# The Heart and Circulation: AQA A Level Biology Exam Questions by Topi

14 questions · 32 marks · about 42 minutes. Answer in the spaces, then check the mark schemes at the end.

**Question 1 · AS Paper 1 · June 2018 · Q01.2 · 1 mark**

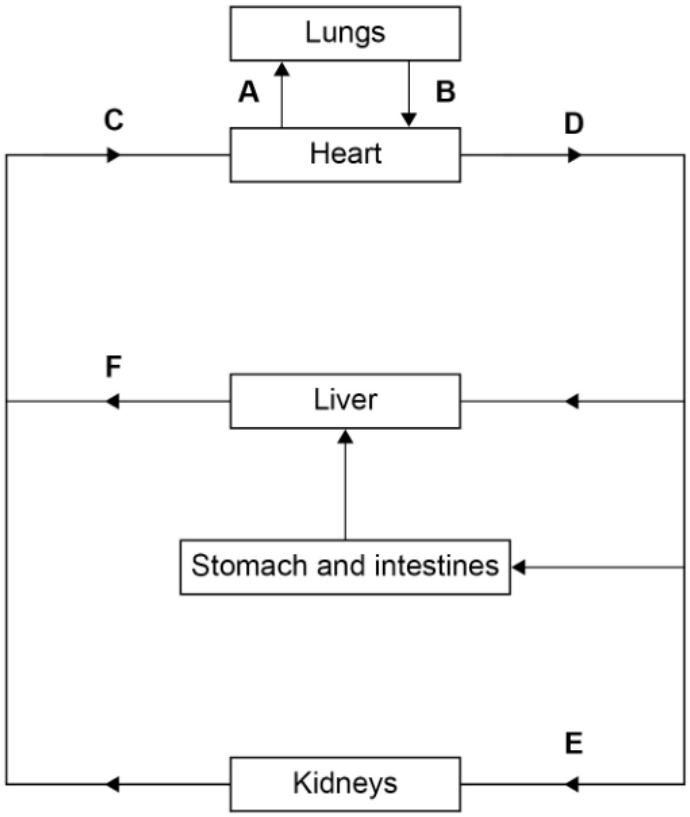
**0 1 . 2** Name the blood vessels that carry blood to the heart **muscle**.

**[1 mark]**

**Question 2 · AS Paper 2 · June 2025 · Q01.1 · 2 marks**

**0 1** **Figure 1** shows the arrangement of some of the blood vessels in a mammalian circulatory system.

**Figure 1**




**0 1 . 1** Name the blood vessels labelled **B** and **E** in **Figure 1**.

**[2 marks]**

**B** _____

**E** _____


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**Question 3 · A level Paper 1 · June 2025 · Q10.3 · 5 marks**

**1 0 . 3** Describe the pathway taken by blood between a kidney and the coronary arteries.

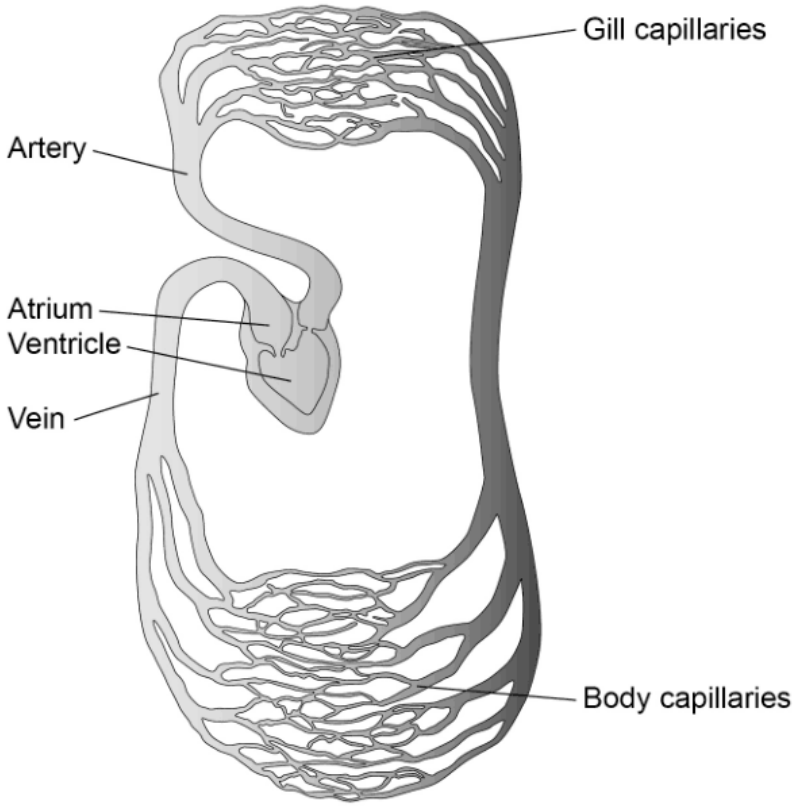
Include names of the major blood vessels (arteries and veins) **and** heart valves involved.

