



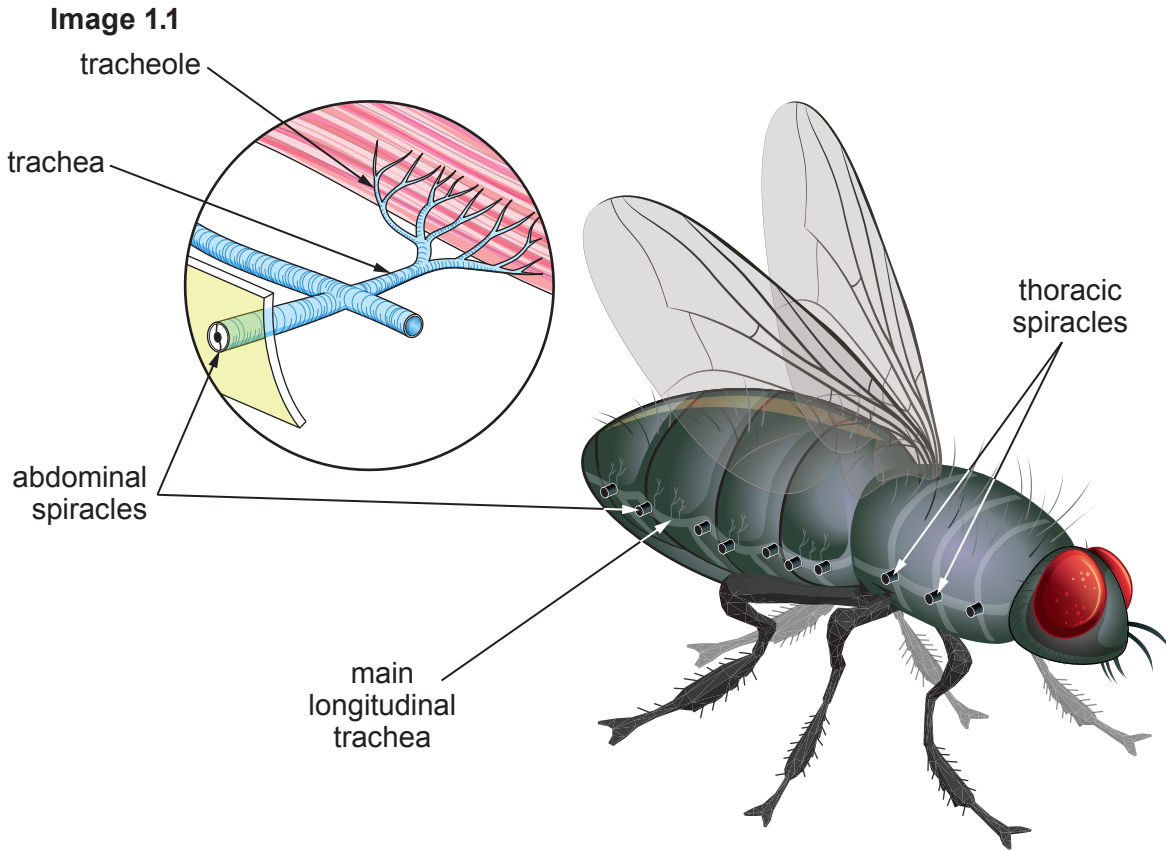
GCE AS Level Biology

S21-B400U20-1

Assessment Resource 12

Biodiversity and Physiology of Body Systems Resource F

1. The tracheal system, as shown in **image 1.1**, is the site of gas exchange in insects.



(a) (i) State precisely where gas exchange takes place in the tracheal system. [1]

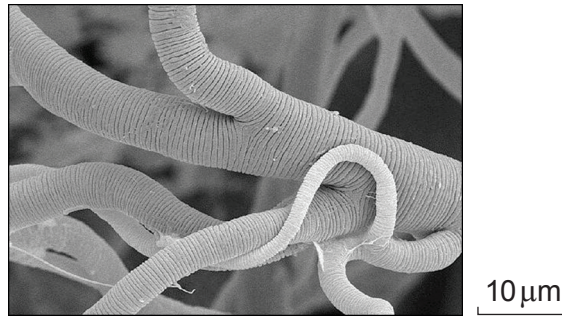
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(ii) One problem facing terrestrial animals like insects is water loss. State **two** adaptations of the insect tracheal system to reduce water loss. [2]

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- (iii) **Image 1.2** is an electron photomicrograph which shows the detail of the insect tracheae.

