

AQA – Organism exchange substances with their environment – AS Biology P1

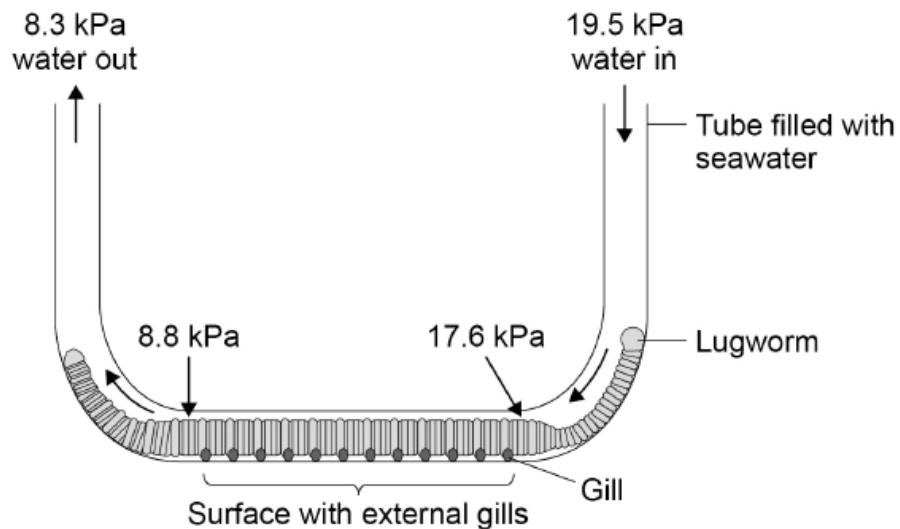
1. No.4

0 4 . 1

Lugworms create tubes in the sand on seashores. The tubes are filled with seawater.

A scientist measured the partial pressure of dissolved oxygen (pO_2) in seawater at different places in a tube with a lugworm inside.

Figure 3 shows her results.

Figure 3

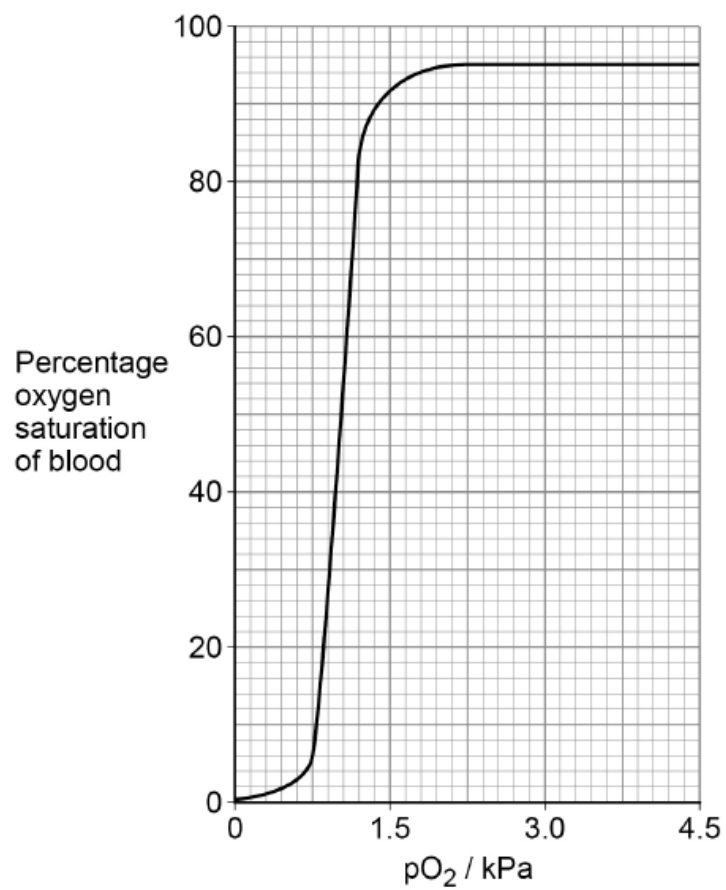
The pO_2 of dissolved oxygen in lugworm blood is < 2.7 kPa

Using the data in **Figure 3**, what can you conclude about the uptake of oxygen over the entire body of the lugworm?

[4 marks]

0 4 . 2 Figure 4 shows the oxyhaemoglobin dissociation curve for a lugworm.

Figure 4



The oxygen saturation in the blood of a lugworm is 92%

The lugworm has 0.2 cm^3 of blood.

