

Background information for teachers

Respiration and photosynthesis made easy

Strictly, neither of these words appears on the curriculum for children at this level. However, indirect reference is likely to be made to both processes, so we give these background notes in a way that could be used with children. These are not easy concepts at this level, but it is very important that a suitable approach is adopted and so avoid misconceptions that occur all too frequently at later stages in the study of science (and biology in particular). Teachers may also wish to refer to the General note on 'Food in plants' in the first booklet (*Parts of a plant and their functions*, page 20).

First, it is important to establish that both processes are unique to living organisms. Both processes are concerned with energy; both processes are involved with the exchange of two gases (oxygen and carbon dioxide) and both processes are part of the carbon cycle.

We look at each process in turn, but remember it's all to do with **energy, oxygen and carbon dioxide**. Children should also understand that in science, we link 'food' primarily with it being a source of energy.

Respiration = the way that energy is released from food

Respiration occurs in ALL living organisms ALL the time. When an organism stops respiring, it is no longer alive. Respiration uses food molecules (usually glucose) and releases energy from them. Respiration usually requires oxygen to do this and gives off carbon dioxide. Remember that plants as well as animals carry out respiration and don't confuse 'respiration' with 'breathing' (see extra notes below).

Photosynthesis = the way plants use energy to make food

Photosynthesis occurs ONLY in green plants (and some simple organisms that contain pigments similar to chlorophyll) and ONLY when there is light. The green pigment (chlorophyll) traps the energy in the (sun)light and then uses this energy to build up certain carbohydrates (including glucose). The process of photosynthesis uses carbon dioxide from the air and water inside the plant to make this glucose. The process gives off oxygen and this passes out of the plant into the air. The glucose is the 'food' that has been made and it can then be converted into other substances in the plant (including proteins, fats and other carbohydrates).

Look at the words: **photo + synthesis** (light + building up); **carbo + hydrate** (carbon dioxide + water).

Some extra notes

Respiration

1. The energy released is used in different ways by the living organism – for living processes, moving around, keeping warm, growing, making new substances.
2. People often get confused with 'breathing' and 'respiration' and use the words as if they mean the same thing. Make sure the children understand that in humans, 'breathing' is the way we fill our lungs with air (and so get oxygen into the body) then empty the lungs (and so get rid of the carbon dioxide that has been produced). Plants also need a supply of oxygen and to get rid of carbon dioxide, but the gases pass in and out of the leaf (or other parts of the plant) without any special breathing movements.

Photosynthesis

1. Chlorophyll is the green pigment in plants. Other pigments can trap light energy, and this energy can also contribute to photosynthesis. Some leaves look red because another pigment obscures the green chlorophyll, but the chlorophyll is still there and can trap the light energy for photosynthesis.
2. There is plenty of water already inside the cells of a plant, so the plant does not take in extra water just for photosynthesis.

Gases in and out of a plant – Let’s look more closely at what happens to the gasses involved in photosynthesis in a (green) leaf of a plant. Remember, respiration is going on all the time, so the leaf is using oxygen and giving off carbon dioxide. If it is a bright sunny day, photosynthesis is occurring at the same time. This means the net effect is that the leaf uses carbon dioxide and gives off oxygen. So it probably uses up the carbon dioxide (already inside the leaf) given off from respiration and then takes in more from the air outside the leaf. Similarly, some of the oxygen (from photosynthesis) is used by the plant for respiration and any extra oxygen passes out of the leaf into the air.

Energy capture and release – The process of photosynthesis captures energy in light and converts it into a form that can then be built into food substances. The substances in the plant formed by this process (such as glucose and other carbohydrates) now contain this energy, which is then released in the process of respiration.

Respiration and photosynthesis in a leaf

A summary of these two processes is shown in the box.

| | | | |
|----------------|---------------------------------|---|---------------------------------|
| Respiration | food (glucose) + oxygen | → | energy + carbon dioxide + water |
| Photosynthesis | water + carbon dioxide + energy | → | food (glucose) + oxygen |

The diagram shows you materials needed for respiration and photosynthesis pass into and out of a leaf.

