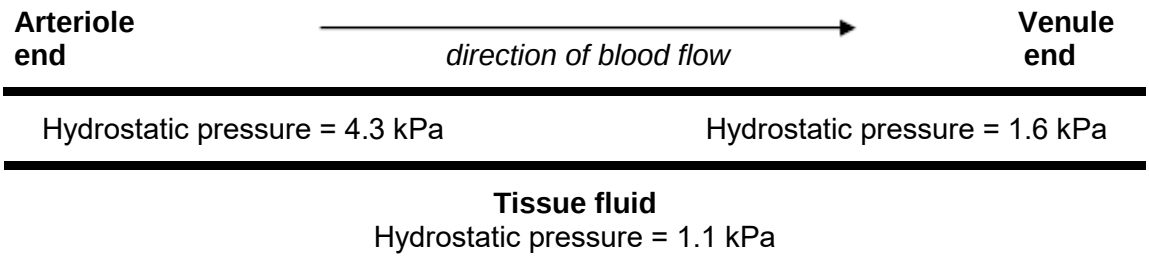
Q1. The figure below represents a capillary surrounded by tissue fluid.
The values of the hydrostatic pressure are shown.



(a) Use the information in the figure above to explain how tissue fluid is formed.

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(2)

(b) The hydrostatic pressure falls from the arteriole end of the capillary to the venule end of the capillary. Explain why.

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(1)

(c) High blood pressure leads to an accumulation of tissue fluid. Explain how.

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(Extra space) .....

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(3)

(d) The water potential of the blood plasma is more negative at the venule end of the capillary than at the arteriole end of the capillary. Explain why.

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(3)
(Total 9 marks)

Q2. Breathing out as hard as you can is called forced expiration.

(a) Describe and explain the mechanism that causes forced expiration.

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(4)

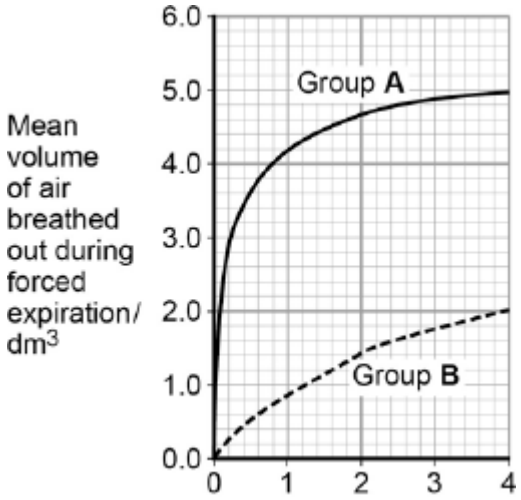
Two groups of people volunteered to take part in an experiment.

- People in group **A** were healthy.
- People in group **B** were recovering from an asthma attack.

Each person breathed in as deeply as they could. They then breathed out by forced expiration.

A scientist measured the volume of air breathed out during forced expiration by each person.

The graph below shows the results.



(b) Forced expiration volume (FEV) is the volume of air a person can breathe out in1 second.

Using data from the first second of forced expiration, calculate the percentage decrease in the FEV for group **B** compared with group **A**.

Answer = ... %

(1)

(c) The people in group **B** were recovering from an asthma attack.
Explain how an asthma attack caused the drop in the mean FEV shown in the figure below.

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(4)
(Total 9 marks)

Q3. Organic compounds synthesised in the leaves of a plant can be transported to the plant's roots.
This transport is called translocation and occurs in the phloem tissue of the plant.

(a) One theory of translocation states that organic substances are pushed from a high pressure in the leaves to a lower pressure in the roots.

Describe how a high pressure is produced in the leaves.

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(Extra space) .....

