1 Fig. 4.1 shows a cross section of part of a stem of buttercup, *Ranunculus*.

Fig. 4.2 is an outline drawing of one vascular bundle from the stem of *Ranunculus*.

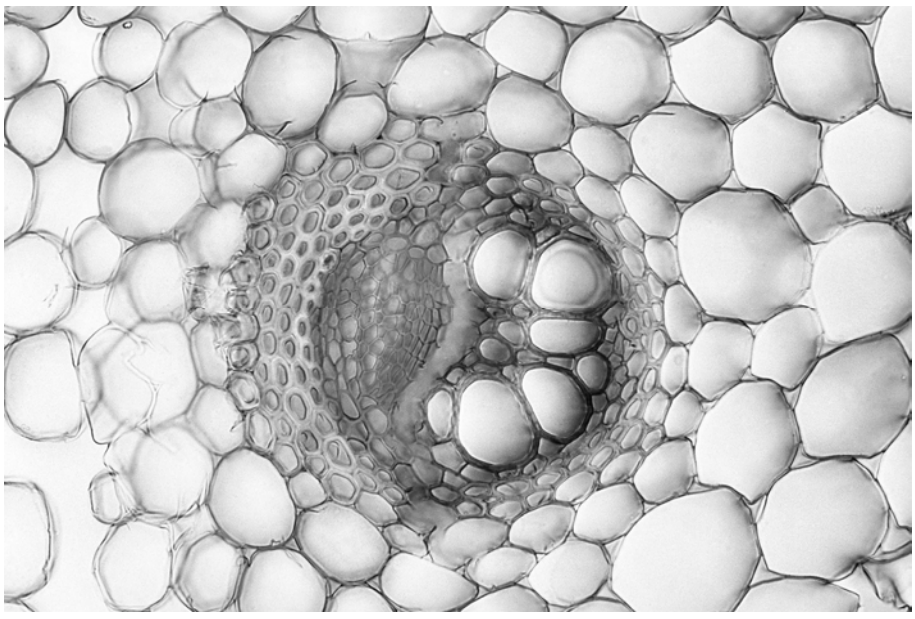

Fig. 4.1

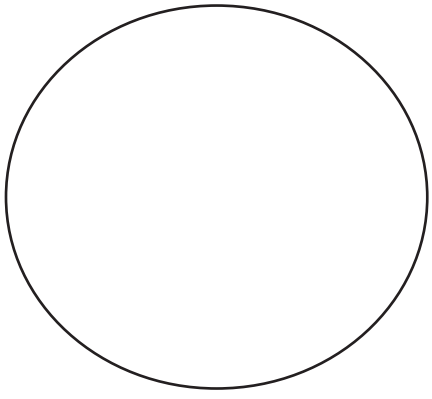

Fig. 4.2

(a) Draw **and** label the position of the xylem and the phloem in the outline of the vascular bundle in Fig. 4.2. [2]

(b) Name the carbohydrate that is transported in the phloem.

..... [1]

(c) Substances transported in the phloem are carried upwards in the stem at some times of the year and downwards at other times.

Explain why substances are transported in the phloem upwards at one time of the year **and** downwards at another.

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..... [4]

(d) Define the term *transpiration*.

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..... [3]

(e) The rattan palm is a plant that climbs on rainforest trees to heights of about 40 metres.

Explain how water is moved to the tops of tall plants, such as the rattan palm.

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..... [4]

[Total: 14]

2 This question is about transport in plants.

(a) Two pea plants, **D** and **E**, were supplied with substances containing the radioactive isotopes, carbon-14 (^{14}C) or phosphorus-32 (^{32}P), as shown in Fig. 4.1.

A leaf of plant **D** was exposed to radioactive carbon dioxide.

Plant **E** was placed into a solution containing radioactive phosphate ions.

