Core 1

(a) The chemical equation for photosynthesis shown below is incomplete.

$$\underset{\text{water}}{6H_2O} + \text{.....} \xrightarrow[\text{plant pigment}]{\text{energy}} \underset{\text{glucose}}{C_6H_{12}O_6} + \text{.....}$$

(i) Complete the equation in **either** symbols **or** words. [2]

(ii) State the source of energy for this reaction.

.....[1]

(iii) Name the plant pigment necessary for this reaction.

.....[1]

(iv) Which mineral is needed by a plant to form this pigment?

.....[1]

(b) (i) Name the tissue in which the sugar produced in photosynthesis is carried to other parts of the plant.

.....[1]

(ii) In many plants some of the sugar formed in photosynthesis is converted to starch for storage. Explain the advantage of storing starch rather than sugar.

.....

.....

.....[2]

(iii) Name the carbohydrate, formed from sugar produced in photosynthesis, which is used to build cell walls.

.....[1]

[Total : 9]

Fig. 1 shows changes in the rate of water loss from a plant during part of a day. It also shows changes in the temperature and light intensity over the same period.

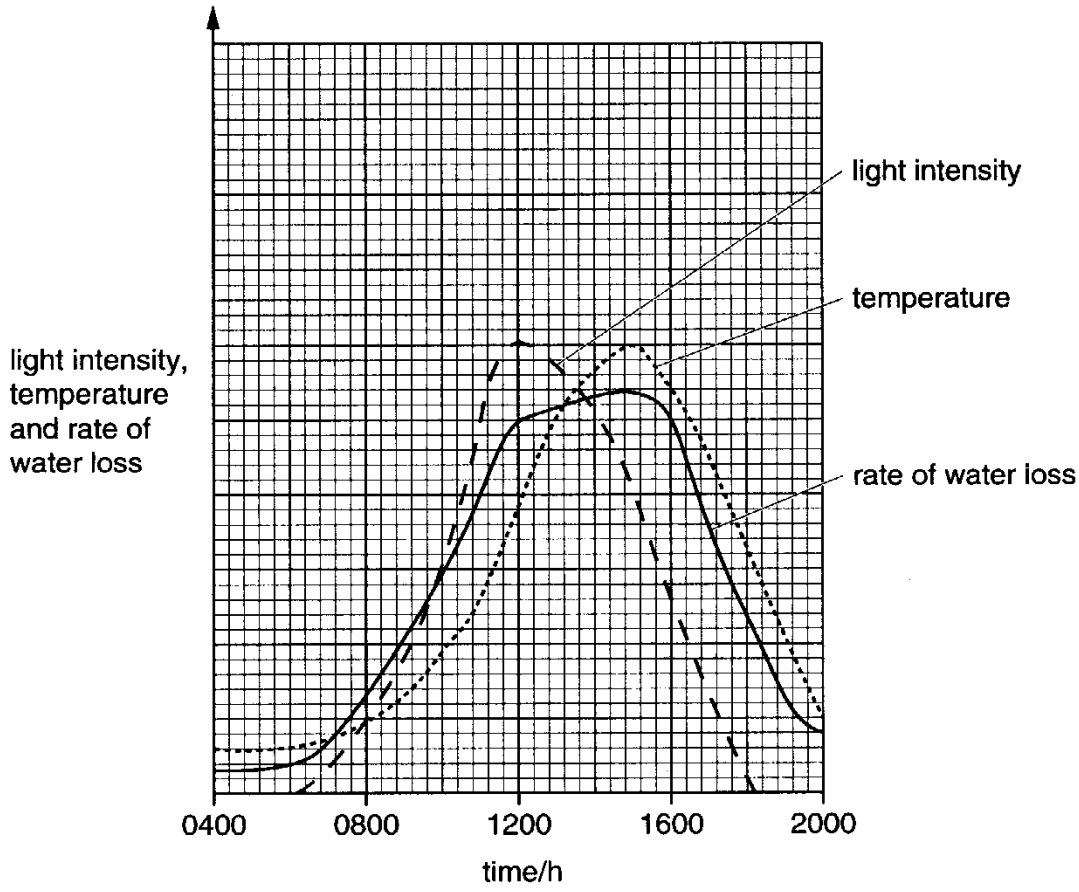

Fig. 1

(a) Explain why the rate of water loss rises steeply between 0700 and 1200 hours.

