1 Fig. 6.1 shows a leaf and a flower of *Helleborus orientalis*.

Fig. 6.1

(a) *H. orientalis* is a dicotyledonous plant.

State three features **visible** in Fig. 6.1 that show it is a dicotyledonous plant.

1. .....

2. .....

3. ..... [3]

Fig. 6.2 is a photograph of a section through a leaf of *H. orientalis*.

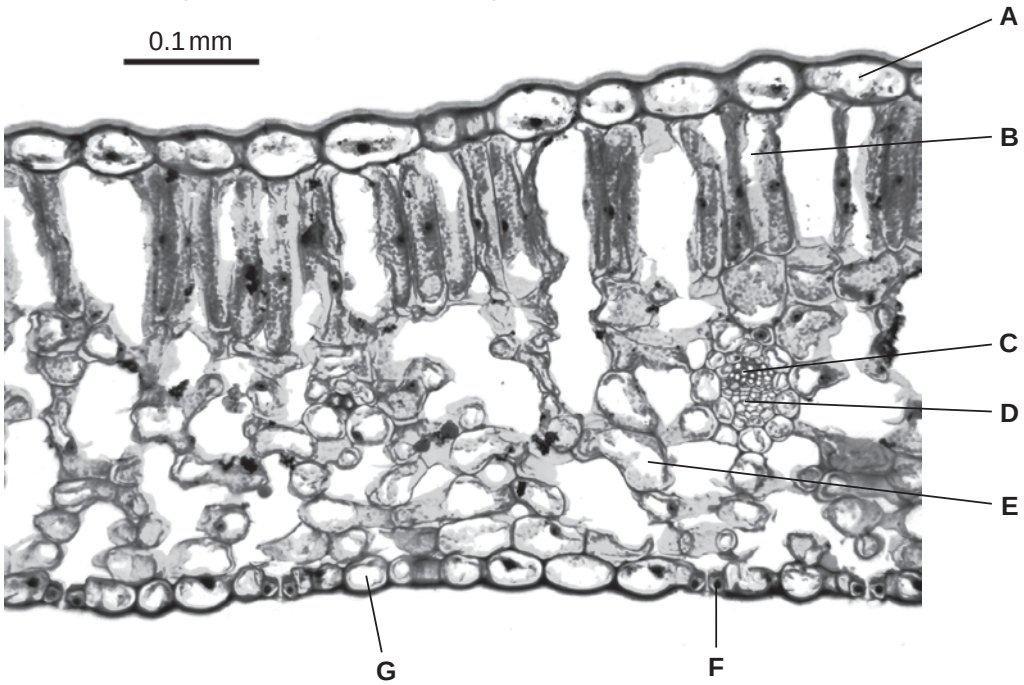

Fig. 6.2

(b) Complete the table, using ticks (✓), to show the cells that carry out photosynthesis.

cell	cells that carry out photosynthesis
A	
B	
C	
D	
E	
F	
G	

[2]

(c) Explain how two features of leaves, **visible** in sections such as that shown in Fig. 6.2, are adaptations for efficient photosynthesis.

1. .....

.....

.....

2. .....

.....

..... [4]

(d) During the period when *H. orientalis* is photosynthesising at a fast rate, substances are transported through the plant in the phloem from sources to sinks.

(i) Name **two** substances that are translocated from a source to a sink.

.....

..... [2]

(ii) For these substances state the source and **two** possible sinks.

source .....

sink 1 .....

sink 2 ..... [2]

[Total: 13]

2 **(a** Explain how water is absorbed by plant roots.

.....

.....

.....

.....

.....

..... [3]

(b) Young plants were grown in pots of sand for four weeks.

Some plants were watered with distilled water at pH 7.0 (no salts).

Most pots were watered with solutions containing different concentrations of salt (sodium chloride) at pH 7.0.

The plants were kept at 20 °C.

The growth of the plants was measured after four weeks.

The growth of the plants is shown in Fig. 4.1 as percentages of the growth of the plants watered with distilled water.

