

LEARNING OUTCOMES

At the end of this topic you should be able to:

- define the term *photosynthesis*
- state the source of energy, the raw materials and the products of photosynthesis
- write word and balanced chemical equations for photosynthesis
- state the role of chlorophyll in photosynthesis
- describe the fate of the products of photosynthesis.



Figure 4.2.1 In bright sunshine the freshwater plant, *Elodea*, releases bubbles of gas rich in oxygen.

STUDY FOCUS

You should learn these two equations, but realise they summarise many reactions that occur within chloroplasts. In one of these reactions carbon dioxide gains electrons. These come from the splitting of water. A reaction where a substance gains electrons is called a *reduction reaction*.

Water weeds oxygenate the water in fish tanks, ponds, lakes and rivers. During daylight hours they release bubbles of gas that are rich in oxygen – the waste product of photosynthesis (Figure 4.2.1).

Photosynthesis is a process that uses light energy to drive chemical reactions in which carbon dioxide and water are changed to glucose and oxygen.

Light is absorbed by **chlorophyll**, a green pigment which is found only in chloroplasts.

The process is summarised in this word equation:



The chemical equation for photosynthesis is:



In the process of photosynthesis, carbon dioxide and water diffuse into chloroplasts. Chlorophyll absorbs light to split water to form hydrogen ions, electrons and oxygen. These ions and electrons are used to reduce carbon dioxide to a simple sugar.

The simple sugar produced in photosynthesis is used to produce a wide range of substances for the plant. Some is respired immediately by cells as it provides the energy needed to keep the cells alive.

The fate of glucose

The plants use the glucose they produce to make:

- **sucrose** – this is transported around the plant in the phloem. It is used in nectar and fleshy fruits to attract animals for pollination and seed dispersal (see 6.8, 9.5 and 9.6)
- **starch** in storage organs, such as seeds, swollen roots (e.g. yams), swollen stems (e.g. Irish potatoes), as a long-term energy store
- **starch** in leaves to store energy for use in respiration at night
- **cellulose** to make cell walls, also used to make fibres in cotton bolls to help seeds disperse in the wind
- **lipids** to make cell membranes and for energy storage, e.g. in seeds.

By combining sugars with nitrogen from nitrate ions, plants can make amino acids and then use them to make proteins, such as enzymes (see 5.3) and carrier proteins in cell membranes (see 3.4).

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