.....

.....

.....

.....[3]

(b) Suggest which factor, light intensity or temperature, has the greater effect on the rate of water loss between 1200 and 1500 hours. Explain your answer.

Factor .....

Explanation .....

.....

[2]

(c) Predict and explain the likely effect on the rate of water loss if there had been heavy rainfall between 1100 and 1200 hours.

Prediction .....

Explanation .....

.....

[2]

[Total : 7]

Alternative to Practical 1

Fig. 2 shows three sets of apparatus, **A**, **B** and **C**, used to measure different biological processes.

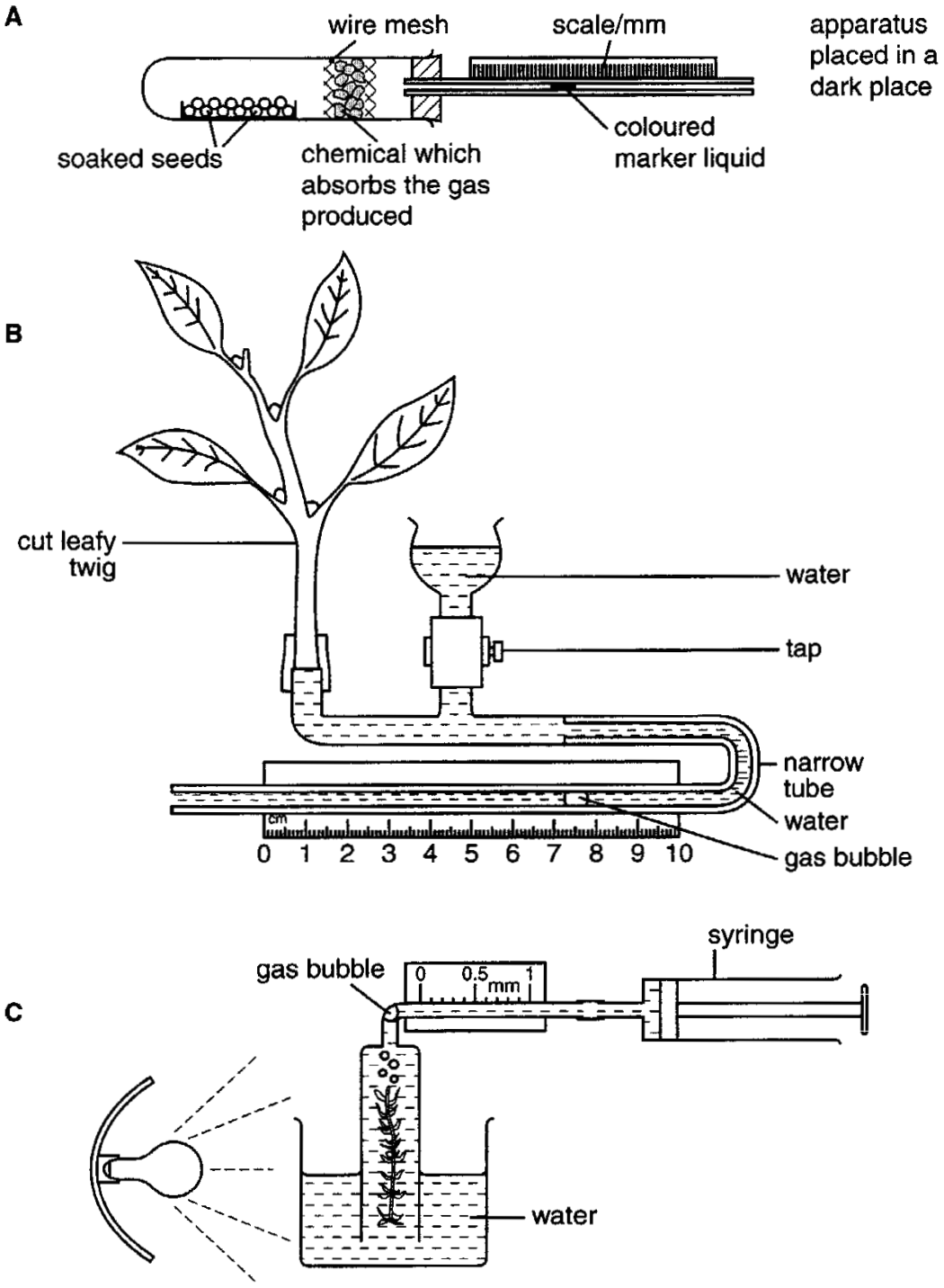

Fig. 2

(a) Name the process that can be measured by each apparatus.

A .....

B .....

C .....[3]

Alternative to Practical 1

(b) (i) Name the gas which is produced by the process measured using apparatus **A**.

.....[1]