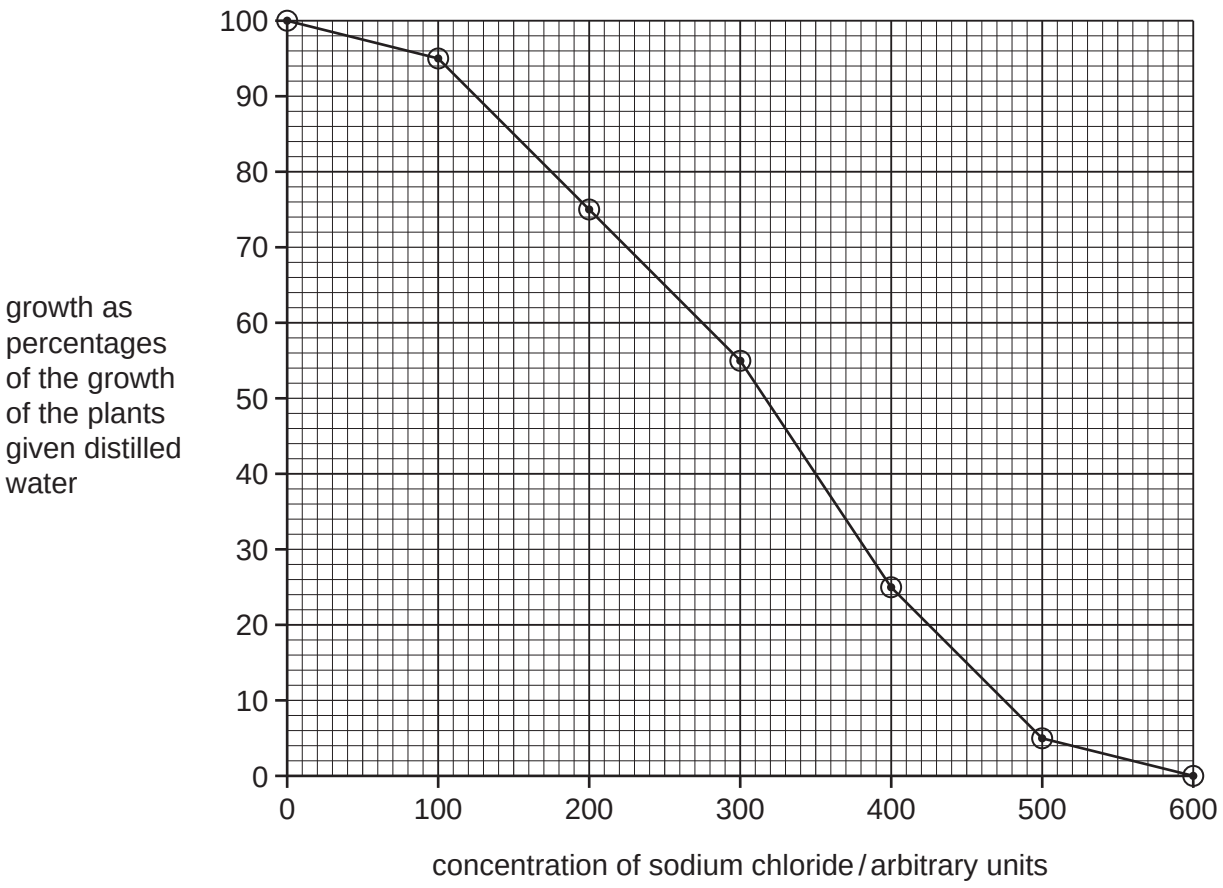

Fig. 4.1

(i) Describe the results shown in Fig. 4.1.

You will gain credit for using the figures in the graph to support your answer.

.....

.....

.....

.....

.....

..... [3]

(ii) Explain the difference in growth between the plants watered with low concentrations and those watered with high concentrations of salt solution.

.....

.....

.....

.....

.....

.....

.....

..... [4]

The pH of soils influences the availability of ions to plants.

Fig. 4.2 shows the availability of ions in soils of different pH.

