

Learning Intention Expanding knowledge and understanding of our natural world.	Curriculum Outcomes <u>Science</u> ST2 - 1WS-S -questions, plans and conducts scientific investigations, collects and summarises data and communicates using scientific representations. ST3-4LW-S - examines how the environment affects growth, survival and adaptation of living things. ST3 - 1WS-S -plans and conducts scientific investigations to answer testable questions, and collects and summarises data to communicate conclusions.	
Lesson 1 - Plants - Content Plants are really important for our planet Earth and for all living things. Living things need plants to live - they eat them and live in them. Plants help to clean water also. Plants absorb carbon dioxide and release oxygen from their leaves, which humans and other animals need to breathe in a process called PHOTOSYTHESIS		Activities 1A – What is photosynthesis? 1B – What is chlorophyll? 1C – Why do
Online Links (optional) https://www.youtube.com/watch?v=UPBMG5EYydo Search the internet for these words - photosynthesis; stomata; chlorophyll, chloroplasts. https://www.youtube.com/watch?v=D1Ymc311XS8 https://www.youtube.com/watch?v=OnRS2Dt4ww0 https://www.thenakedscientists.com/get-naked/experiments/chlorophyll-chromatography		ic - Wny do some trees' leaves change colour in winter.

1A) What is PHOTOSYNTHESIS?

Humans are animals and we know this because like all animals, humans inhale oxygen and exhale carbon dioxide. Humans eat plants, and some humans eat meat. Plants however get their energy via a process called photosynthesis.

Sunlight is energy and **photosynthesis** is the process plants use to take the energy from sunlight and use it to convert carbon dioxide (CO2) and water (H2O) into food. Plants need **water**, **sunlight**, **and carbon dioxide** to live. Plants breathe in carbon dioxide through tiny holes in their leaves called **stomata**. With the energy from the sun, and with water brought up by the roots and transported via stems (trunks and branches), they change the CO2 into sugars (food) for the plant to use. Oxygen is a waste product of this process and are emitted (breathed out) by the plant.



PHOTOSYNTHESIS for all you budding scientists



Photosynthesis means 'putting together with light.' Use the information above and image below to answer these questions. Plants use L_____ from the sun during the day as energy to absorb carbon dioxide through their S______. Chlorophyll in the leaves changes the carbon dioxide into S______. O_____ is a waste product of this process.



PLANT EXPERIMENT - CREATING OXYGEN

Plants provide us with oxygen (air) to breathe.

Nearly a quarter of the air that we breathe is oxygen. After we breathe in oxygen we exhale carbon dioxide. Carbon dioxide is needed by plants for them to live. In these experiment you will see how a leaf creates oxygen that we breathe from sunlight.



MATERIALS

- Green leaf
- Clear glass
- Water
- Sunlight
- Small hand lens optional

DIRECTIONS

- 1. Cut a green leaf off a plant and fill a glass with water.
- 2. Place the leaf in the glass and put glass containing the leaf in a sunny location.
- 3. Write down what you think will happen (your prediction) below.
- 4. After an hour carefully look at the leaf and side of the glass.
- 5. You should be able to see lots of tiny bubbles that have formed on the edges of the plant and on the side of the glass. If you are having a hard time seeing the bubbles you might get a small hand lens to observe the edges of the leaf.

Write your prediction (What I think will happen) below

Time your experiment. After an hour draw what you see and label the parts – glass, leaf, water, bubbles.

SCIENCE BEHIND THE EXPERIMENT

The bubbles you see on the leaf and sides of the glass were oxygen bubbles. Leaves take in carbon dioxide and through the process of **photosynthesis** they create food for the plant.

Oxygen is a waste product of this process of this and goes into the air. The air we breathe contains 21% oxygen produced by plants. Without plants we would not have enough oxygen to live.

Extension - Extend this experiment

- 1. Leave the plant in the sunlight for several more hours. Do the bubbles increase or decrease.
- 2. Take two glasses of water and place a fresh leaf in each one. Place one leaf in a dark area and the other in sunlight for two hours and then observe how much oxygen each leaf produced.

https://www.kids-fun-science.com/plant-experiments.html

1B) PHOTOSYNTHESIS occurs only in plants that contain CHLOROPHYLL. What is CHLOROPHYLL?