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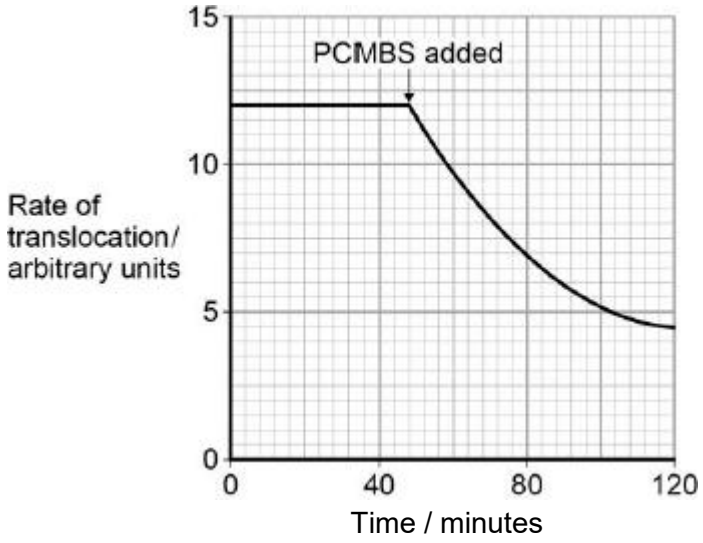
(3)

PCMBS is a substance that inhibits the uptake of sucrose by plant cells.

Scientists investigated the effect of PCMBS on the rate of translocation in sugar beet.
The figure below shows their results.



(b) During their experiment, the scientists ensured that the rate of photosynthesis of their plants remained constant.
Explain why this was important.

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(2)

(c) The scientists concluded that some translocation must occur in the spaces in the cell walls.
Explain how the information in the figure above supports this conclusion.

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(2)
(Total 7 marks)

Q4.(a) Describe how oxygen in the air reaches capillaries surrounding alveoli in the lungs. Details of breathing are **not** required.

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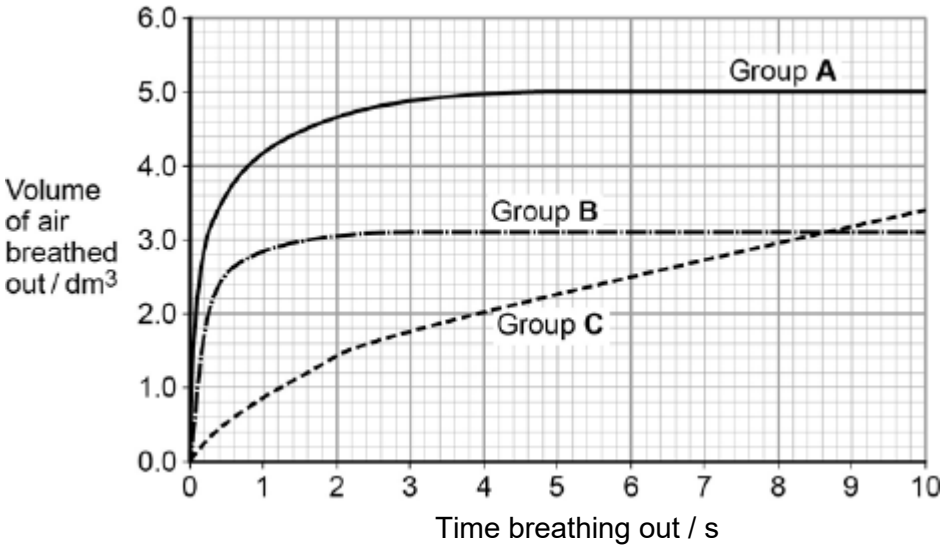
(4)

Forced expiratory volume (FEV) is the greatest volume of air a person can breathe out in 1 second.

Forced vital capacity (FVC) is the greatest volume of air a person can breathe out in a single breath.

The figure below shows results for the volume of air breathed out by three groups of people, **A**, **B** and **C**. Group **A** had healthy lungs. Groups **B** and **C** had different lung conditions that affect breathing.



(b) Calculate the percentage drop in FEV for group **C** compared with the healthy people.

Answer = ...

(1)

(c) Asthma affects bronchioles and reduces flow of air in and out of the lungs. Fibrosis does not affect bronchioles; it reduces the volume of the lungs.