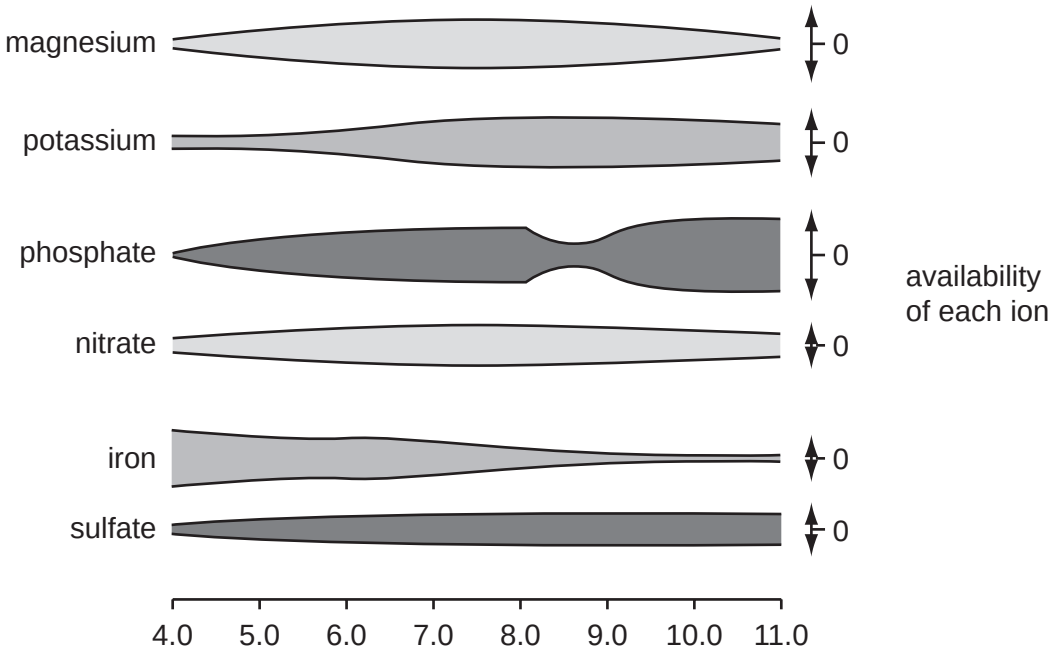

Fig. 4.2

(c) Name the ion that is **least** available in soils of pH 4.0 and in soils of pH 11.0.

pH 4.0 .....

pH 11.0 ..... [2]

(d) Plants grown in soils of pH 10 may show symptoms of deficiency. They are stunted and their leaves are yellow.

Explain how deficiencies of magnesium ions and nitrate ions lead to the symptoms described.

magnesium ions .....

.....

.....

.....

.....

.....

nitrate ions .....

.....

.....

.....

.....

..... [4]

[Total: 16]

3 An agricultural student investigated nutrient cycles on a farm where cattle are kept for milk. The farmer grows grass and clover as food for the cattle. Clover is a plant that has bacteria in nodules in its roots.

Fig. 6.1 shows the flow of nitrogen on the farm as discovered by the student. The figures represent the flow of nitrogen in kg per hectare per year. (A hectare is 10 000 m^2.)