Calculate the volume of dissolved oxygen in the blood of this lugworm using this equation

$$pO_2 = \frac{CdO_2}{0.000\ 031}$$

CdO_2 is the concentration of dissolved oxygen in the blood, with units cm^3 oxygen per cm^3 of blood.

Show your working.

[3 marks]

Answer _____ cm^3

0 4 . 3

The intensity of the red colour in blood is affected by the pO_2 of the blood. The intensity of the colour in a solution is measured using a colorimeter.

The scientist used a colorimeter to measure the intensity of red colour in samples of lugworm blood with different pO_2 values. She prepared a calibration curve with this information.

Describe how the scientist will use information from the colorimeter and her calibration curve to determine the pO_2 in a sample of lugworm blood.

[2 marks]

2. No.6

0 6 . 1

Explain a property of iron ions that enables these ions to carry out their role in red blood cells.

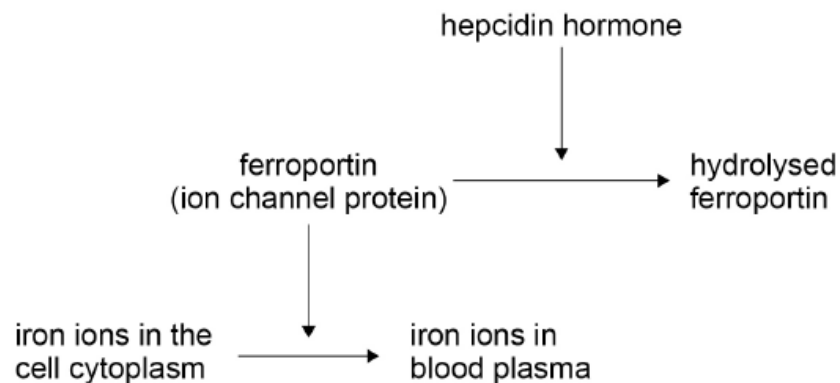
[2 marks]

0 6 . 2

The hormone hepcidin controls the iron ion concentration in blood plasma. Hepcidin affects ferroportin, the iron ion channel protein in cell-surface membranes.

Figure 7 shows how hepcidin controls the iron ion concentration in plasma.

Figure 7



People with the disease haemochromatosis do **not** produce hepcidin.

Use information in **Figure 7** to explain why the iron ion concentration is higher in the plasma of people with haemochromatosis.

[3 marks]

0 6 . 3

The mass of iron ions in the plasma of a person with haemochromatosis is $6104 \mu\text{g}$
The iron ion concentration in the plasma of a healthy person is $50 \mu\text{g dm}^{-3}$
The volume of blood in each of these people is 4000 cm^3

Calculate the ratio of the mass of iron ions in the plasma of the person with haemochromatosis to the mass of iron ions in the plasma of the healthy person.

[2 marks]

Answer _____

3. No.9

0 9

Read the following passage.

The placenta is a specialised exchange surface.

In the placenta, substances are exchanged between the blood of a fetus and the blood of its mother. Gas exchange for the fetus occurs in the placenta.

There is also transfer of IgG antibodies in the placenta between the mother's blood and fetal blood. These IgG antibodies protect the fetus against the pathogens that infect its mother during pregnancy. The IgG antibodies can circulate at high concentration in the mother's blood for months or years. A fetus does not produce IgG antibodies.

5

The UK immunisation programme vaccinates as many babies as possible to protect the UK population against pathogens such as measles viruses and tetanus bacteria. Measles viruses spread quickly from infected people. Despite the efforts of the NHS, there has been a recent increase in the number of children catching measles.

10

Tetanus bacteria enter the body through skin wounds. Tetanus bacteria do not spread from infected people. In order to develop good immunity against tetanus, children are given three tetanus vaccinations at regular intervals before they reach their first birthday.

15

Use the information in the passage and your own knowledge to answer the following questions.

0 9

. 1

Gas exchange for the fetus occurs in the placenta (line 3).

Describe how the composition of blood in the pulmonary artery of a fetus is different from the composition of blood in the pulmonary artery of its mother.

Give **one** reason for this difference.

[2 marks]

09.2

Explain how a fetus is protected against the pathogens that infect its mother during pregnancy (lines 5–6).

Do not give details of an active immune response in the mother.

[3 marks]

09.3

Suggest how vaccinating as many babies as possible protects the UK population against pathogens such as measles viruses and tetanus bacteria (lines 9–11).

[2 marks]

Protection against measles _____

Protection against tetanus _____

09.4

Suggest why there has been a recent increase in the number of children catching measles (lines 12–13).

[1 mark]

09.5

Explain why giving children more than one tetanus vaccination develops good immunity against tetanus (lines 15–17).