Image 1.2



Use the scale bar in **image 1.2** to calculate the magnification of the photomicrograph.

[2]

Magnification = \times

- (b) In the experiment shown in **image 1.3**, a grasshopper was placed in a gas syringe. Its abdomen was observed and the number of abdominal movements per minute was counted for three consecutive minutes. The student then exhaled one breath gently into the syringe through the plastic tubing and the number of abdominal movements was counted again in the same way. The experiment was repeated using two, three and four exhalations. The results are shown in **table 1.4**.

Image 1.3

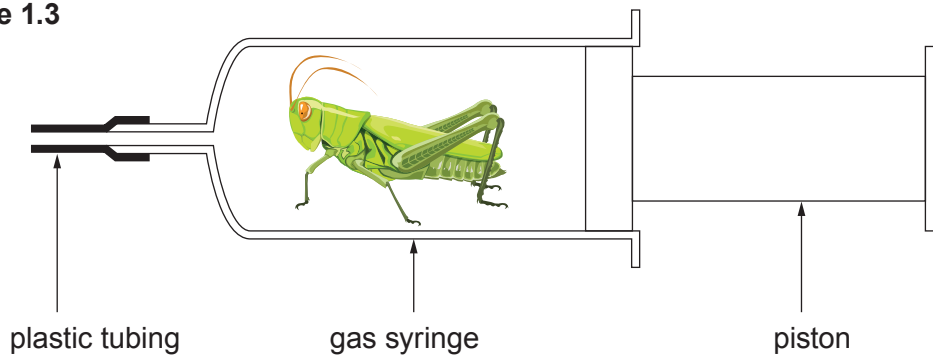


Table 1.4

Number of exhalations	Number of abdomen movements per min			
	Minute 1	Minute 2	Minute 3	Mean
0	47	43	50	47
1	64	66	62	64
2	89	89	91	90
3	103	99	106	103
4	104	106	105	105

- (i) State **two** factors that would need to be controlled during the experiment.

[2]

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(ii) Explain how abdominal movements are linked to ventilation in the insect. [2]

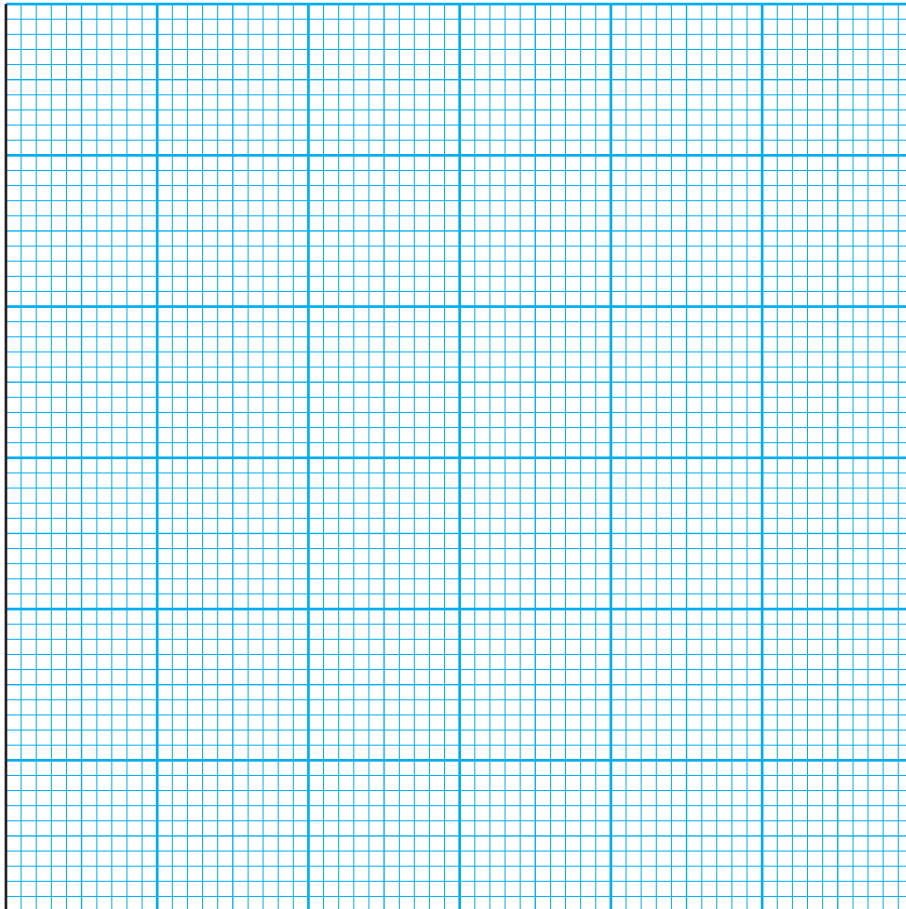
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(iii) Plot the mean data from the experiment as a **bar graph** on the graph paper below [2]