**[5 marks]**


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**Figure 12** shows the general pattern of blood circulation in fish.

**Figure 12**




**0 8 . 4** Use **Figure 12** to complete **Table 5** to show **two** differences between the circulation of blood in fish and the circulation of blood in a mammal.

**[2 marks]**

**Table 5**

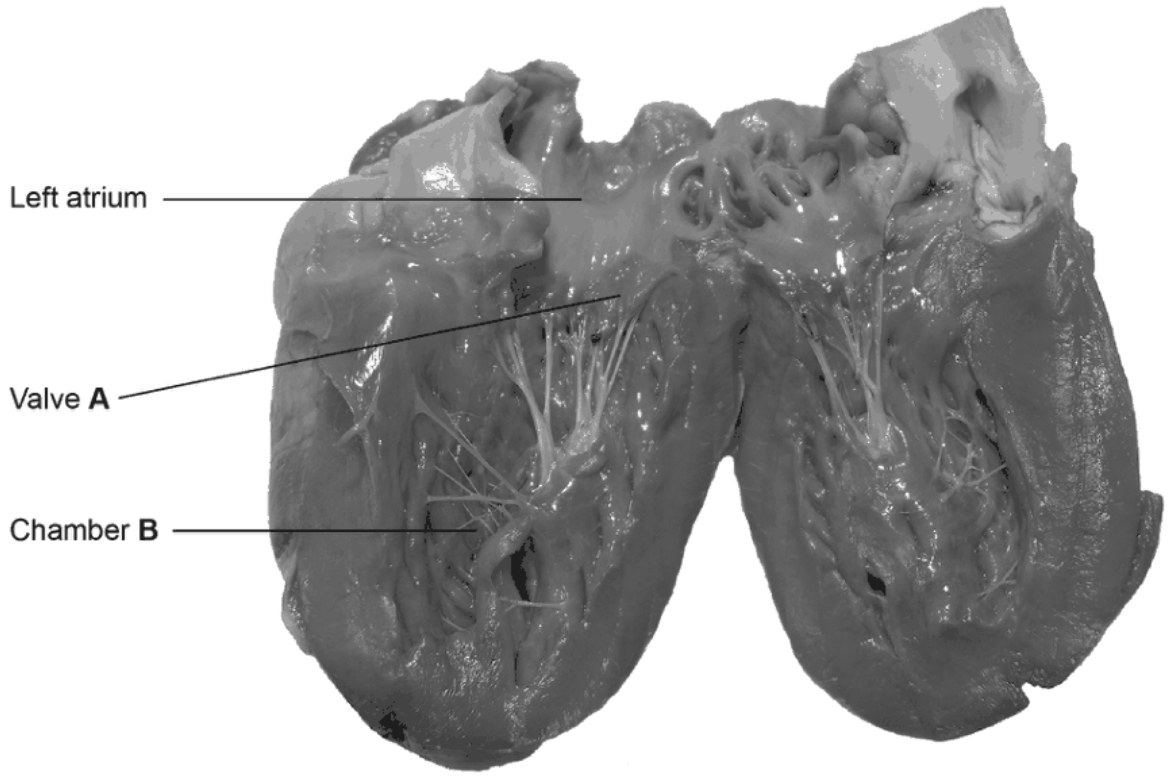
| Difference | Circulation of blood in fish | Circulation of blood in mammal |
|---|---|---|
| 1 | | |
| 2 | | |


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**Question 5 · information from earlier in the question**

0 3 **Figure 2** shows a photograph of a dissected heart.

**Figure 2**




**Question 5 · A level Paper 3 · June 2019 · Q03.3 · 2 marks**

0 3 . 3 Explain how valve **A** in **Figure 2** maintains a unidirectional flow of blood.