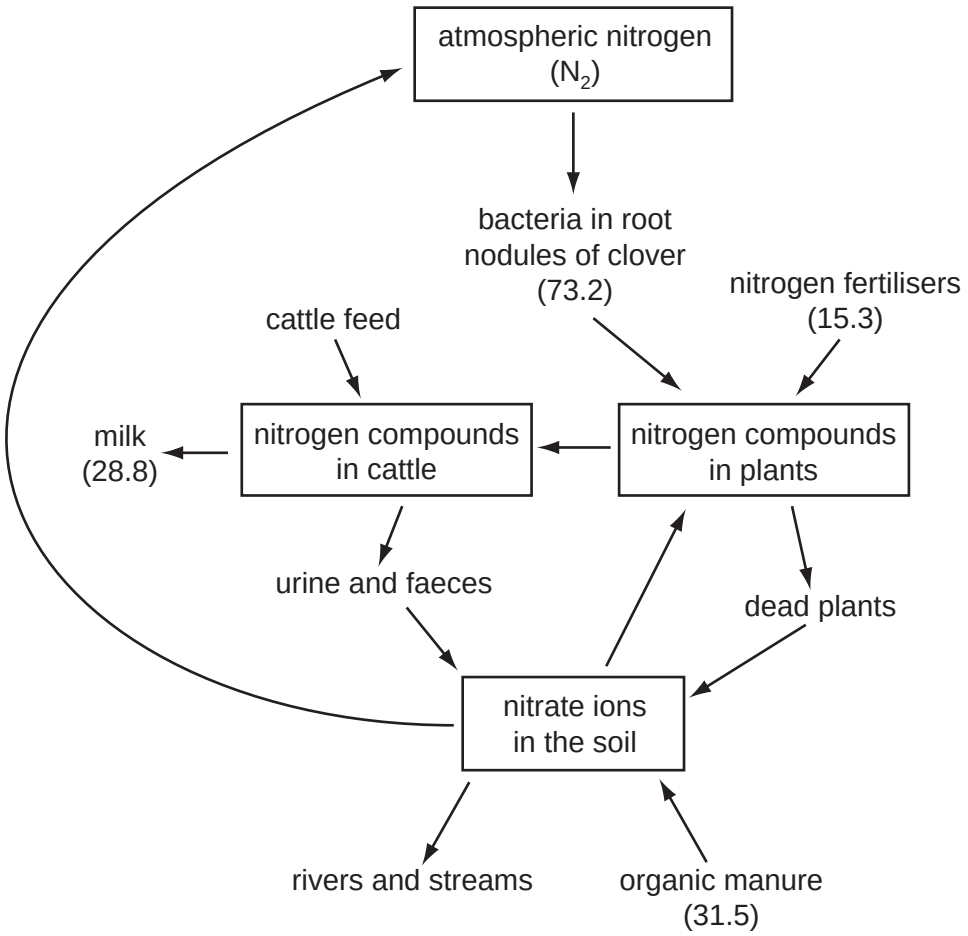

Fig. 6.1

(a) (i) Name the process in which bacteria convert atmospheric nitrogen into a form that is available to clover plants.

.....

[1]

(ii) Name **two** processes that convert nitrogen compounds in dead plants into nitrate ions that can be absorbed by grass.

..... and .....

[2]

(b) The total quantity of nitrogen added to the farmer's fields is 120 kg per hectare per year.

Calculate the percentage of this nitrogen that is present in the milk.

Show your working.

Answer = ... % [2]

(c) State two ways in which the nitrogen compounds in the cattle's diet are used by the animals **other than to produce milk**.

1. .....

2. ..... [2]

(d) The student found that a large quantity of the nitrogen compounds made available to the farmer's fields was not present in the milk or in the cattle.

Use the information in Fig. 6.1 to suggest what is likely to happen to the nitrogen compounds that are eaten by the cattle, but are **not** present in compounds in the milk or in their bodies.

.....

.....

.....

.....

.....

.....

.....

.....

.....

..... [5]

(e) The carbon dioxide concentration in the atmosphere has increased significantly over the past 150 years.

Explain why this has happened.

.....

.....

.....

..... [2]

[Total: 14]

4 A student set up the apparatus shown in Fig. 3.1 to investigate the effect of light intensity on the rate of photosynthesis of a pond plant.

