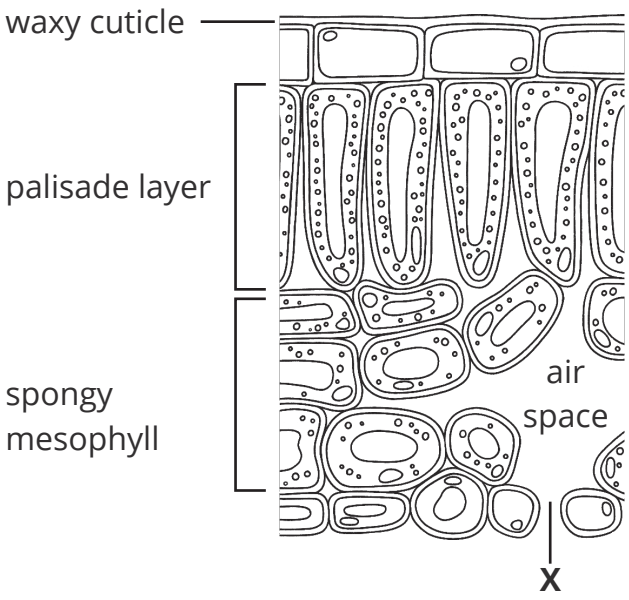
0 1 **Figure 1** shows a cross section of a plant leaf.

Figure 1



0 1 . 1 Name the opening labelled **X** into which gases can diffuse.

[1 mark]

0 1 . 2 Name the process that takes place in the palisade cells using carbon dioxide from the air.

[1 mark]

0 1 . 3 Explain how the air spaces in the spongy mesophyll layer increase the rate of diffusion through the leaf.

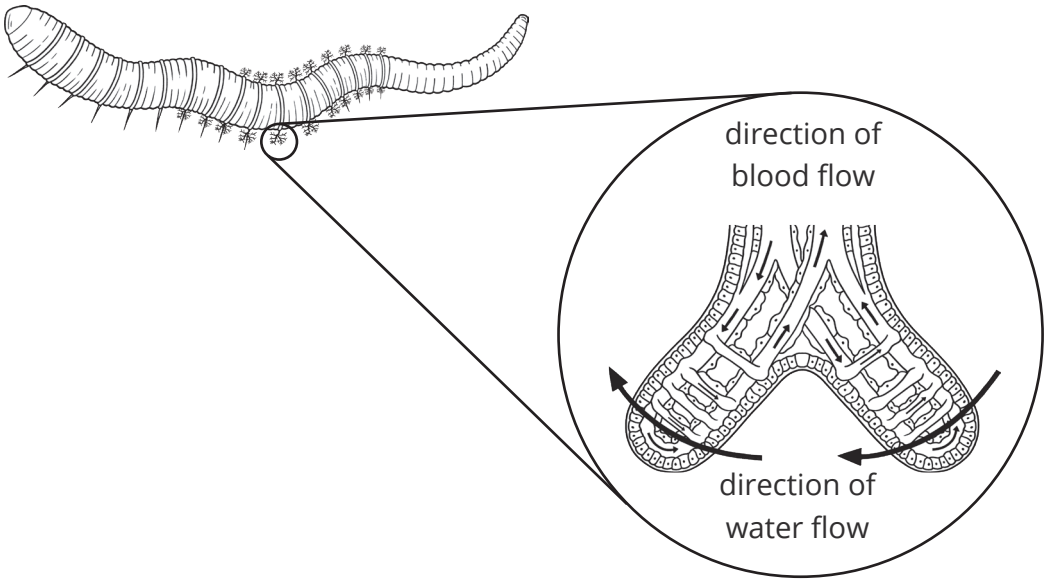
[2 marks]

4

0 2 Lugworms are a type of worm that live in burrows in sand. Lugworms have gills to absorb oxygen from water.

Figure 2 shows a drawing of a lugworm and the gill structure.

Figure 2



0 2 . 1 Oxygen moves from the water to the blood by diffusion.

Define diffusion.

[1 mark]

0 2 . 2 The direction of blood flow in the gills is in the opposite direction to the flow of water.

Explain why this is an advantage.

[3 marks]

0 2 . 3 Fish also use gills to absorb oxygen from water.

Explain **two** ways that the gills of a fish are adapted for efficient gas exchange by diffusion.

[4 marks]

8

0 3 **Table 1** compares the surface area and volume of some different organisms.

Table 1

Organism	Surface Area (m^2)	Volume (m^3)	Surface Area to Volume Ratio
bacterium	2×10^{-12}	5×10^{-19}	4 000 000:1
amoeba	2×10^{-8}	5×10^{-12}	4000:1
human	2	0.05	
elephant	20	5	4:1

0 3 . 1 Calculate the surface area to volume ratio of the human in **Table 1**.

[2 marks]

surface area to volume ratio = _____

0 3 . 2 Single-celled organisms such as bacteria and amoebae carry out gas exchange by diffusion across the cell membrane.

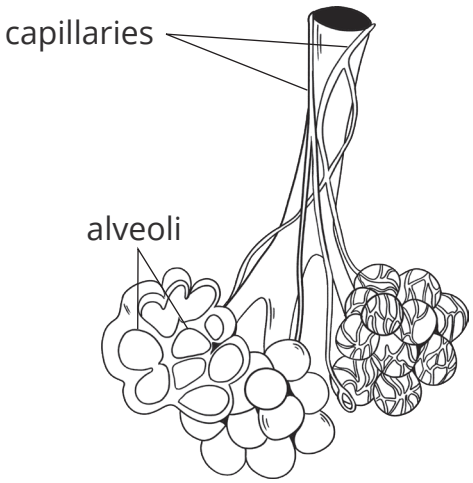
Multicellular organisms such as humans and elephants have lungs for gas exchange.

Explain why multicellular organisms require specialised exchange surfaces.

[3 marks]

0 3 . 3 **Figure 3** shows a diagram of the alveoli in the lungs.

Figure 3



Explain how having a large network of capillaries surrounding the alveoli helps to increase the rate of diffusion.

[2 marks]

0 3 . 4 Emphysema is a lung disease that causes damage to the walls of the alveoli, creating fewer larger air spaces instead of many smaller ones.

Explain how the changes to the lung structure in a patient with emphysema will affect gas exchange in the lungs.

[3 marks]

10