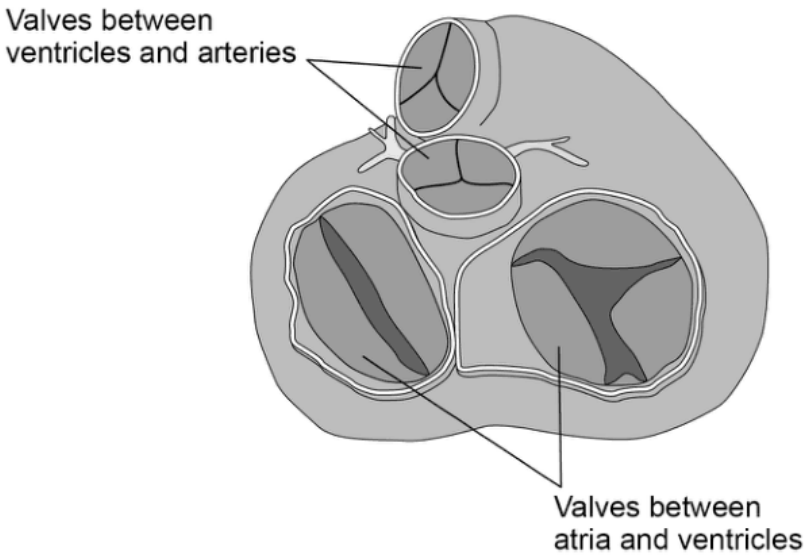
**[2 marks]**


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**Figure 1** shows heart valves during one stage of a cardiac cycle.

Ventricles are visible through the open valves.

**Figure 1**




**0 3 . 2** What can you conclude from the appearance of valves in **Figure 1** about heart muscle activity and blood movement between:

1. ventricles and arteries?

**[2 marks]**

2. atria and ventricles?

**[2 marks]**


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**Question 7 · AS Paper 2 · June 2024 · Q07.5 · 2 marks**

**0 7 . 5** A ventricular septal defect (VSD) is a common feature of Edwards' syndrome.

A VSD is a hole in the wall between the two ventricles of the heart. A VSD can cause higher blood pressure in the lungs.

Explain how a VSD can cause higher blood pressure in the lungs.

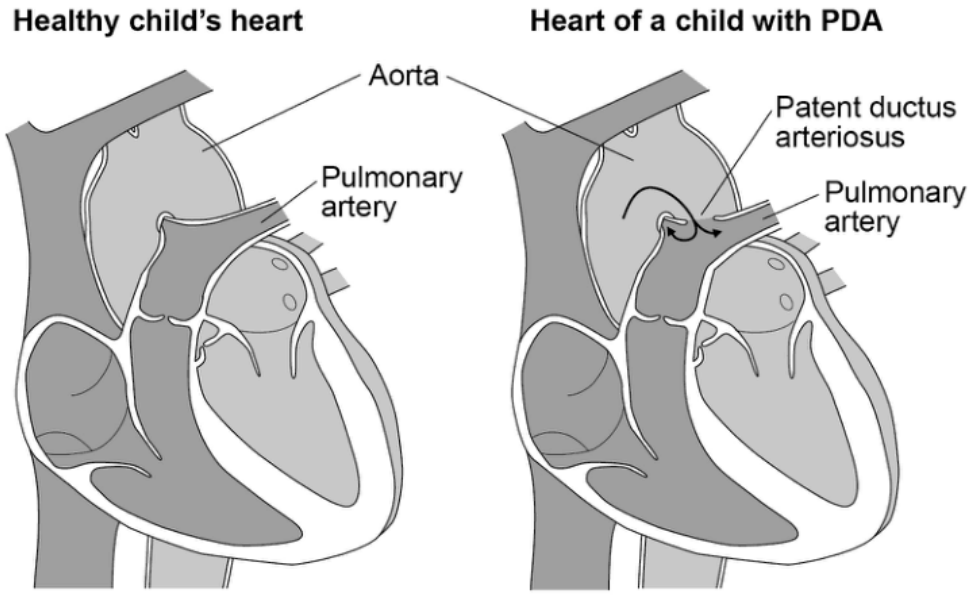
**[2 marks]**


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Most children born with Patau syndrome die in the first 12 months, often due to defects of circulation of blood.

One of these defects is patent ductus arteriosus (PDA). This can result in some of the blood flowing between the aorta and the pulmonary artery.
**Figure 9** shows a healthy child's heart and the heart of a child with PDA.