(ii) Suggest **one** possible control for an experiment using apparatus **A**.

.....

.....[1]

(c) When using apparatus **B**, it is possible to vary the external conditions.
Suggest how changing **one named** external condition would affect the biological process measured by apparatus **B**.

.....

.....

.....[1]

(d) (i) Name the gas produced by the process measured using apparatus **C**.

.....[1]

(ii) How would you keep **one named** external factor constant when using apparatus **C**?

.....[1]

[Total : 8]

Extension 1

Fig. 3 shows part of the lower surface of a typical dicotyledonous leaf.

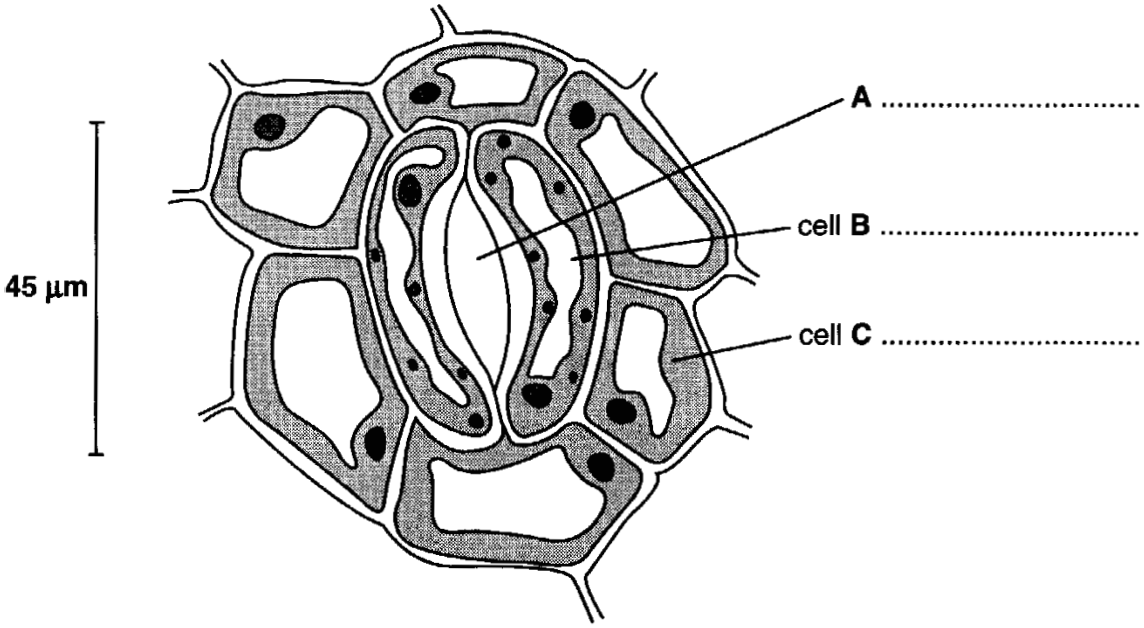

Fig. 3

(a) On Fig. 3 , label part **A** and the cells **B** and **C**. [3]

The surfaces of the leaves of two species of plant were studied and the number of stomata per unit area (stomatal frequency) was recorded.

