper 1 · June 2025 · Q5(a)(i) · 1 mark

5 The graph shows the pressure changes in the left ventricle of a human heart.



(a) (i) Draw a line on the graph to show the pressure changes in the **right** ventricle from 0.16 to 0.44 seconds.

(1)

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Question 18 · AS Paper 1 · June 2025 · Q5(a)(iv) · 4 marks

(iv) Explain what is causing the change in pressure in the left ventricle during the following time periods:

(4)

0.0 to 0.08 seconds

0.16 to 0.3 seconds

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Question 19 · A level Paper 2 · June 2017 · Q2(c) · 3 marks

(c) During the cardiac cycle there are pressure changes in the chambers of the heart.

Explain how pressure differences in the heart ensure efficient pumping of the blood into the arteries.

(3)

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Mark schemes

Question 1 · A level Paper 3 · June 2023 · Q1(a) · 2 marks

Question number	Answer
1(a)	An explanation that makes reference to two of the following: • to pump blood around blood vessels (1) • enabling mass transport (1) • therefore overcoming the limitations of diffusion (1)

Additional guidance	Mark
IGNORE to move blood IGNORE to move blood around the body ALLOW a description e.g. 'needed to carry oxygen to where it is used' e.g. 'organism is too large for {substances/gases/glucose} to diffuse directly to organs' / distance for diffusion is too great ALLOW surface area to volume ratio too small for diffusion	(2)

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Question 2 · AS Paper 1 · June 2025 · Q7(a) · 3 marks

Question Number	Answer
7(a)	An explanation that makes reference to the following: • {surface area to volume ratio is (too) small / diffusion distance (too) large} (to rely on diffusion alone) (1) • to transport {(sufficient) oxygen / substances} (to cells) (1) • for (aerobic) respiration / metabolic {reactions / demands of cells) (1)

Additional Guidance	Mark
ALLOW diffusion alone would be insufficient	(3)

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Question 3 · A level Paper 2 · November 2021 · Q4(a) · 4 marks

Question Number	Answer
4 (a)	An answer the makes reference to four of the following: • both have same volume (1) • animal A has a larger surface area (1) • animal A has a larger surface area to volume ratio (1) • so sufficient (surface area in animal A) for diffusion (1) • distance to cells in centre of A is shorter than for B allowing {quicker/sufficient} diffusion / shorter diffusion distance (in A) (1)

Additional guidance	Mark
ALLOW both have a volume of 64 mm^3 ALLOW converse ALLOW figures given (e.g. 168 mm^2 v 96 mm^2) or difference given as 72 mm^2 ALLOW {168:64 / 2.6:1} compared to {96:64 / 1.5:1} ALLOW converse ALLOW converse	

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Question 4 · AS Paper 1 · June 2024 · Q8(c)(i) · 3 marks

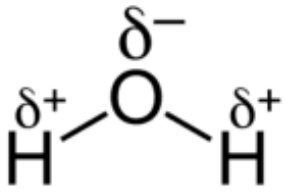
Question Number	Answer
8(c)(i)	An answer which makes reference to three of the following: <u>Similarities</u> • both contain heart and blood vessels (1) • both have a closed circulatory system (1) <u>Differences (max two)</u> • squid have {three hearts / two different types of heart / branchial and systemic hearts} whereas humans have one heart (1) • squid heart has {three chambers / one ventricle} whereas human heart has {four chambers / two ventricles} (1) • squid has single circulatory system (doesn't go through a heart twice) whereas human has double circulatory system (1)

Additional Guidance	Mark
Full marks can only be awarded if answer contains both similarities and differences. ALLOW named blood vessel ALLOW squid have more hearts (than humans)	**(3)**

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Question 5 · AS Paper 1 · June 2018 · Q2(a) · 2 marks

Question Number	Answer
2(a)	• correct symbol and charge on the oxygen atom (1) • correct symbol and charge on both hydrogen atoms (1)

Additional Guidance	Mark
e.g.  ALLOW one mark for all correct charges without symbols	(2)

Question 6 · AS Paper 1 · June 2017 · Q3(a) · 2 marks

Question Number	Answer
3(a)	An explanation which includes reference to two of the following: • description of water as a {polar / dipole / dipolar} molecule (1) • water surrounds (polar) molecules allowing them to dissolve (1) • hydrogen bonds form (1)

Additional Guidance	Mark
ALLOW correct description of uneven charges	(2)

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Question 7 · A level Paper 3 · June 2023 · Q4(a) · 2 marks

Question number	Answer
4(a)	An explanation that makes reference to two of the following: • dipole allows water molecules to {form hydrogen bonds / bond with each other} (1) • {heat / energy} is used to break bonds (between water molecules) (1) • evaporation of water causes {cooling / removal of heat} (1)

Additional guidance	Mark
IGNORE strength of bonds ALLOW high latent heat of evaporation / high latent heat of vaporisation ALLOW evaporative cooling ALLOW sweat for water	(2)

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Question 8 · AS Paper 1 · June 2017 · Q6(a) · 3 marks

Question Number	Answer
6 (a)	An explanation that makes reference to the following: • (more) collagen provides strength (to withstand pressure) (1) • (contraction of) muscle allows constriction (of lumen / artery) (1) • elastic fibres allow (stretch and) {recoil / lumen to return to original size} (1)

Additional Guidance	Mark
ALLOW narrowing of {lumen / artery}	(3)

