

- 1 Three plants were grown to study the effects of nitrate and magnesium ion deficiency on their development. They were kept in the same conditions, except for the types of minerals supplied.

Plant **A** was provided with all essential minerals.

Plant **B** was given all minerals except nitrate ions.

Plant **C** was given all minerals except magnesium ions.

Fig. 1.1 shows the plants a few weeks later.

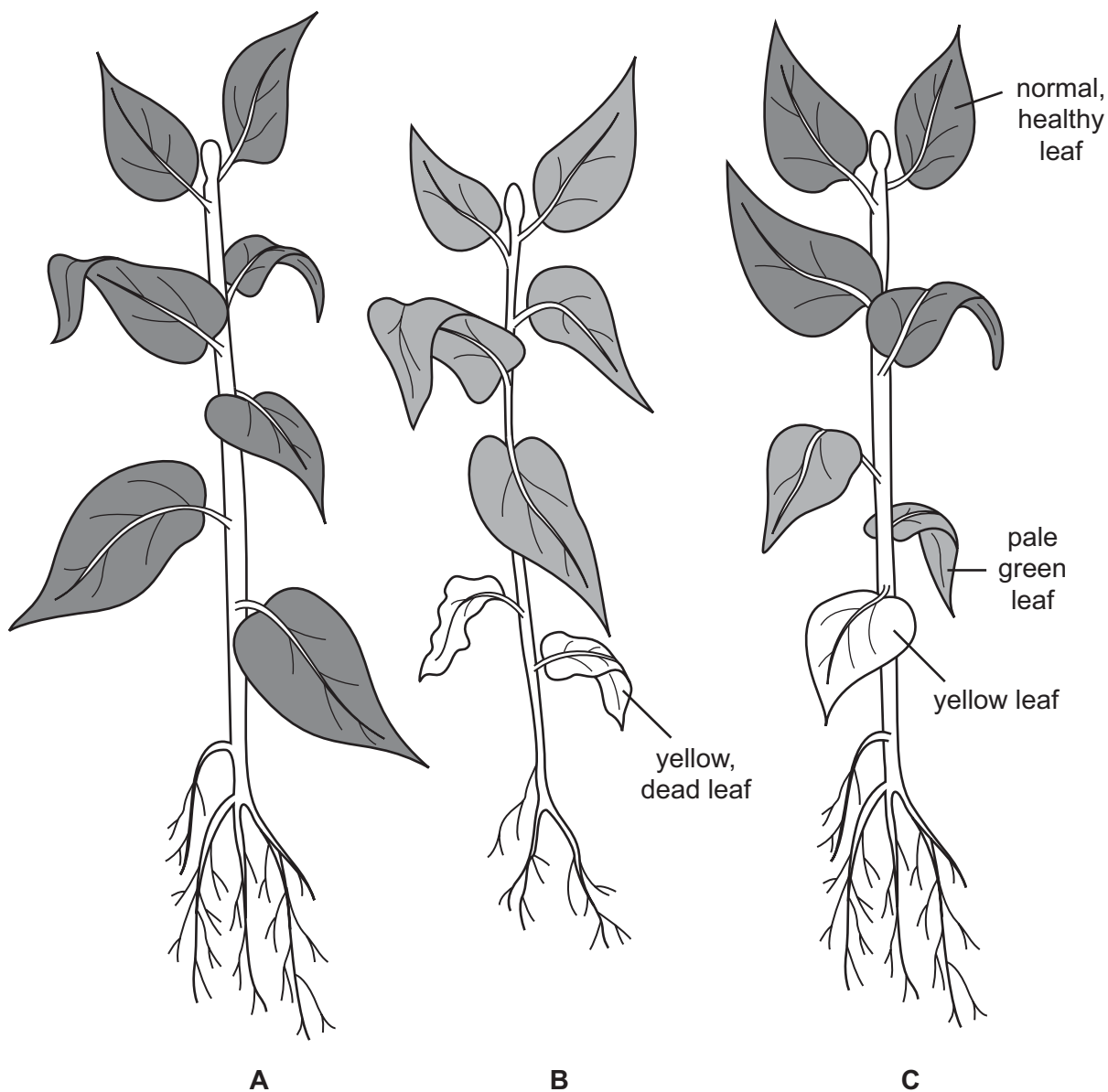


Fig. 1.1

(a) State three conditions, **other than** water and the concentration of mineral ions, that would need to be kept the same for all the plants, in order to make the investigation a fair test.

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3. [3]

(b) Describe and explain the effect on plant growth of

(i) a deficiency of nitrate ions on plant **B**;

description

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explanation

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(ii) a deficiency of magnesium ions on plant **C**.

description

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(c) A farmer tested the soil in a field and found that there was a high nitrate ion concentration.

