Q1.

(a) Give **two** roles of phosphate ions in cells.

1 _____

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_____

2 _____

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(2)

(b) Diseased lungs can cause carbon dioxide to build up in the blood plasma. This leads to an increase in hydrogen ion concentration in the plasma.

Describe the effect this increase in hydrogen ion concentration has on the plasma **and** on the proteins in the plasma.

Do **not** refer to the Bohr effect.

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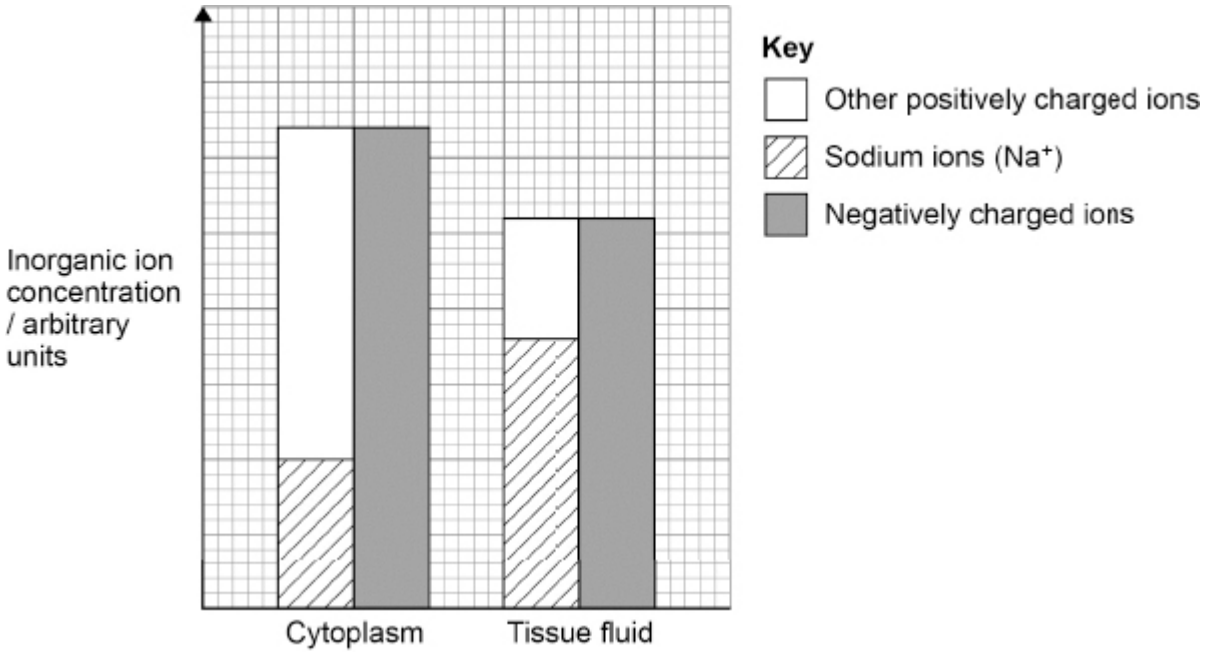
(2)

Scientists measured the concentration of inorganic ions in the cytoplasm of mammalian cells and in the tissue fluid surrounding those cells.

The graph below shows their results.



(c) Use the graph above to describe **two** patterns shown in the **total** concentrations of positively and negatively charged ions in the cytoplasm and in tissue fluid.

1 _____

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_____

2 _____

_____

_____

(2)

(d) In these mammalian cells, the:

- cell-surface membrane is permeable to sodium ions
- sodium ion concentration does not increase in the cytoplasm over time.

Use this information and the graph above to suggest and explain the ion transport mechanisms involved in the transport of sodium ions.

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(2)

(Total 8 marks)

Q2.

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

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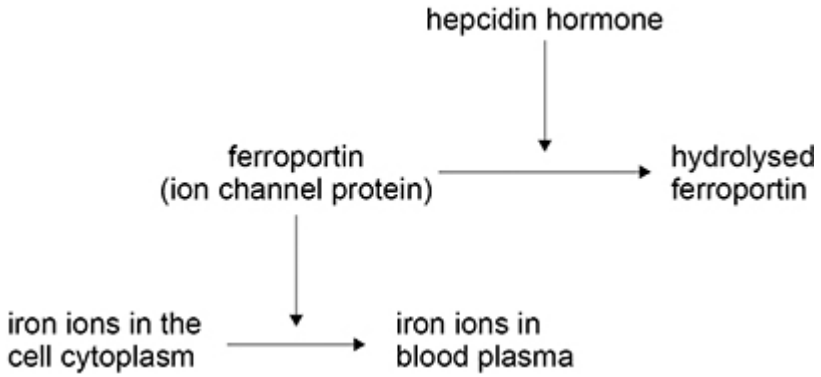
(2)

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

The figure below shows how hepcidin controls the iron ion concentration in plasma.



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

Use information in above figure to explain why the iron ion concentration is higher in the plasma of people with haemochromatosis.

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(3)

(c) The mass of iron ions in the plasma of a person with haemochromatosis is 6104 μg The iron ion concentration in the plasma of a healthy person is 50 μg 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.

Answer _____

(2)

(Total 7 marks)