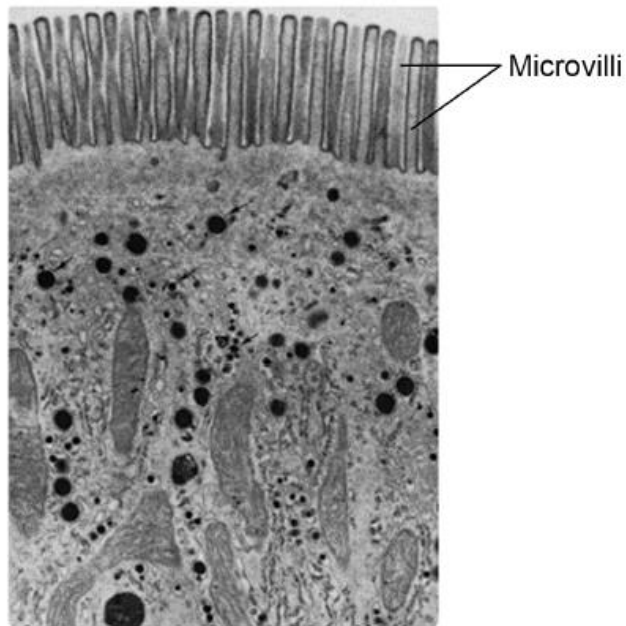
[2 marks]

4. No.3

0	3
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Figure 1 is an image of part of a cell lining the ileum.

Figure 1



0	3	.	1
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Describe and explain **two** ways that structures shown in **Figure 1** increase the rate of absorption by this cell.

[2 marks]

1 _____

2 _____

0 3 . 2

An ileum cell **without** microvilli has $7.85 \mu\text{m}^2$ of cell surface in contact with digested substances.

A scientist found an ileum cell with 1000 microvilli. The microvilli cover the entire cell surface in contact with digested substances.

Microvilli are $0.1 \mu\text{m}$ in diameter and $1 \mu\text{m}$ in length.

The surface area of a microvillus is calculated using this equation

$$2 \pi r l + \pi r^2$$

where π is 3.14,

r is the radius,

l is the length.

Calculate the ratio of the area of the ileum cell surface **with** microvilli to the area of ileum cell surface **without** microvilli.

Show your working.

[2 marks]

Ratio _____:1

0	3	.	3
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The protein ZO-1 is found on the surface of ileum cells.

A scientist used an anti-ZO-1 monoclonal antibody to identify ileum cells in a sample of intestine observed using an optical microscope.

Suggest how the monoclonal antibody helped the scientist to identify ileum cells in the sample of intestine.

[3 marks]

5. No.6

0 6 . 1

A student dissected a sheep's heart. He prepared a risk assessment on:

- carrying a scalpel
- using a scalpel.

Complete **Table 3** by giving **three** control measures the student must use to reduce the risks associated with carrying and using a scalpel.

Table 3

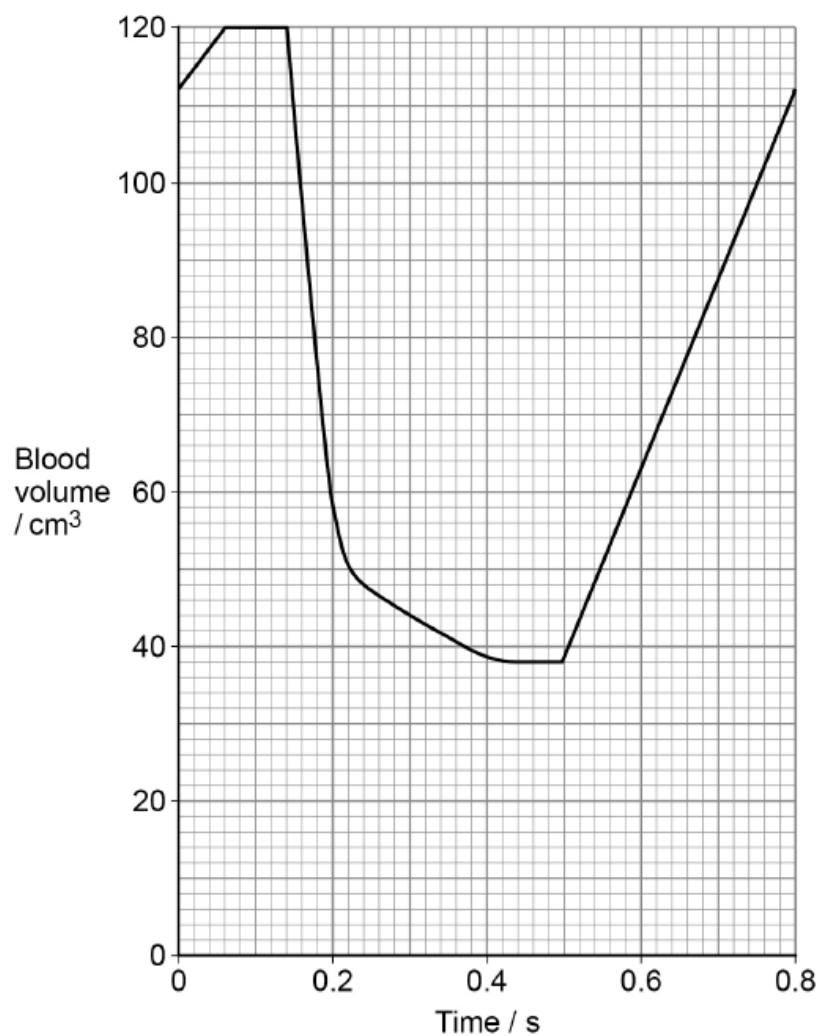
Source	Hazard	Control measures to reduce risk
Sharp knife		1.
		2.
		3.