(iv) Describe and explain the trend shown by the data. [4]

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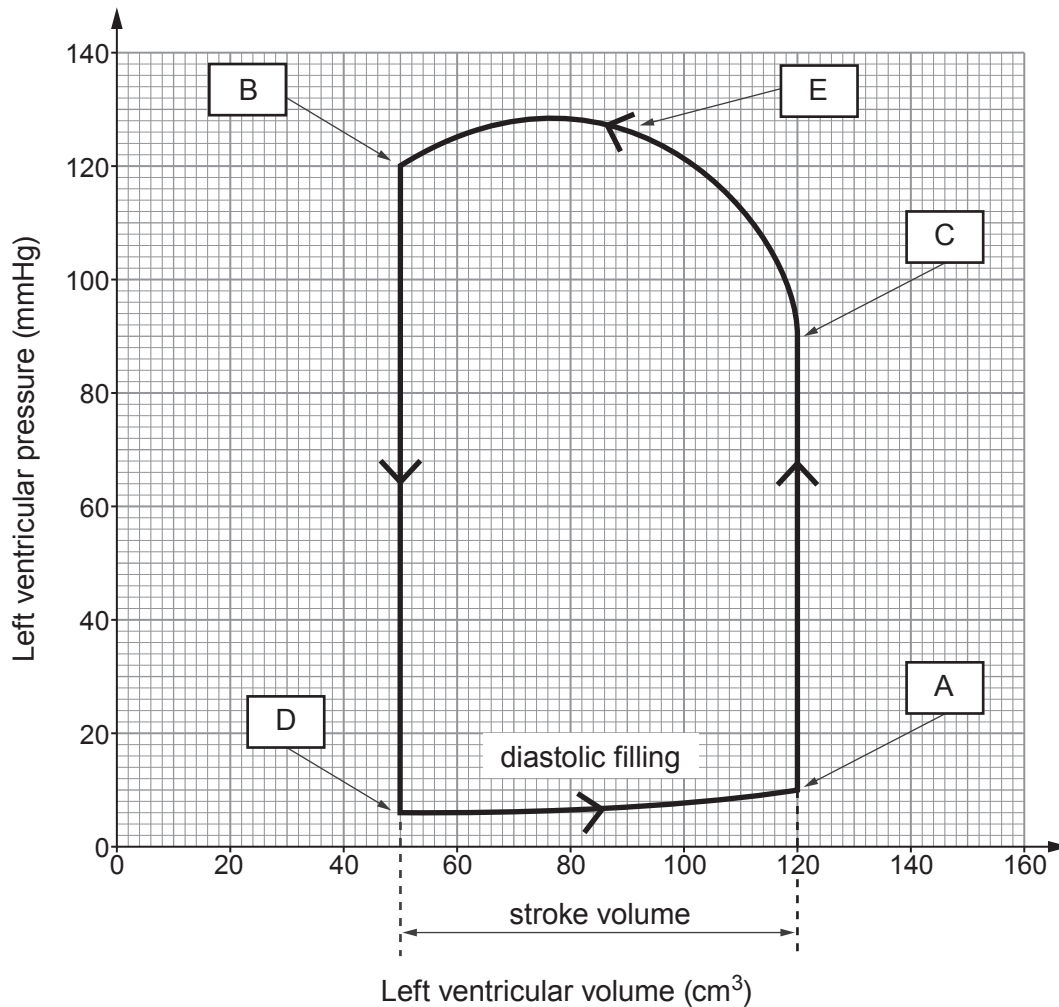
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2. **Graph 2.1** shows how pressure and volume change in the left ventricle during the cardiac cycle in mammals. This is known as a pressure-volume loop. The arrows represent the sequence of these changes during one cardiac cycle. The diagram also shows the stroke volume (SV), which is the volume of blood pumped from the left ventricle during each contraction.