**Figure 9**




**0 8 . 4** Suggest how the flow of some of the blood between the aorta and pulmonary artery could cause children to die in the first 12 months.

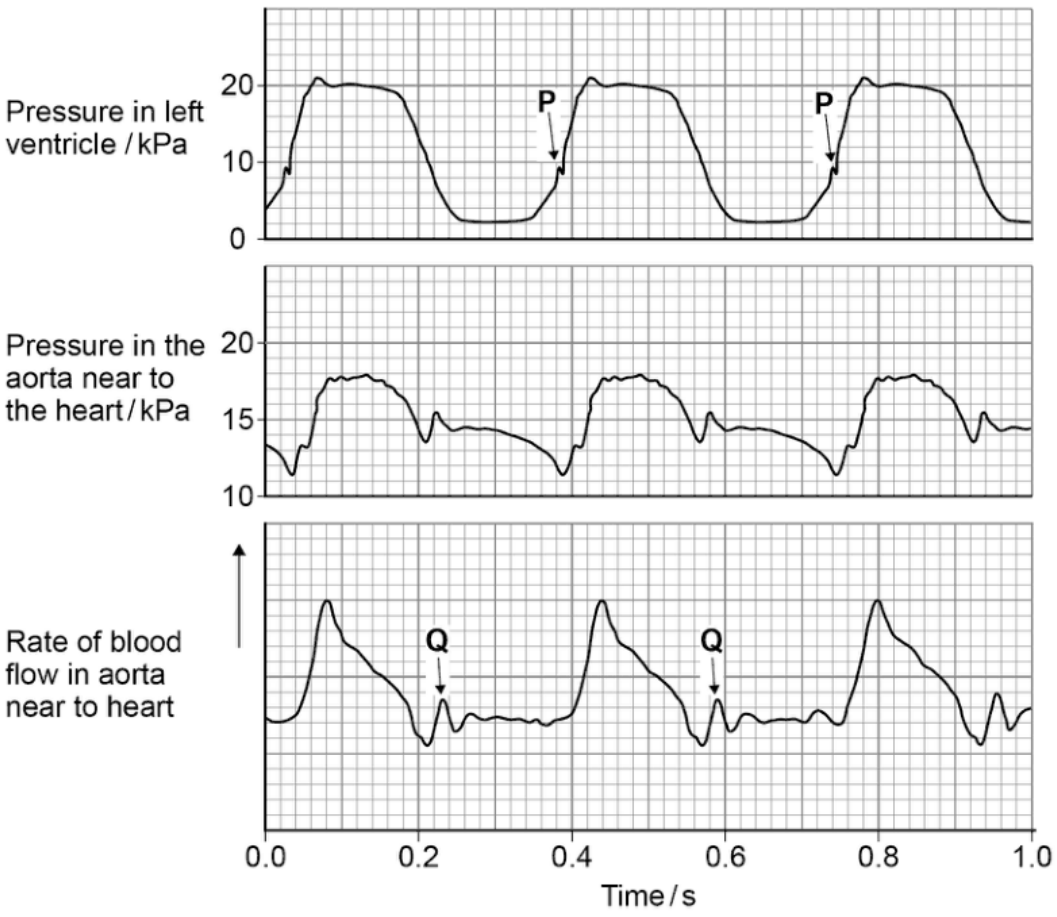
**[3 marks]**

**[Extra space]**


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**0 3** **Figure 3** shows pressure and blood flow during the cardiac cycle in a dog.

**Figure 3**




**0 3 . 1** At **P** on **Figure 3**, the pressure in the left ventricle is increasing. At this time, the rate of blood flow has not yet started to increase in the aorta.

Use evidence from **Figure 3** to explain why.

**[2 marks]**


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**Question 10 · A level Paper 1 · November 2020 · Q03.3 · 2 marks**

**0 3 . 3** A student correctly plotted the right ventricle pressure on the same grid as the left ventricle pressure in **Figure 3**.

Describe **one** way in which the student's curve would be similar to and **one** way it would be different from the curve shown in **Figure 3**.