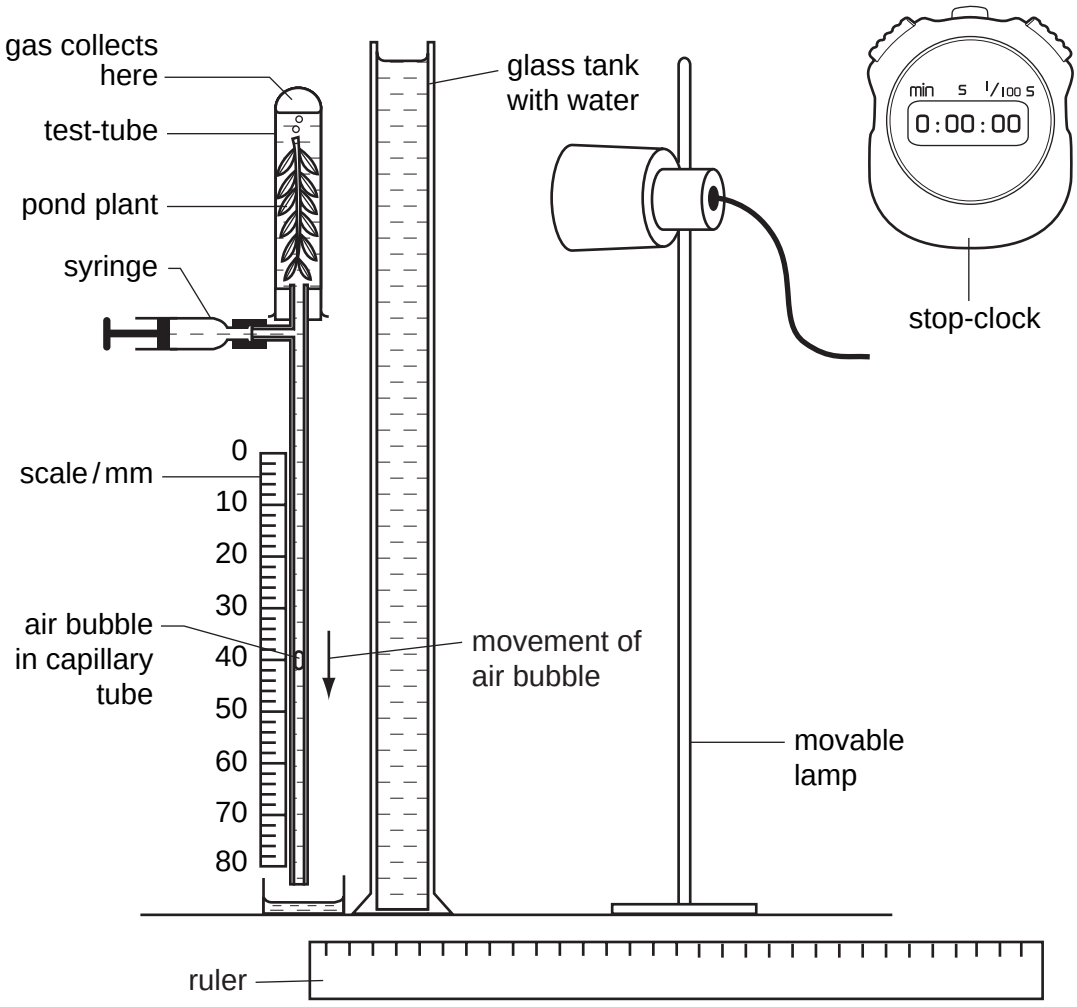

Fig. 3.1

The student maintained the temperature at 20 °C and measured the distance travelled by the air bubble in the capillary tube for a period of five minutes on three occasions for each light intensity.

The student's results are shown in Table 3.1 on page 8.

(a) Explain why the student included the glass tank and the syringe in the apparatus.

glass tank .....

.....

syringe .....

..... [2]

(ii) Explain why the air bubble moves down the capillary tube.

.....

.....

.....

.....

.....

..... [3]

Table 3.1

distance of lamp from pond plant / mm	distance travelled by air bubble / mm	rate of photosynthesis / mm per minute
20	30	6.0
30	26	5.2
40	14	2.8
50	7	
60	3	0.6

(b) Calculate the rate of photosynthesis when the lamp was 50 mm from the pond plant and write your answer in the table. [1]