Graph 2.1



- (a) (i) Using **graph 2.1**, determine which letter(s) fits the statements in **table 2.2**. The letters can be used, once, more than once or not at [4]

all. **Table 2.2**

Statement	Letter(s)
Atrio-ventricular valve closes	
Left ventricle is relaxed	
Left ventricle pressure is greater than in the aorta	
Semi-lunar valves close	

- (ii) A patient has a heart rate (HR) of 80 beats per minute. Using the information from **graph 2.1** and the following formula, **calculate their cardiac output in $\text{cm}^3 \text{min}^{-1}$** .

$$\text{Cardiac output (CO)} = \text{HR} \times \text{SV} \quad [2]$$

Cardiac output = $\text{cm}^3 \text{min}^{-1}$

- (b) (i) Name the structures which ensure that the atrio-ventricular valves only open in one direction. [1]

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- (ii) Explain why blood only flows into the aorta and nowhere else when the left ventricle contracts. [3]

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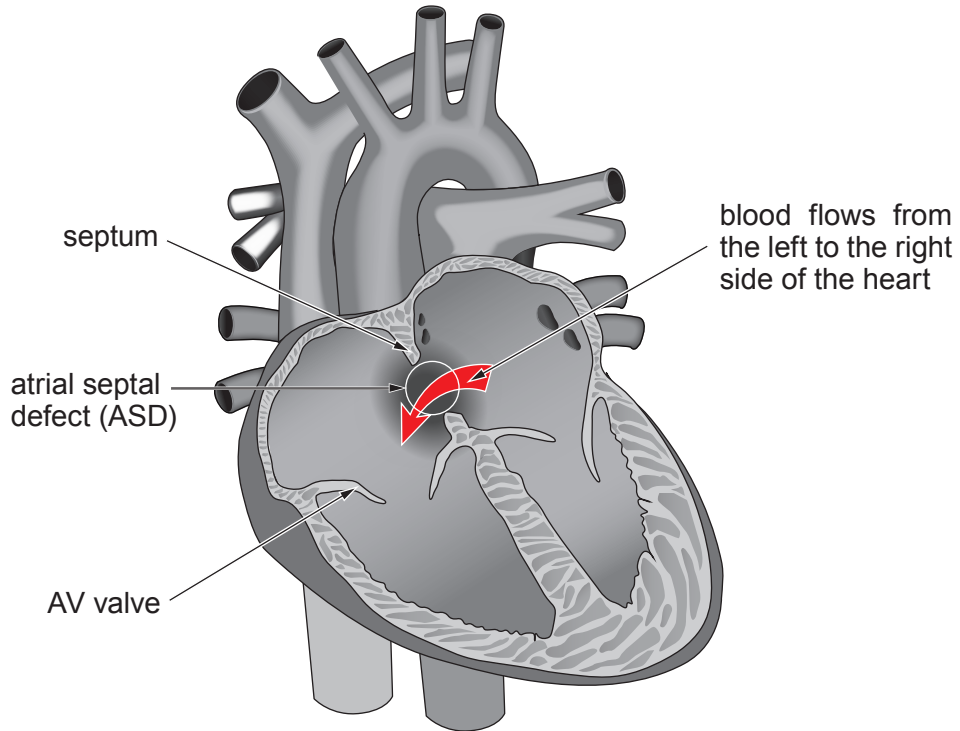
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- (c) **Image 2.3** shows a condition called atrial septal defect in the heart of a child. The septum of the atria has a hole which allows blood to flow from the left atrium to the right atrium.