[2 marks]

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.

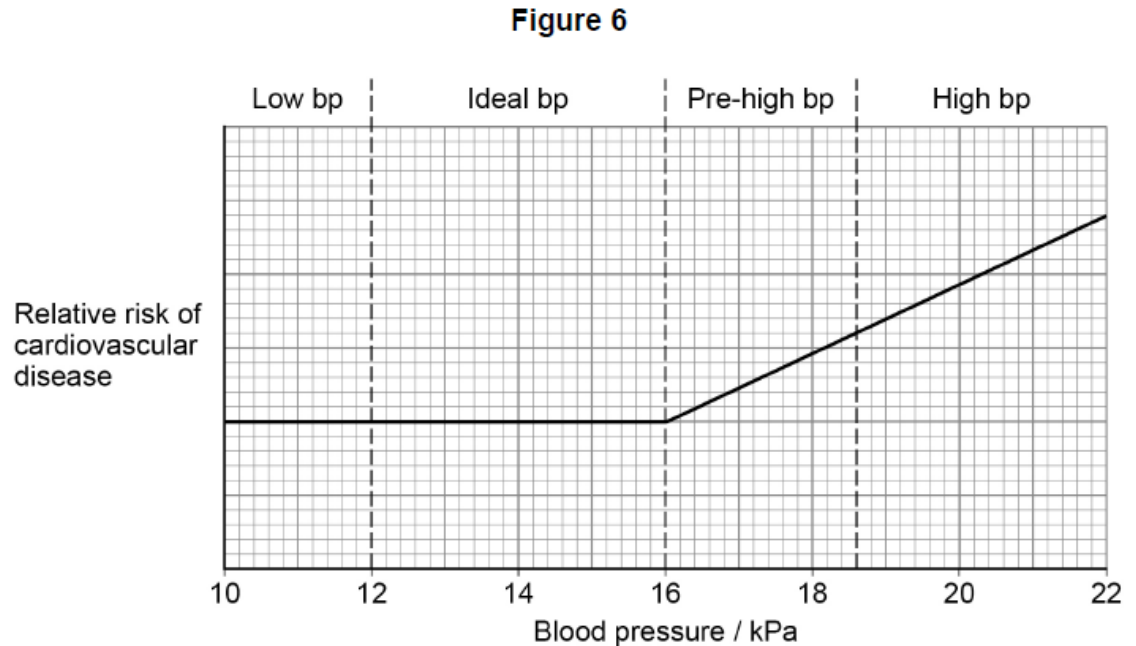
[2 marks]

Answer _____ cm³

Scientists investigated the correlation between patients' blood pressure (bp) and the risk of these patients developing cardiovascular disease.

They grouped the blood pressure measurements into four health categories: low, ideal, pre-high and high blood pressure.

Figure 6 shows the scientists' results.



In a separate investigation, a doctor measured the effect of blood pressure medicines on treating a large number of patients with a mean blood pressure of 22 kPa

The doctor used two different treatments.

- Treatment 1 contained one blood pressure medicine.
- Treatment 2 contained three blood pressure medicines.

He measured the change in the mean blood pressure after each treatment in these patients.

Describe how the structure of the insect gas exchange system:

- Explain your answers.

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0	9	.	2
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Describe how humans breathe in and out.

[5 marks]

[illegible]