Photosynthesis and nutrition in plants - answers

1 A green plant can make all the substances it needs. It builds up carbohydrates by the process of *photosynthesis*. In this process it combines *water* from the *soil* with *carbon dioxide* from the *air* to form *glucose*. The *energy* needed for this process comes from *sunlight* which is absorbed by the *chlorophyll* in the *chloroplasts* of leaf cells. The waste product of the process is *oxygen.* .

2 $6CO_2 + 6H_2O \longrightarrow C_6H_{12}O_6 + 6O_2$

3 (a) In low light intensities a green plant will be taking in oxygen and giving out carbon dioxide
(b) In bright sunlight a green plant will be taking in carbon dioxide and giving out oxygen.
Note: Water vapour will also be escaping from the leaf; more so in sunlight.

4 A plant respires all the time. During daylight photosynthesis and respiration will be going on at the same time.

5 (a) From glucose, a plant makes the carbohydrates sucrose, starch and cellulose.
(b) Carbohydrate is transported round the plant as sucrose.
(c) The main storage carbohydrate in plants is starch.

6 (a) To make amino acids and proteins from glucose, a plant needs a supply of nitrate (for nitrogen) and sulphate (for sulphur).
(b) These substances come from the soil.

7 (a) To make ATP (adenosine triphosphate) a plant needs a supply of phosphate ions.
(b) To make chlorophyll a plant needs a supply of magnesium ions.

8 NPK compound fertiliser contains nitrogen (N) as nitrate, phosphorus (P) as phosphate and potassium (K) in suitable proportions. Alternatively, ammonium nitrate (NH_4NO_3) may be used as a source of nitrogen, and superphosphates as a source of phosphorus.

9 (a) If a potted plant is kept in darkness for 48 hours, all starch in its leaves should have been converted to sugars and conducted out of the leaves. This is destarching.
(b) To check on the destarching, one of the leaves or part of a leaf should be tested with iodine to make sure the leaf is free from starch.

10 The accumulation of starch in a previously destarched leaf is accepted as evidence that photo-synthesis has occurred.

11 (a) In an experiment to find out whether light is needed for photosynthesis, light should be excluded from a destarched leaf or part of a destarched leaf. After a few hours of sunlight the covered leaf and an exposed leaf (or simply the partly covered leaf) should be tested for starch. Only the parts which received light should go blue with iodine.
(b) The control is the leaf, or part of the leaf, which has not been exposed to light and does not contain starch. Alternatively, if the exclusion of light from the leaf is thought to be the experiment, the parts of the leaf exposed to light constitute the control.

12 (a) If a (suitably prepared) leaf goes blue with iodine, it tells you that starch is present.
(b) Unless the leaf is known to have been free from starch at the beginning of the experiment you cannot conclude that photosynthesis has occurred. The starch might be permanently present in this leaf. Also, in the absence of an experimental design (with a control), there is no telling where the starch has come from. It might have been produced from sucrose which was transported to the leaf from another part of the plant.