Image 2.3



- (i) Using **image 2.3** and your own knowledge of the cardiac cycle, explain how the defect shown could result in tiredness and a lack of energy. [4]

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- (ii) Suggest why the atrial septal defect could reduce the stroke volume of the child. [1]

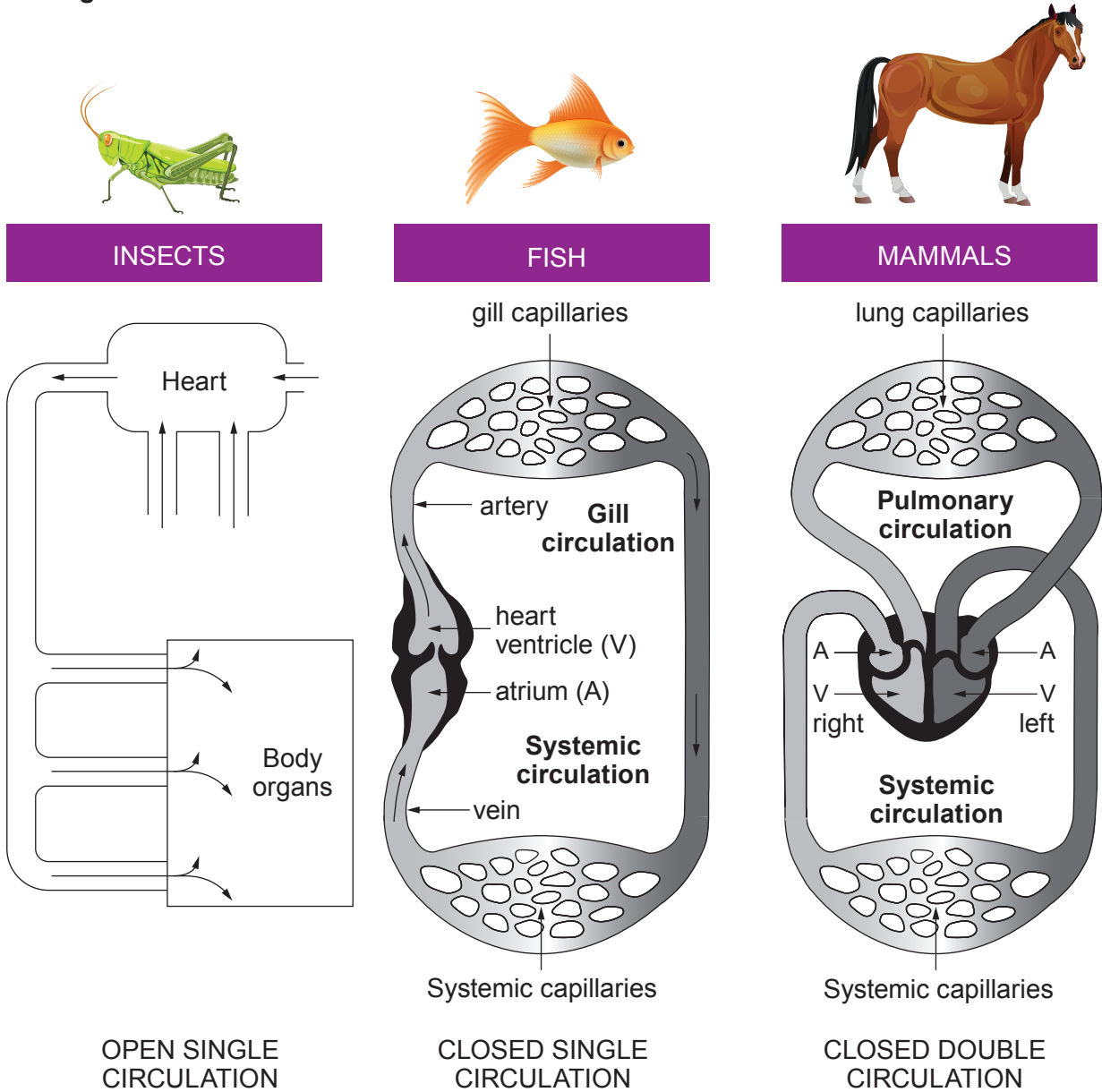
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3. Circulatory systems in animals have evolved in different ways.

Image 3.1 shows organisms which have different arrangements of their circulatory systems.

Image 3.1



Explain the similarities and differences between the circulatory systems shown in the diagrams.

Outline the advantages and disadvantages of the single and double circulatory systems.

[9 QER]

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