Question 9 · AS Paper 1 · June 2022 · Q6(b)(i) · 2 marks

Question Number	Answer	Additional Guidance	Mark
6(b)(i)	An explanation that makes reference to two of the following: • opens as blood pumped into aorta (1) • valve closes {during diastole / start of diastole} (1) • prevents backflow of blood (from aorta back) into the (left) ventricle (1)	ALLOW opens to allow blood to flow into aorta	(2)

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Question 10 · AS Paper 1 · June 2022 · Q6(b)(ii) · 2 marks

Question Number	Answer
6(b)(ii)	An explanation that makes reference to the following: • allows stretch and recoil (of aorta) (1) • in order to maintain blood pressure (1)

Additional Guidance	Mark
ALLOW in order to prevent damage of aorta	(2)

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Question 11 · A level Paper 2 · June 2022 · Q1(a)(i) · 2 marks

Question Number	Answer
1(a)(i)	A description that makes reference to two of the following: • the valves are open { when atria contract / atrial systole / when blood pressure greater in atria (than ventricles) } (1) • the valves close { when ventricles contract / during ventricular systole/when pressure greater in ventricles (than atria) } (1) • valves prevent backflow of blood into the atria during ventricular systole (1)

Additional Guidance	Mark
ALLOW valves open to allow blood to flow from atria to ventricles ALLOW tendons prevent valves from inverting during ventricular systole	(2)

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Question 12 · A level Paper 2 · June 2022 · Q1(a)(ii) · 2 marks

1(a)(ii)	An explanation that makes reference to the following: • { larger lumen / less muscle (in walls) / thinner walls } (1) • explanation { larger lumen as blood pressure lower / less muscle because contraction not needed to push blood back to the heart } (1)

IGNORE valves

ALLOW thinner walls linked to lower blood pressure

(2)

Question 13 · A level Paper 3 · October 2020 · Q1(c) · 2 marks

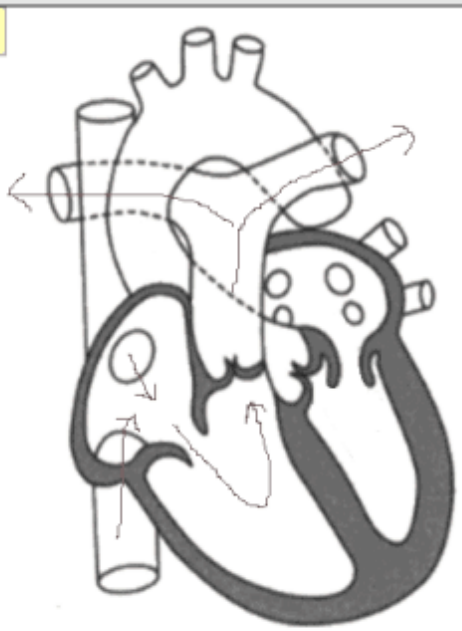
Question number	Answer
1(c)	An explanation that makes reference to the following: • capillary lumen diameter is small so blood flow will be slow (1) • allowing (time) for the {process of diffusion / exchange between blood and tissue fluid} (1)

Additional guidance	Mark
	(2)

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Question 14 · AS Paper 1 · November 2021 · Q1(a)(i) · 2 marks

Question Number	Answer
1 (a)(i)	An answer that makes reference to the following: • arrows on right hand side of heart only (1) • arrows enter heart through vena cava and leaves heart through pulmonary artery (1)

Additional Guidance	Mark
	(2)

Question 15 · AS Paper 1 · November 2021 · Q1(a)(ii) · 1 mark

Question Number	Answer	Additional Guidance	Mark
1 (a)(ii)	An answer that makes reference to the following: • atrial systole		(1)

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Question 16 · AS Paper 1 · June 2023 · Q2(a)(iii) · 2 marks

Question Number	Answer
2 (a)(iii)	An answer that makes reference to two of the following: • atria **and** ventricles relax (1) • blood enters the atria (1) • semilunar valves close / atrioventricular valves open (1)

Additional Guidance	Mark
ALLOW {cardiac / heart / myocardium} muscle {relaxes / no longer contracts} ALLOW atrium singular ALLOW pressure inside the {atria / ventricles} decreases	**(2)**

Question 17 · AS Paper 1 · June 2025 · Q5(a)(i) · 1 mark

Question Number	Answer	Additional Guidance	Mark
5(a)(i)	An answer that makes reference to the following: • line below that of left ventricle, but same shape, starting at 0.16 and ending at 0.44 (1)		**(1)**

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Question 18 · AS Paper 1 · June 2025 · Q5(a)(iv) · 4 marks

Question Number	Answer
5(a)(iv)	An explanation that makes reference to the following: 0.0 to 0.08 seconds: • blood is entering the ventricle (from the atrium) (1) • due to {contraction of (atrial cardiac) muscle wall / atrial systole} (1) 0.16 to 0.3 seconds: • volume of the (left) ventricle is decreasing (1) • (due to) contraction of (cardiac) muscle wall / ventricular systole (1)

Additional Guidance	Mark
IGNORE opening of AV valve ALLOW {blood is leaving ventricle / entering aorta} ignore blood is leaving the heart	**(4)**

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Question 19 · A level Paper 2 · June 2017 · Q2(c) · 3 marks

Question number	Answer
2(c)	An explanation that makes reference to three of the following points: • pressure increases in the ventricles (1) • greater pressure (in the ventricles) than in the { atria / arteries } (1) • causing atrioventricular valves to close (1) • causing the semilunar valves to open / forcing blood into the arteries (1)

Additional guidance	Mark
IGNORE reference to events during atrial systole	(3)

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