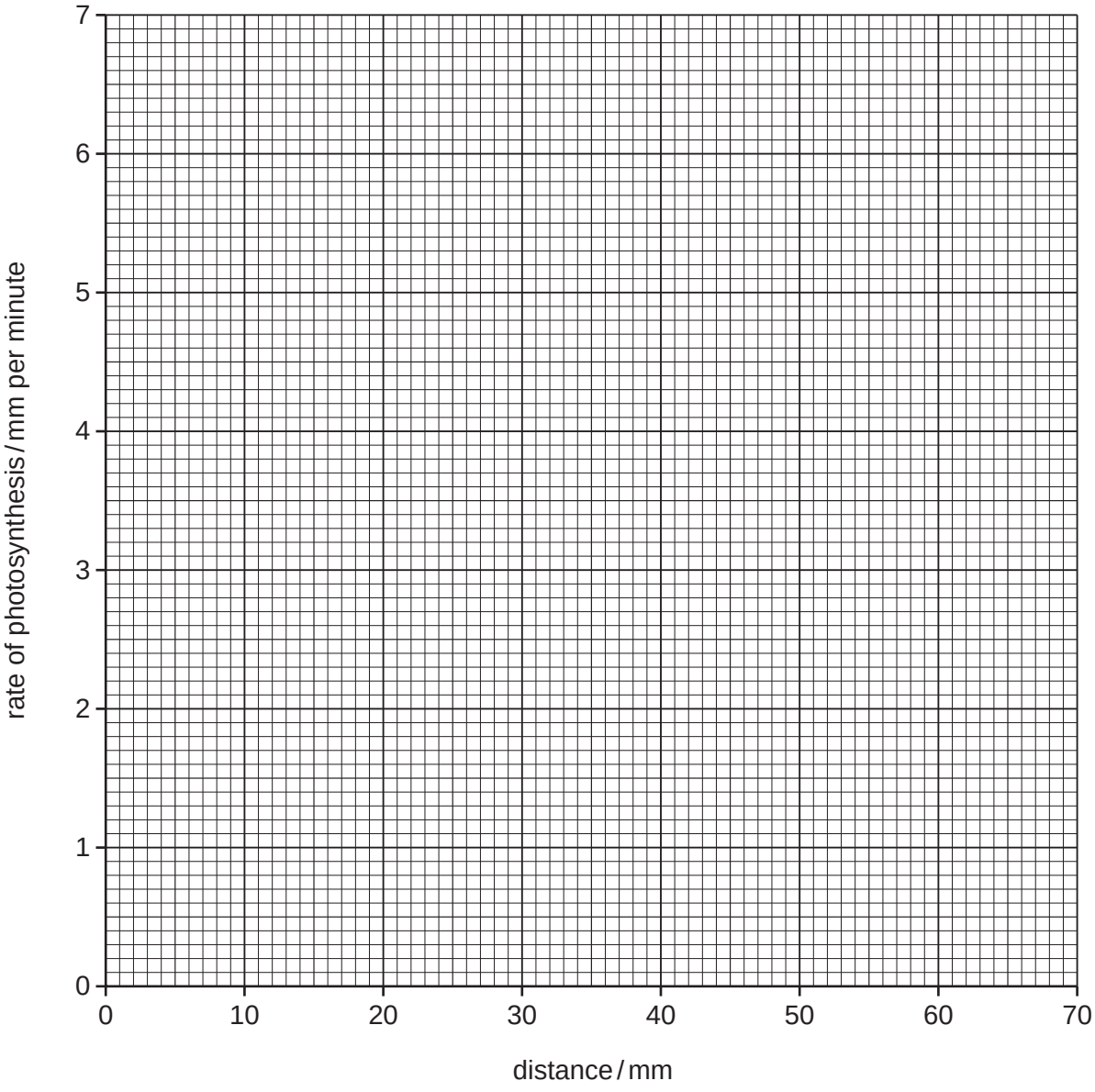

Fig. 3.2

(ii) Plot the student's results from Table 3.1 on the axes on Fig. 3.2.
Draw an appropriate line on the graph to show the relationship between distance of the lamp from the pond plant and the rate of photosynthesis. [2]

(c) Using the graph to help you, predict the results that the student would get if the lamp was positioned 15 mm and 70 mm from the pond plant.

15 mm ..... mm per minute

70 mm ..... mm per minute [2]

(ii) Explain why the rate of photosynthesis **decreases** as the distance of the lamp from the pond plant increases.

.....

.....

.....

.....

.....

..... [3]

[Total: 13]