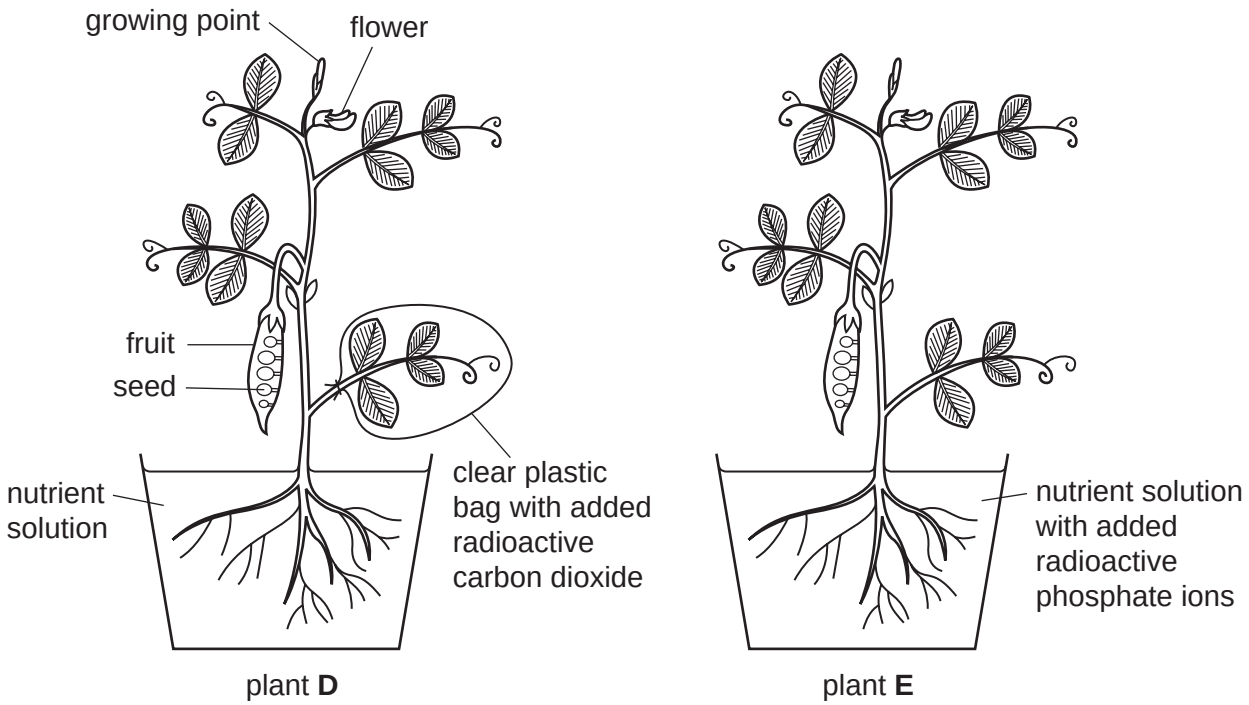

Fig. 4.1

After several hours the plants were analysed for the presence of the radioactive isotopes.

Sucrose containing ^{14}C was found throughout plant **D**.

Compounds containing ^{32}P were found throughout plant **E**.

Complete Table 4.1 to show:

- the tissue in which each substance is transported;
- **one** possible sink for each substance.

Table 4.1

pea plant	**D**	
substance transported	sucrose	ph ions
transport tissue		
sink		

[4]

(b) State **one** substance, **other than sucrose**, that is produced in leaves and translocated to other parts of the plant.

..... [1]

(c) Outline how sucrose is produced from carbon dioxide in pea plants.

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..... [3]

(d) State **two** uses of sucrose within a pea plant.

1 .....

2 ..... [2]

(e) Explain how ions, such as phosphate ions, are absorbed by plant roots.

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..... [3]

[Total: 13]

3 **(a** Define the term *growth*.

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..... [2]

Some students investigated the responses of tomato seedlings to receiving light from one side (unidirectional light).

The students germinated tomato seeds in the dark and then placed the seedlings in test-tubes with water. The seedlings were treated in four different ways, **E** to **H**, as shown in Fig. 2.1. The responses of the seedlings are shown in Fig. 2.2.