The farmer then grew a crop in this field.

After the crop was removed, the soil was tested again. The nitrate ion concentration had decreased.

(i) Suggest two reasons why the nitrate ion concentration had decreased.

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(ii) Describe two methods the farmer could use to improve the nitrate ion concentration in the soil.

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(d) Some species of plant grow well in soil that is always low in nitrate ions.

Explain how they can obtain a source of nitrogen compounds.

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[Total: 16]

- 2 A student investigated the diffusion of substances through Visking tubing, an artificial membrane which has some of the properties of cell membranes.

The student made a bag of Visking tubing as shown in Fig. 4.1.

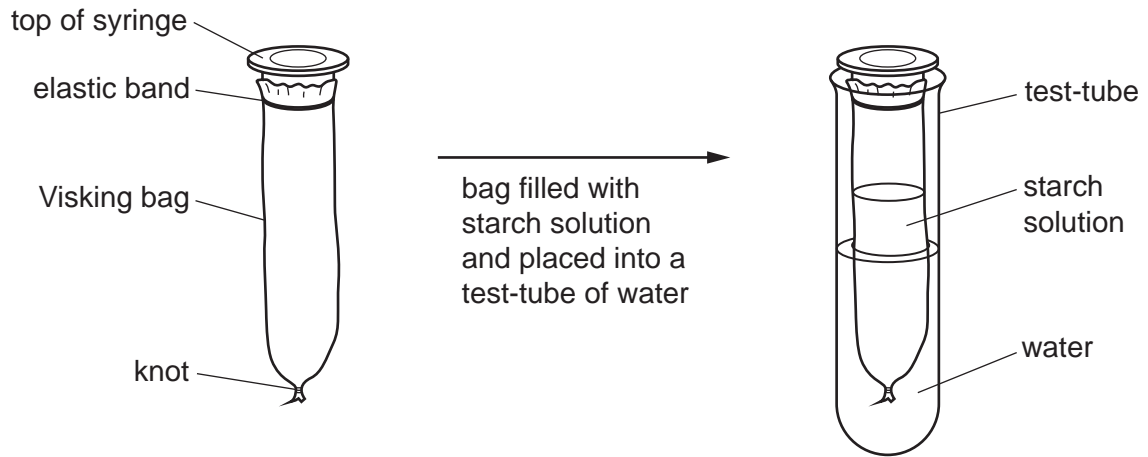


Fig. 4.1

The student added some iodine solution to the water in the test-tube.

After 30 minutes at room temperature, the contents of the Visking bag were stained blue-black, but the water outside remained a yellow colour.

- (a) (i) Explain these results.

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[4]

(ii) State **three** factors that influence the movement of molecules through membranes.

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(b) Fig. 4.2 is an electron micrograph of a red blood cell within a capillary.



Fig. 4.2

- (i) Molecules of carbon dioxide that are produced in muscle cells are transported to the blood.

Describe the pathway taken by these molecules of carbon dioxide.

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- (ii) Explain how capillaries are adapted for their functions.

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- (c)** Mammals have a transport system for carbon dioxide. Plants absorb carbon dioxide from their surroundings to use in photosynthesis.

Explain how a molecule of carbon dioxide from the atmosphere reaches the site of photosynthesis in a leaf.

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[Total: 17]

3 Microorganisms in the soil release enzymes to digest dead leaves.

(a) Explain how enzymes catalyse chemical reactions.

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(b) Protease and cellulase are two enzymes secreted by soil microorganisms. Protease digests protein.

Suggest what part of the dead leaf cells are digested by the enzyme cellulase.

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- (c) Table 6.1 shows the results of a study comparing the decomposition of dead leaves at two locations **A** and **B**.

Table 6.1

	location A	location B
protease activity/ $\mu\text{mol min}^{-1}$	2750	2670
cellulase activity/ $\mu\text{mol min}^{-1}$	4790	2500
soil pH	6.0	3.5
soil water content/%	10	77

- (i) Compare the enzyme activity at location **A** with the enzyme activity at location **B**.

You will gain credit for using the data from Table 6.1 to support your answer.

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- (ii) Suggest possible reasons for any differences in the enzyme activity at location **A** and location **B**.

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(d) Describe how nitrogen in proteins in dead leaves is recycled to be absorbed by plants.

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(e) Microorganisms also process and convert atmospheric nitrogen to form a nitrogen compound that can be absorbed by plants.

(i) Name this process of converting atmospheric nitrogen.

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(ii) Explain how this process happens.

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[Total: 17]