Colours in Leaves Experiment

Key Stage 3

Scheme of work unit: **9C** Plants and Photosynthesis

Intended learning: Investigate and understand the role of chlorophyll in Photosynthesis

Suggested discussion

- Discuss with children their understanding of what a plant requires in order to grow.
- Describe/discuss in detail the process of Photosynthesis, including main points.

Introduction notes:

- Photosynthesis is the synthesis of triose phosphates, and ultimately starch, glucose and other products, from sunlight, carbon dioxide and water.
- Oxygen is also produced, as a result of splitting water.
- Triose phosphates (G3P) can be used as an immediate food source, or combined and rearranged to form monosaccharide sugars, such as glucose, which can be transported to other cells, or packaged for storage as insoluble polysaccharides such as starch.
- Chlorophyll is vital for photosynthesis. It is a very large molecule that is attached to chloroplasts in leaves.
- Chlorophyll selectively absorbs red/blue light and reflects green light. Hence why the vast majority of leaves appear green, in spring/summer.
- The colours in the leaves are pigments. These are coloured molecules that are insoluble in the liquid inside the leaf (though they may be soluble in other liquids).
- When the amount of chlorophyll in the leaf reduces in autumn/winter, we see the colours of the other pigments in the leaf.
- Carotene is a large molecule found in chloroplasts that absorbs blue-green and blue light. The light reflected appears to be yellow.
- In some trees, the concentration of sugar in the leaf increases. The sugar reacts to form anthocyanins. Anthocyanin is a molecule that absorbs blue, blue-green and green light, appearing to be red/brown in colour.
- Nb: Pigments are insoluble in their vehicle, i.e. chlorophyll is a pigment in the leaf, but is soluble in water outside the leaf, so becomes a dye.

Resources required:

- Leaves from 2 different deciduous (colour changing) trees
- 2 large leaves or 4 small leaves per container
- Sample containers
- Parafilm or clingfilm
- Warm ethanol
- Filter paper
- Pencils

Practical notes:

Care needs to be taken to ensure the water is not too warm as to scald the pupils. Containers should ideally be long and thin – we have successfully used sample vials. Ethanol should not be ingested.

Further work:

From what pupils understand about absorption and refection of light, ask questions about the copper beech tree, which has purple/black leaves. Leaves are different colour to normal green leaves, because they contain "green chlorphyll", so the light reflected is different from the normal chlorophyll found in most trees and plants (purple/black). See if pupils are able to identify the reason for seeing the different colour is because the chlorophyll is absorbing and reflecting different light colours.

Ask pupils to think about why leaves are a darker colour on the surface than underneath.

The reason is the leaf needs to absorb as much light as possible, so has a much higher concentration of chlorophyll on the surface of the leaf, where it is more likely to catch the most sunlight.

Answers:

1. Light irradiance and wavelength, carbon dioxide and temperature.
2. A pigment is a material that changes the colour of light it reflects as the result of selective colour absorption.
   Because they are insoluble in the vehicle (the leaf). They are only soluble when they are removed from the vehicle.
3. The shortening days and cool nights of autumn trigger a change in the plant/tree. The plant requires less food in winter, so the amount of chlorophyll required decreases. It is the chlorophyll that provides the green colour we see, so the green colour fades and the leaves change colour.
4. Monosaccharides are the simplest form of carbohydrates. They consist of one sugar and are usually colourless, water-soluble, crystalline solids. Some monosaccharides have a sweet taste.
   Glucose, fructose, galactose, ribose.
5. Triose phosphates: Ultimately starch, glucose, oxygen and water.