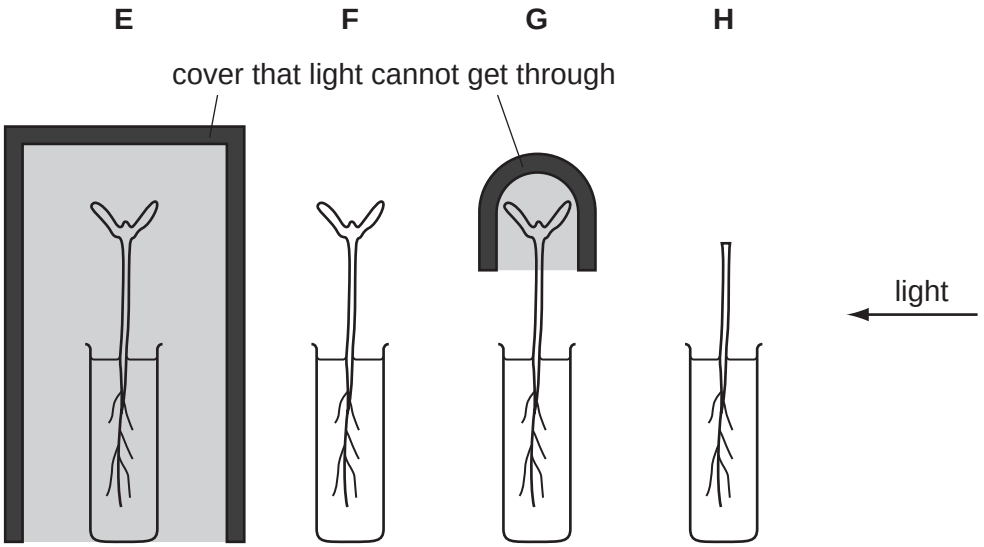

Fig. 2.1

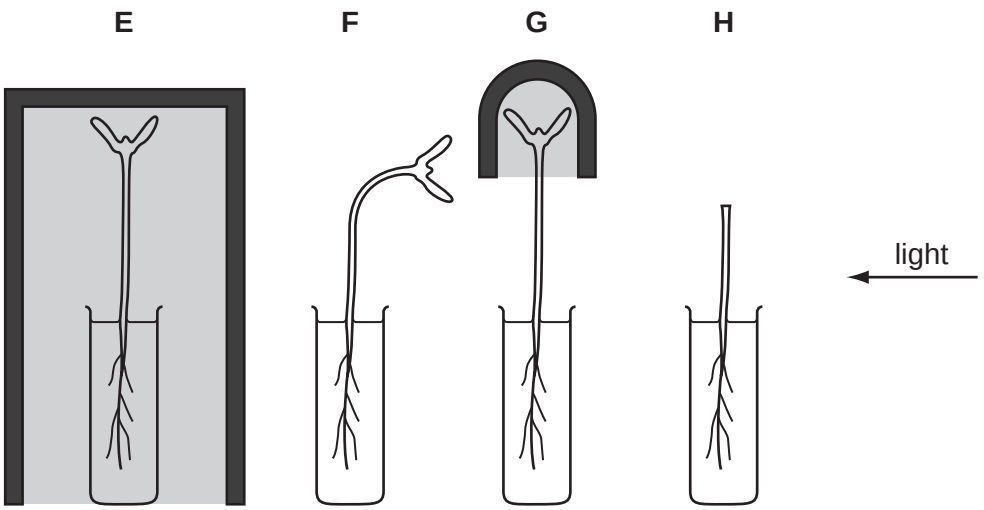

Fig. 2.2

(b) Name the response shown by the tomato seedling, **F**, which has bent 90º towards the light.

..... [2]

(c) Using the results shown in Fig. 2.2, suggest what conclusions may be made about how the tomato seedlings detected the stimulus of unidirectional light.
You may refer to the seedlings by the letters **E** to **H**.

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..... [3]

(d) Explain the advantage of the response shown by seedlings to unidirectional light.

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..... [2]

(e) Responses to light are coordinated by plant growth substances known as auxins.

Explain the role of auxins in coordinating the response.

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..... [2]

(f) Research workers in India tested the hypothesis that pigments in tomato seedlings detect blue light. They used a variety of tomato seedling that does **not** have the ability to make a certain pigment.

These seedlings and a control group of seedlings were grown in the dark and then exposed to unidirectional blue light for 360 minutes.

The scientists measured the degree of bending of the seedlings at intervals during the 360 minutes. Their results are shown in Fig. 2.3.