**[2 marks]**

Similarity _____

_____

_____

_____

Difference _____

_____

_____

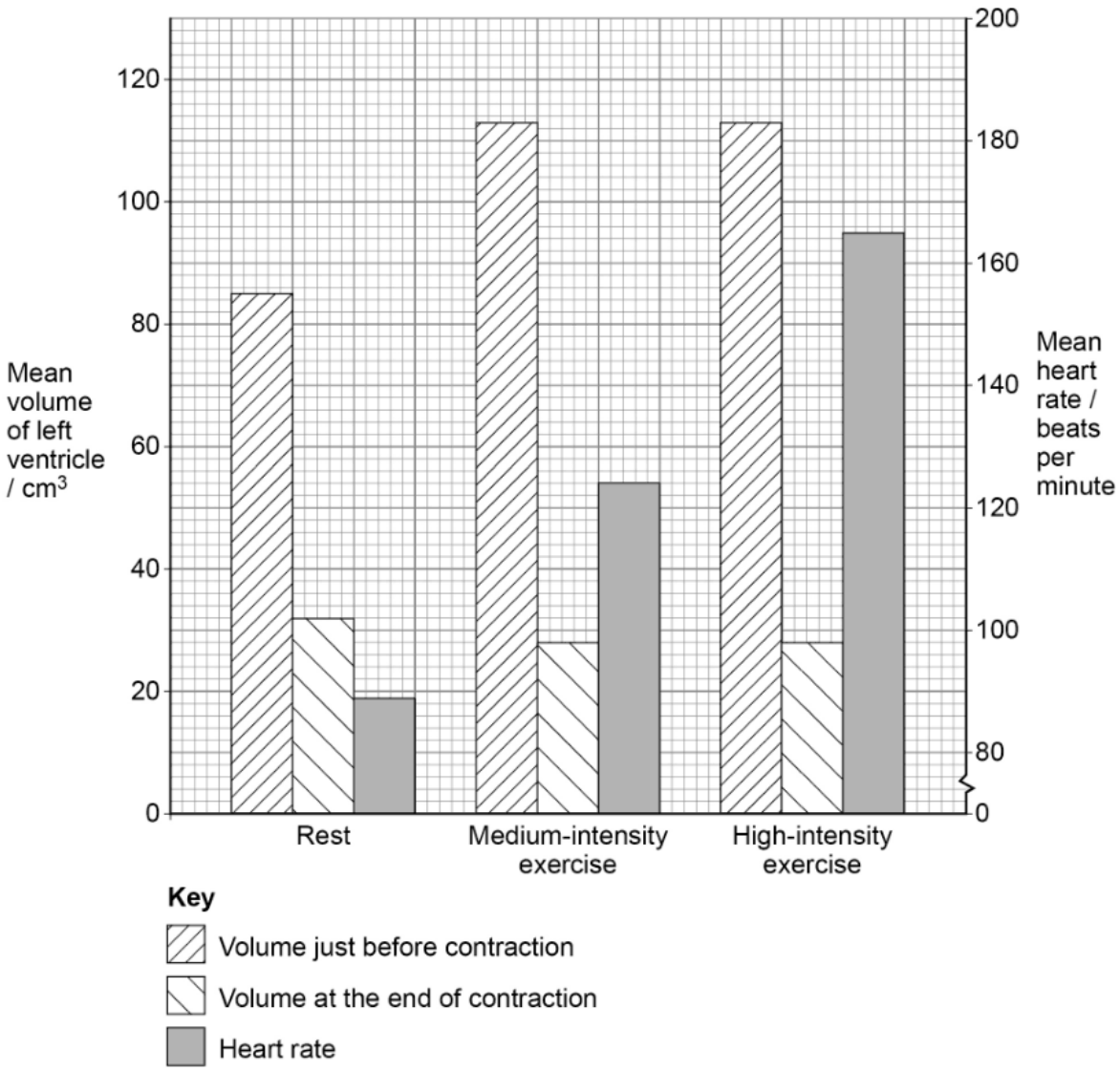
_____


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**0 4 . 2** Scientists investigated the heart activity of humans at rest, during medium-intensity exercise and during high-intensity exercise.

**Figure 2** shows the scientists' results.

**Figure 2**




Stroke volume = volume of blood leaving a ventricle with each contraction
Cardiac output = stroke volume × heart rate

Use all the information to describe what causes the increase in cardiac output:

- from rest to medium-intensity exercise
- from medium-intensity exercise to high-intensity exercise.

You do **not** need to calculate cardiac output to answer this question.