Cobalt chloride paper changes colour in the presence of water.

Pieces of cobalt chloride paper were attached to the upper and lower surfaces of leaves on both plants. The plants were set up for one hour during the day. Any colour changes were recorded. The experiment was repeated for one hour at night. Table 1 shows the results.

Table 1

plant species	stomatal frequency		colour change to cobalt chloride paper			
			day		night	
	lower surface	upper surface	lower surface	upper surface	lower surface	upper surface
Cassia fistula	0	18	✘	✔	✘	✘
Bauhinia monandra	22	0	✔	✘	✘	✘

Key

✔ colour change

✘ no colour change

(b) Describe the differences in stomatal distribution between the two species of plant.

.....

.....

.....[2]

Extension 1

(c) **(i)** Explain the colour changes to the cobalt chloride paper during the day.

.....

.....

.....[3]

(ii) Suggest why there was no colour change for either plant at night.

.....

.....[1]

(d) Outline the mechanism by which water in the roots reaches the leaf.

.....

.....

.....

.....[3]

(e) State and explain the effect of the following on transpiration rate:

(i) increasing humidity;

.....

.....

.....[2]

(ii) increasing temperature.

.....

.....

.....[2]

[Total : 16]

Extension 2

Fig. 4 shows an aphid feeding on a plant stem. Its mouthparts are hollow tubes which are pushed into the stem to remove sugar solution.

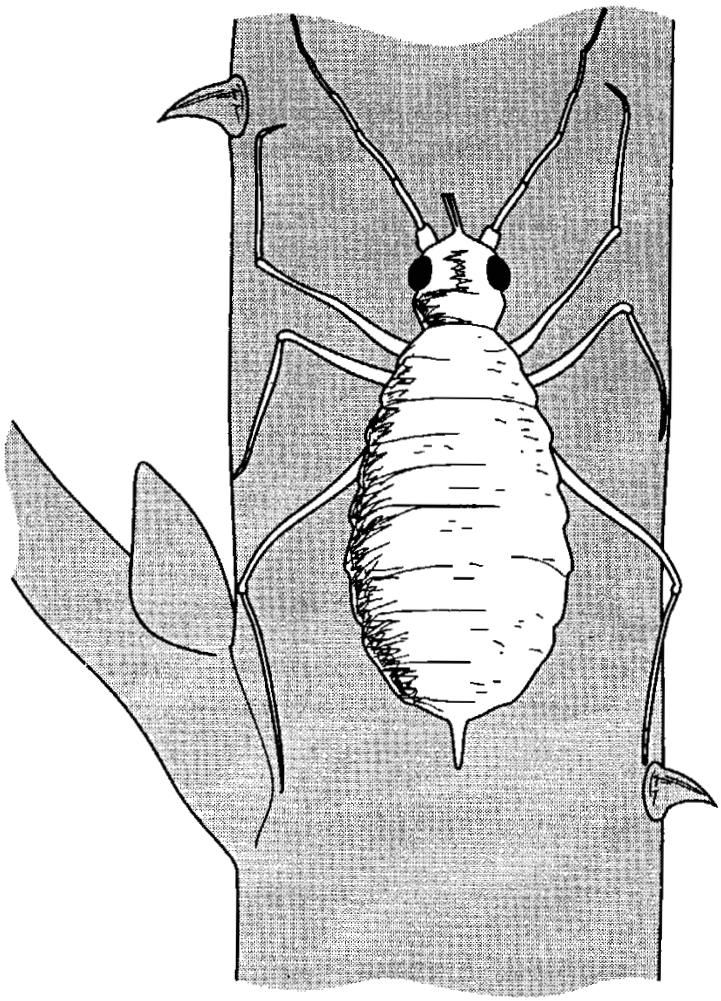

Fig. 4

(a) Aphids are arthropods. State **two** features, visible in Fig. 4, which are common to all arthropods.