Which group, **B** or **C**, was the one containing people with fibrosis of their lungs? Use the information provided and evidence from the figure above to explain your answer.

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(Extra space) .....

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(3)
(Total 8 marks)

Q5.(a) The oxygen dissociation curve for haemoglobin shifts to the right during vigorous exercise. Explain the advantage of this shift.

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(3)

(b) Weddell seals are diving mammals that live in cold environments. A Weddell seal is shown in **Figure 1**.

Figure 1

By Jerzystrzelecki (own work) [CC BY 3.0] via Wikimedia Commons

(i) Explain how the body shape of a Weddell seal is an adaptation to living in a cold environment.

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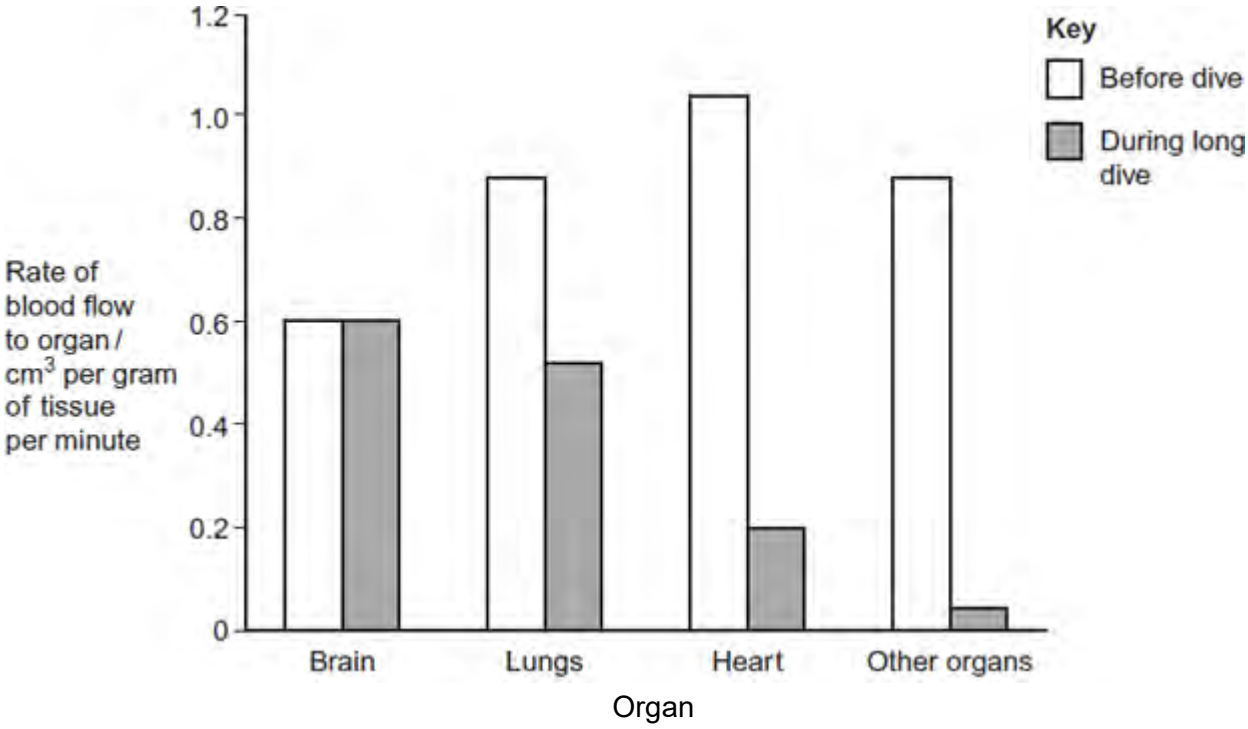
(2)

(ii) Weddell seals can remain underwater for long periods of time. **Figure 2** shows the rate of blood flow to different organs of a Weddell seal before a dive and during a long dive.

Figure 2



Describe and explain the changes in the rate of blood flow to the different organs during a long dive.

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(3)
(Total 8 marks)