**[2 marks]**

Rest to medium-intensity exercise

**Question 12 · information from earlier in the question**

**0 9** **Table 1** shows the volume of blood in a woman's left ventricle at different times during **one** second.

**Table 1**

| Time / seconds | Volume of blood in left ventricle / $cm^3$ |
|---|---|
| 0.0 | 112 |
| 0.1 | 120 |
| 0.2 | 95 |
| 0.3 | 65 |
| 0.4 | 50 |
| 0.5 | 55 |
| 0.6 | 82 |
| 0.7 | 90 |
| 0.8 | 100 |
| 0.9 | 112 |
| 1.0 | 120 |

**Question 12 · AS Paper 2 · June 2016 · Q09.2 · 1 mark**

**0 9 . 2** The stroke volume is the volume of blood pumped out of the left ventricle during one cardiac cycle.

Use **Table 1** to determine the stroke volume.

**[1 mark]**

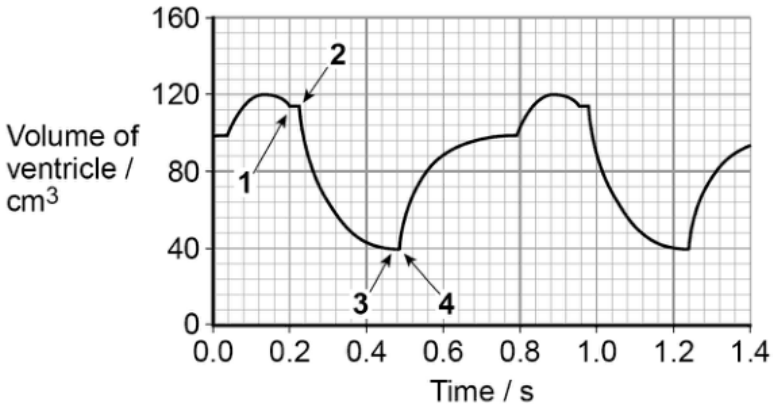
Stroke volume = _____ $cm^3$


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**Question 13 · information from earlier in the question**

0 4 **Figure 3** shows the volume changes in the left ventricle of a human heart during two cardiac cycles. The numbers **1**, **2**, **3** and **4** represent times when heart valves open or close.

**Figure 3**




**Question 13 · AS Paper 1 · June 2017 · Q04.2 · 2 marks**

0 4 . 2 Use **Figure 3** to calculate the volume of blood pumped per minute by the left ventricle.