1. .....

2. .....[2]

(b) In which tissue, and by what processes, does the sugar solution move through the plant?

Tissue .....

Processes .....

.....[3]

Extension 2

Some of the sugar solution was collected from the plant stem. Plant cells were placed on a microscope slide and covered with this sugar solution.

(c) (i) Describe what changes would occur to each of the cell parts listed below, if the sugar solution was more concentrated than the sap in the cell vacuole.

Sap vacuole

.....

.....

Cytoplasm

.....

.....

Cell wall

.....

.....[3]

(ii) Explain, in terms of water potential gradient, how these changes occur.

.....

.....

.....

.....[3]

(d) Systemic pesticides can be used to kill pests such as aphids. Describe how the application of these pesticides to leaves kills aphids feeding on the stem.

.....

.....

.....

.....[2]

[Total : 13]

Extension 3

A student carried out an experiment to investigate the growth of floating water plants taken from a pond. Equal masses of the plants were placed into three separate glass containers **A**, **B** and **C**, similar to the one shown in Fig. 5

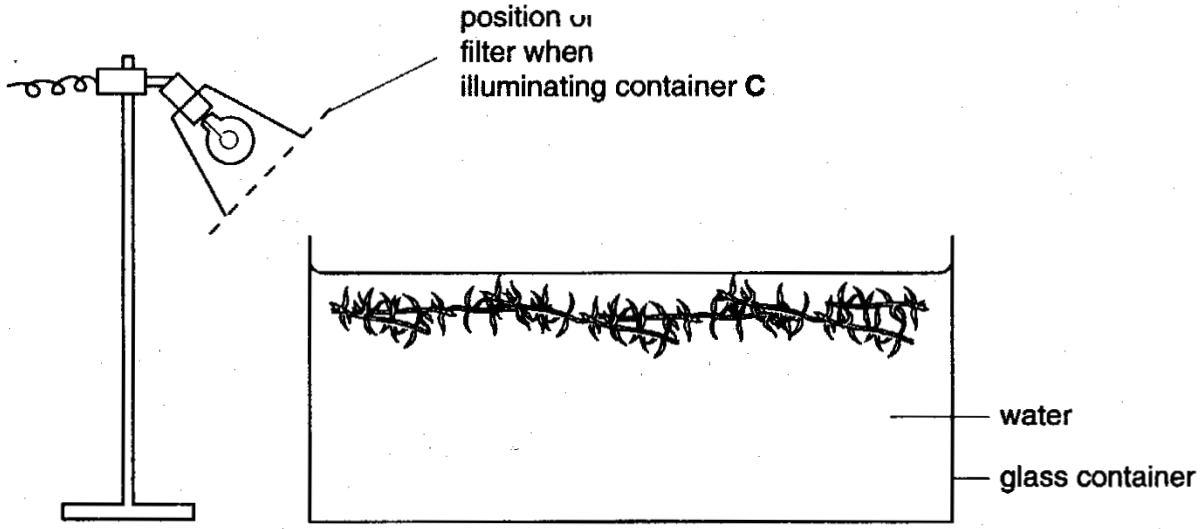

Fig. 5

Container **A** was lit by a 250 W bulb, **B** was li by a 75 W bulb and **C** was lit by a 250 W bulb with a coloured filter in front of the lamp, as shown in Fig. 5

At weekly intervals, the plants were removed from each container in turn, gently dried, weighed and returned to the containers after their mass had been recorded. Fig. 6 shows the results plotted on a graph.