CHLOROPHYLL is an amazing green chemical that lives inside **CHLOROPLASTS**. Chlorophyll absorbs the sunlight and uses this energy to combine carbon dioxide and water to make sugar and oxygen. Green plants use the sugar to make plant food. There are tiny pores called **stomota**. Carbon dioxide and oxygen enter and leave through the stomata.



Looking through a microscope at a thin section of a leaf will reveal cells containing what looks like little green jellybeans. These jellybean-appearing structures within the cell are called chloroplasts. They are full of chlorophyll. During photosynthesis chlorophyll, carbon dioxide, water, and light-energy from the sun are used to make the sugar-like food that becomes the basic source of energy for the plant and other living things that might eat the plant. While making this food, the green plant gives off water vapour and oxygen as waste products of the process.

This amazing green chemical stored in the cells of green plants lets plants make their own food! This chemical is called chlorophyll.

Beat-a-leaf Experiment

1. Use 2 pieces of clean white paper, one on top of the other.

2. Collect a fresh, green leaf. Place it between the sheets of paper, on top of a hard surface.



3. Use a hammer and gently beat the paper over the leaf to break the chloroplasts. Follow the contour of the leaf to get the best leaf print. As the cell structures are broken, the pigments in the leaf will stain the paper. Careful beating can actually "trace" the leaf on the fabric with pigment. The green chlorophyll forced out of the chloroplasts will leave an imprint of the leaf shape.

5. After beating, lift the top page and gently pull off any "clinging" leaf pieces.



Extension- Find a purple leaf and repeat experiment. What colour is the imprint?

1C - Why do some trees' leaves change colour in winter.

There are 4 compounds that can occur in leaves that give it its colour - chlorophyll, xanthophylls, carotenoids, and anthocyanins. The main one is chlorophyll and that is what gives leaves its green colour. Other compounds are xanthophylls which give the leaf its yellow hue, the carotenoids which give leaves their yellow and orange hues and anthocyanins which give leaves a reddish hue. In winter deciduous leaves respond to days with less sunlight by pulling the chlorophyll into the stems, branches and trunks to be used in Spring in new leaves. This allows the carotenoids (yellow/orange), xanthophylls (yellow) and anthocyanin (red) hues to show.

Experiment - Separating colour pigment from leaves - chromography

Ingredients

Thick paper towel Nail polish remover which contains acetone A clear glass jar without a lid Leaves (ideally thin but still juicy leaves). A small coin

Instructions

1. Cut a piece of paper towel about 2cm wide and a bit longer than your jar is tall.



- 2. Place your leaf over the top of the strip and scrape the coin across leaf and a blob of green squished out of the leaf off onto the strip about 2cm from the bottom. Leave the juice blob to dry out.
- 3. Put acetone (nail varnish remover) in the bottom of your jar, half a cm is plenty.



4. Suspend your strip of paper so the bottom end is sticking a few mm into the acetone. Fold the top end of the strip over forming a hook which will rest over the lip of the jar.



- 5. Wait a few minutes.
- 6. You should be able to see the colour travel up the paper.

Draw your experiment results in the box below. Label your plant, the objects you used in your experiment, the results and what pigments you found in your leaf.

Result

You should find that the acetone slowly rises up the paper, and when it reaches the green mark it takes some of the colour with it, and separating out the colours. Check after an hour.





Hints:

- Chromatography depends on the type of paper you are using and the solvent you are using, so if it doesn't work try a different type of paper.

- Don't let the paper touch the side of your jar.

Different colour leaves will show they still contain green pigments – the chlorophyll – this is so they can still photosynthesize.

Explanation

This is a technique called chromatography, it works because when you put the paper into the solvent, the solvent is drawn up into the paper by surface tension. This means that there is a flow of liquid over the paper. Some substances spend more time in the solvent and others spend more time on the paper, so they move at different speeds, and get separated out. The particles of the dyes all start off in one place.

Extension: Repeat the experiment with different coloured leaves