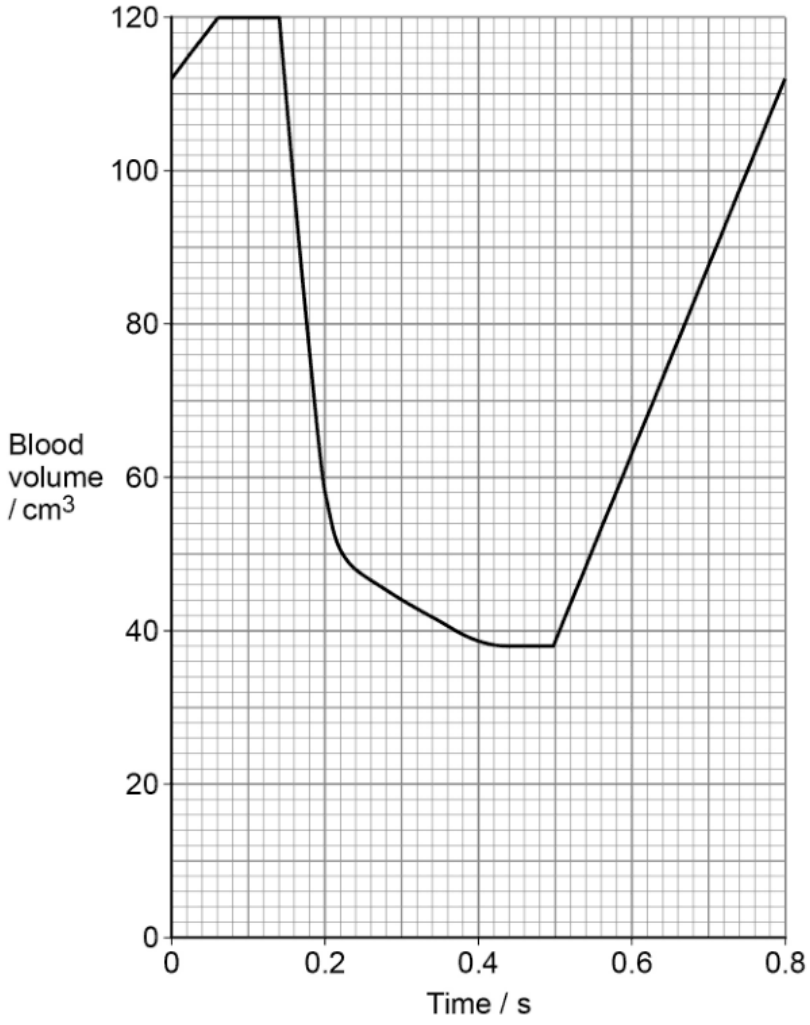
**[2 marks]**

Answer = _____ $cm^3 min^{-1}$


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**0 6 . 2** A scientist measured the changes in blood volume inside the left ventricle of a mammalian heart during one heartbeat. **Figure 5** shows her results.

**Figure 5**




Use **Figure 5** to calculate the total volume of blood pumped from the left ventricle in 1 minute.

**[2 marks]**

Answer _____ cm³


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## Mark schemes

**Question 1 · AS Paper 1 · June 2018 · Q01.2 · 1 mark**

| | | | |
|---|---|---|---|
| **01.2** | Coronary arteries; | 1 | Accept coronary artery<br><br>Ignore aorta, arteriole and capillary<br><br>Reject coronary veins<br><br>Do not accept coronary by itself<br><br>Accept phonetic spelling |

**Question 2 · AS Paper 2 · June 2025 · Q01.1 · 2 marks**

| | | |
|---|---|---|
| **01.1** | B – Pulmonary vein;<br><br>E – Renal artery; | 2<br>(2 x AO1) |


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| | | |
|---|---|---|
| **10.3** | 1. Renal vein (to) vena cava (to) right atrium;<br>2. (Via) atrio-ventricular valve (to) right ventricle;<br>3. (Via) semi-lunar valve (to) pulmonary artery (to) pulmonary vein;<br>4. Left atrium (via) atrio-ventricular valve (to) left ventricle;<br>5. (Via) semi-lunar valve (to) aorta to coronary artery; | 5 (5 x AO1) |

2. Accept tricuspid valve

2 and 4 Penalise using 'AV valve' for atrio-ventricular valve only once

3. Accept pulmonary valve for 'semi-lunar valve

4. Accept bicuspid/mitral valve

5. Accept aortic valve for 'semi-lunar valve


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| | | | |
|---|---|---|---|
| **08.4** | 1 mark for each correct row | 2 max (2 x AO2) | 3 and 4 Accept name of relevant blood vessels eg aorta, pulmonary artery/vein, vena cava<br><br>5 Accept descriptions of single circulation and double circulation<br><br>5 Accept 'system' for circulatory system |

| Difference | Circulation of blood in fish | Circulation of blood in mammal; |
|---|---|---|
| **1** | 2 chambers **OR** 1 ventricle **OR** 1 atrium **OR** 2 valves | 4 chambers **OR** 2 ventricles **OR** 2 atria **OR** 4 valves; |
| **2** | Blood does not return to heart after being oxygenated **OR** Blood does not return to heart after passing through gills **OR** Heart contains deoxygenated blood | Blood returns to heart after being oxygenated **OR** Blood returns to heart after passing through lungs **OR** Heart contains oxygenated and deoxygenated blood; |
| **3** | One vein (carrying blood towards the heart) | Two veins (carrying blood towards heart) |
| **4** | One artery (carrying blood away) | Two arteries (carrying blood away) |
| **5** | Single circulation | Double circulation; |
| **6** | Blood reaching body capillaries at low(er) | Blood reaching body capillaries at high(er) |


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**Question 5 · A level Paper 3 · June 2019 · Q03.3 · 2 marks**

| | | | |
|---|---|---|---|
| 03.3 | 1. Pressure in (left) atrium is higher than in ventricle/**B causing** valve to open;<br>**OR**<br>(When) pressure above valve is higher than below valve it opens;<br><br>2. Pressure in (left) ventricle/**B** is higher than in atrium **causing** valve to close;<br>**OR**<br>(When) pressure in below valve is higher than above valve it closes; | 2 | 1. and 2. Ignore pressure in front of/behind valve<br>1. and 2. As long as direction of opening/closing of valve is correct, ignore 'semi lunar'<br>2. Accept cords/tendons prevent valve turning inside out |