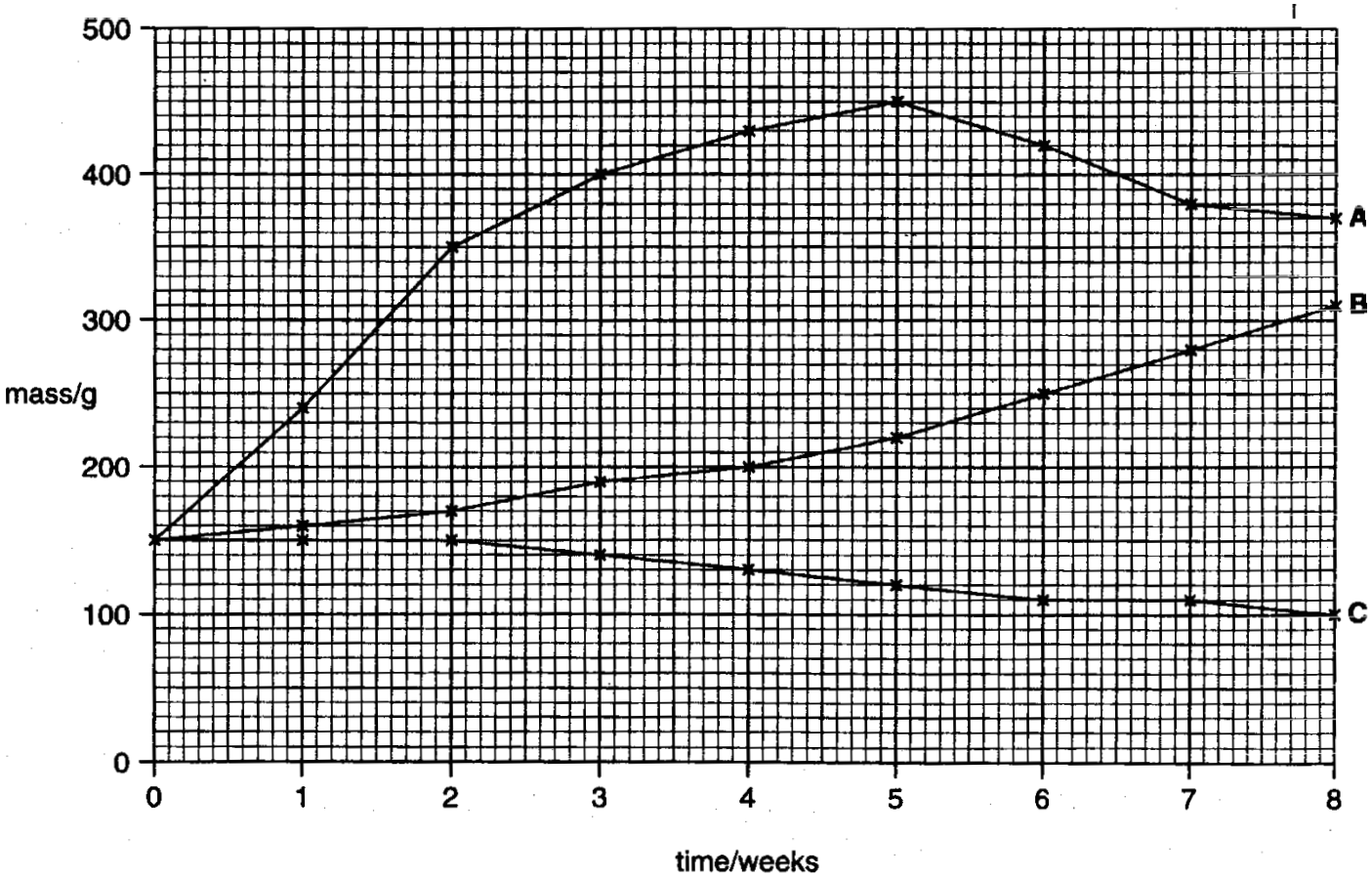

Fig. 6

Extension 3

(a) With reference to Fig. 6 calculate the percentage increase in mass of the plants in container **A** during the first five weeks of the experiment. (Show your working.)