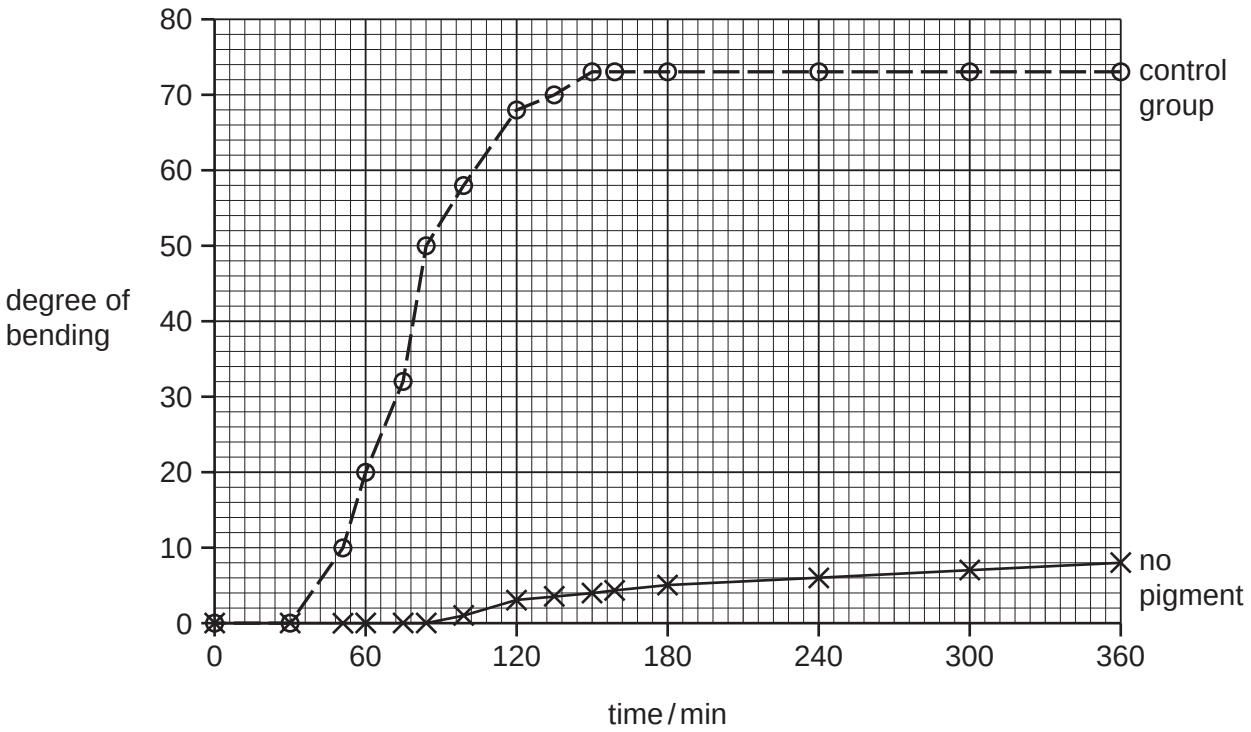

Fig. 2.3

(i) Describe the results shown in Fig. 2.3.

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..... [4]

(ii) Suggest an explanation for the differences between the responses of the two groups of seedlings.

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..... [2]

[Total: 17]

4 Many growers of crops in glasshouses use carbon dioxide enrichment to improve yields.

(a) Explain the advantages of carbon dioxide enrichment of glasshouses.

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..... [2]

Fig. 3.1 shows the carbon dioxide concentrations inside three glasshouses, **D**, **E** and **F**, on a hot day with bright sunlight.

- Glasshouses **D** and **E** received carbon dioxide enrichment and were ventilated by opening the windows.
- Glasshouse **F** did not receive any extra carbon dioxide and the windows were closed.

The carbon dioxide concentrations in the glasshouses and in the atmosphere were measured. The concentration in the atmosphere was 0.039 %.

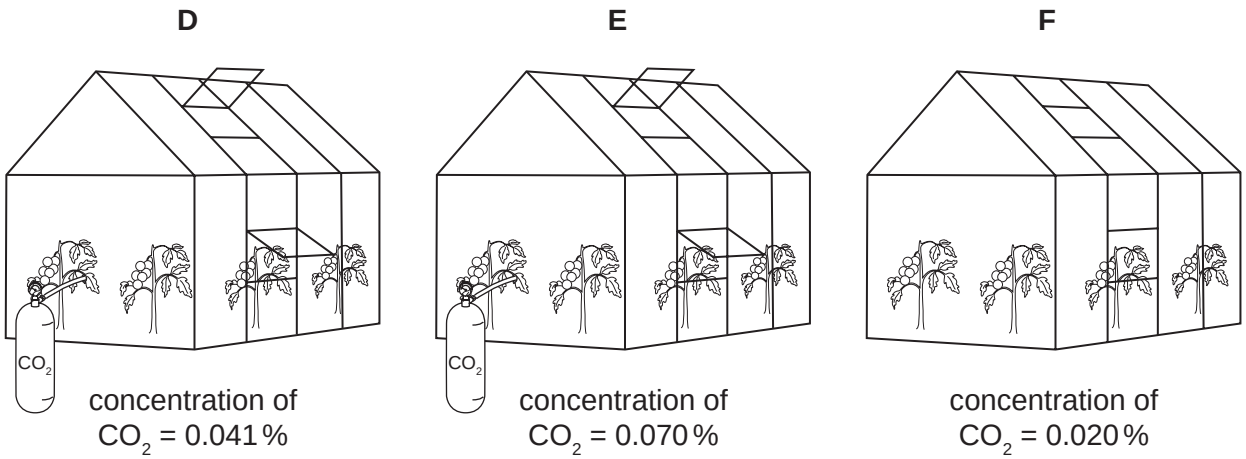

Fig. 3.1

The rate of uptake of carbon dioxide by the crop plants was measured in grams of carbon dioxide absorbed per square metre of glasshouse per hour. These results are shown in Table 3.1.

Table 3.1

glasshouse	rate of uptake of carbon dioxide by crop plants / g per m^2 per hour
D	2.5
E	5.7
F	1.0

(b) Suggest why it may **not** be cost effective to maintain a high concentration of carbon dioxide in glasshouse **E** compared to the concentration of carbon dioxide in the atmosphere.

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..... [2]

(c) **(i)** Concentrations of carbon dioxide in all three glasshouses in Fig. 3.1 increased at night. State why this happened.

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..... [1]

(ii) Explain why it is important to ventilate glasshouses by opening the windows.

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..... [4]

[Total: 9]