**Question 6 · AS Paper 2 · November 2020 · Q03.2 · 4 marks**

| | | | |
|---|---|---|---|
| 03.2 | (Ventricles and arteries)<br>1. Ventricle (muscles) relaxed<br>**OR**<br>Arteries recoiled;<br>2. No (blood) backflow (into ventricles)<br>**OR**<br>No blood movement to/in/from arteries;<br>(Atria and ventricles)<br>3. Atria (muscle) contracted;<br>4. Blood movement from atria (into ventricles); | 4 | Accept references to ventricle, artery or atrium (singular)<br>1. Accept no muscle activity<br>**OR**<br>Diastole<br>**OR**<br>Arteries smoothing blood flow<br>2. and 4. Accept flow/pumped for movement |

**Question 7 · AS Paper 2 · June 2024 · Q07.5 · 2 marks**

| | | |
|---|---|---|
| 07.5 | 1. (More) blood moves from left to right ventricle (as left ventricle has thicker muscle);<br>2. Greater volume of blood to lungs<br><br>**OR**<br>(Higher blood pressure) in pulmonary artery; | 2<br>(2 x AO2) |


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**Question 8 · AS Paper 2 · June 2017 · Q08.4 · 3 marks**

| | | |
|---|---|---|
| **08.4** | 1. (Some) oxygenated blood (from the aorta) flows into pulmonary artery;<br>OR<br>Less oxygenated blood flows out through aorta;<br>OR<br>Lower blood pressure in aorta;<br>2. Less oxygen delivered to cells / tissues / organs / named organ / via named blood vessel;<br>3. So less/not enough oxygen for <u>aerobic</u> respiration (in cell/ tissue/organ);<br>4. Tissue/organ doesn't grow/develop properly (causing death);<br>OR<br>Tissue dies/organ stops working (causing death); | 3 max |

1. Accept mixing of deoxygenated with oxygenated blood in pulmonary artery

2. Do not accept "no oxygen"

3. Do not accept "produce energy"


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**Question 9 · A level Paper 1 · November 2020 · Q03.1 · 2 marks**

| | | | |
|---|---|---|---|
| **03.1** | 1. Aortic/semi-lunar valves is closed;<br>2. Because pressure in aorta higher than in ventricle; | 2 | 1. Accept 'aorta valve' or 'valve to the aorta' or 'valve between the aorta and the ventricle'.<br>1. Do not accept S-L/A-V valve.<br>2. Accept 9-10kPa in ventricle and 13kPa in aorta.<br>2. Ignore incorrect figures. |

**Question 10 · A level Paper 1 · November 2020 · Q03.3 · 2 marks**

| | | | |
|---|---|---|---|
| **03.3** | 1. Peaks/contractions at the same/similar time<br>OR<br>Same/similar pattern;<br>2. Lower pressure; | 2 | Mark the answer as a whole.<br>1. Accept 'shape (of curve)' for 'pattern'. |


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**Question 11 · AS Paper 2 · June 2023 · Q04.2 · 2 marks**

| | |
|---|---|
| **04.2** | 1. (Rest to medium-intensity exercise) Increased stroke volume **and** increased heart rate;<br>2. (Medium-intensity exercise to high-intensity exercise) Increased heart rate; |

| | |
|---|---|
| 2<br>(2 x AO2) | 1. Accept description of increased stroke volume<br>2. Reject reference to increase stroke volume here.<br>1. and 2. Ignore figures. |

**Question 12 · AS Paper 2 · June 2016 · Q09.2 · 1 mark**

| | | |
|---|---|---|
| 09.2 | 70; | 1 |


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**Question 13 · AS Paper 1 · June 2017 · Q04.2 · 2 marks**

| | | | |
|---|---|---|---|
| **04.2** | (Acceptable range is) 6315.79 to 6400;; | 2 | Allow one mark for<br>(SV = 120 – 40 =) 80 ($cm^3$)<br>OR<br>(1 cycle = 1.24 – 0.48 =) 0.76 (s)<br>OR<br>79 / 80 (beats $minute^{-1}$) |

**Question 14 · AS Paper 2 · June 2022 · Q06.2 · 2 marks**

| | | |
|---|---|---|
| **06.2** | Accept for 2 marks, 6150;;<br>Accept for 1 mark,<br>82 (correct blood volume pumped in one heartbeat)<br>**OR**<br>Evidence of 120 and 38 (correct readings from graph)<br>**OR**<br>75 (correct heart rate, bpm)<br>**OR**<br>e.c.f. from graph, e.g. 120 – 40 = 80 and<br>80 × 75 = 6000; | 2<br>(2 x AO2) |


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