% increase .....[2]

(b) Suggest why the mass of plants in container **A** began to decrease after week 5, while the mass of plants in **B** continued to increase.

Container **A** .....

.....

Container **B** .....

.....[2]

(c) During the eighth week, in which container would there be the least dissolved oxygen? Explain your answer.

Container .....

Explanation .....

.....[2]

Core 1

a any three of these
- light intensity increases
- the stomata open
- increase in temperature
- greater rate of evaporation / transpiration / diffusion

b factor- temperature

explanation- as light decreases the rate of loss continues to rise / temperature and water loss curves peak at the similar time

c prediction- rate of water loss / transpiration falls / lower

explanation- air saturated / humid (thus less evaporation)

Core 2

a(i) $6CO_2$ / carbon dioxide
$6O_2$ / oxygen

(ii) sun / solar / sunlight

(iii) chlorophyll

(iv) magnesium / iron / nitrate / ammonium

b(i) phloem

(ii) starch is insoluble
has no osmotic effect / easier to retain in storage / prevent it being moved

(iii) cellulose

Alternative to Practical 1

a A respiration / use of oxygen

B transpiration / uptake of water / water loss

C photosynthesis

b(i) carbon dioxide / CO_2

(ii) one from
- glass beads
- stones
- empty tube
- boiled, sterile, dry or dead seeds

c one from

moving air / wind / fan / dry air	speed up process
enclosed in a bag / increase humidity	slow process
cold air	slow process
hot air	speed up process
in darkness	slow process
in light / sunny	speed up process

d(i) oxygen / O_2

(ii) any one of these

light-intensity	fixed position of bulb / keep light on / same wattage /
temperature-	heat shield / in water bath / heat filter
carbon dioxide-	add hydrogen carbonate to water
biotic idea-	use same piece of waterweed

Extension 1

a any two from
presence of segmented body or abdomen
presence of jointed limbs or appendages
presence of head or eyes
presence of exoskeleton

b tissue phloem / sieve tubes
processes reference to translocation
reference to active transport or active uptake

c(i) sap vacuole gets smaller / shrinks / loses water / reference to increase in concentration
cytoplasm moves away from (cell) wall
cell wall no longer curves outwards

(ii) any three points
water potential in vacuole / cell is higher than outside
due to lower concentration of sugar molecules / higher concentration if water molecules in vacuole / cell
so water moves out by osmosis
through (cell) membrane

d pesticides are absorbed into the leaf / plant / stem
aphids feed on / suck / remove poisonous sap

Extension 2

a
A stoma / stomatal pore
B guard cell
C epidermal cell / epidermis

b
upper surface
C.Fistula has 18 stomata while B.Monhandra has none
lower surface
C.Fistula has no stomata while B.Monhandra has 22

c(i) three of these points
water is only lost if stomata are present
stomata open during the day
so water (vapour) is lost
reference to transpiration

(ii) stomata are closed at night

d any three of these points
reference to xylem
water enters xylem vessel through pots in walls
reference to transpiration stream / pull
reference to capillary action
reference to root pressure

e(i) rate will decrease
reference to smaller gradient for diffusion

(ii) rate will increase
more energy for evaporation
warm air can hold more water vapour than cold air

Extension 3

a $\frac{300}{150} \times 100$
= 200%

b container A
- depletion of salts / nutrients
- seeds released
- disease
- shortage of carbon dioxide
- reached end of life cycle

container B
- photosynthesis
- growth
- nutrients not exhausted
- food stores
- sufficient carbon dioxide

c container C
least or no photosynthesis occurring
respiration exceeds photosynthesis
death of plant so bacteria active, using up oxygen