



## Year 1 – Seasons and how they change

### National Curriculum Objectives:

- Observe changes across the four seasons
- Observe and describe weather associated with the seasons and how day length varies.

Pupils should observe and talk about changes in the weather and the seasons. Pupils might work scientifically by: making tables and charts about the weather; and making displays of what happens in the world around them, including day length, as the seasons change.

### Key Ideas

Children need to learn about how a number of things change with the seasons, including the weather, the temperature and the number of daylight hours. They do not need to know why these things change. It would be best to teach these phenomena through exploring the local environment rather than on topics to do with *Earth and space*.

### Assessment

- Can they observe changes across the four seasons?
- Can they name the four seasons in order?
- Can they observe and describe weather associated with the seasons?
- Can they observe and describe how day length varies?
- Can they talk about what they see, touch, smell, hear or taste?
- Can they use simple equipment to help them make observations?

### Greater Depth

- Can they observe features in the environment and explain that these are related to a specific season?
- Can they observe and talk about changes in the weather?

		<ul style="list-style-type: none"> <li>● Can they talk about weather variation in different parts of the world?</li> </ul>
Prior Learning	Being scientists	Vocabulary
<p>In Early Years:</p> <ul style="list-style-type: none"> <li>● Explore the natural world around them</li> </ul> <p>Understand some important changes in the natural world around them, including the seasons.(ELG The Natural World)</p> <ul style="list-style-type: none"> <li>● Observe and explain why certain things may occur (e.g leaves falling off trees, weather changes).</li> <li>● Look closely at similarities, differences, patterns and change.</li> <li>● Comments and questions about the place they live or the natural world.</li> </ul>	<p>Studies</p> <p>Children could carry out a study of the environment over the entire year. This should be carried out in both Year 1 and 2 to embed the ideas of change. Children should draw conclusions from what they find and make suggestions for how they expect things to change. In tracking temperature and rainfall, pupils can make suggestions for why certain things happen and certain times in the year. Tipping points of temperature are vital as two degree change can impact a wide range of organisms meaning they are no longer visibly present in the local area.</p>	<p>Seasons, spring, summer, autumn, winter, windy, sunny, overcast, snow, rain, temperature</p>
	<p>Why do more frequent days of rain saturate the ground? How long does it take for the ground to dry after it has been raining? (Does more water take longer to dry?) Do countries with a higher temperature have less rain? (compare UK and one other country as a minimum) Track rain fall and temperature in different areas of the school grounds.</p> <p>Investigate the properties of leaves (Which leaf is strongest? Which is most effective at shade cover? Which is most effective at directing water? Which turns brown quickest? What do you notice about the different leaves? What purpose to leaves serve for the tree? Why do you think leaves turn brown in Winter?</p> <p>And down came the rain (<i>What effect does rain have on the environment? How might it be change on different soil types? How does it differ in the nature trail? What would the effect on the environment be if there was too much rain? What would the effect on the environment be if there was not enough rain?</i>)</p>	

**In Year 3:**

- Recognise that they need light in order to see things and that dark is the absence of light.
- Notice that light is reflected from surfaces. ● Recognise that light from the sun can be dangerous and that there are ways to protect their eyes.
- Recognise that shadows are formed when the light from a light source is blocked by a solid object.
- Find patterns in the way that the sizes of shadows change.

## Year 3 – Light and Sight

**National Curriculum Objectives:**

- Recognise that they need light in order to see things and that dark is the absence of light.
- Notice that light is reflected from surfaces.
- Recognise that light from the sun can be dangerous and that there are ways to protect their eyes.
- Recognise that shadows are formed when the light from a light source is blocked by a solid object.
- Find patterns in the way that the sizes of shadows change.

Pupils should explore what happens when light reflects off a mirror or other reflective surfaces, including playing mirror games to help them to answer questions about how light behaves. They should think about why it is important to protect their eyes from bright lights. They should look for, and measure, shadows, and find out how they are formed and what might cause the shadows to change. Pupils might work scientifically by: looking for patterns in what happens to shadows when the light source moves or the distance between the light source and the object changes.

**Key Ideas:**

- There must be light for us to see. Without light it is dark.
- We need light to see things even shiny things.
- Transparent materials let light through them and opaque materials don't let light through.
- Beams of light bounce off some materials (reflection).
- Shiny materials reflect light beams better than non-shiny materials.
- Light comes from a source.

**Assessment**

- Can they recognise that they need light in order to see things?
- Can they recognise that dark is the absence of light?
- Can they notice that light is reflected from surfaces?
- Can they recognise that light from the sun can be dangerous and that there are ways to protect their eyes?
- Can they recognise that shadows are formed when the light from a light source is blocked by a solid object?
- Can they find patterns in the way that the size of shadows change?
- Can they explain the difference between transparent, translucent and opaque?

- Can they set up a simple fair test to make comparisons?
- Can they describe what they have found using scientific language?
- Can they record their observations in different ways? - Labelled diagrams, charts etc.

Greater Depth

- Can they explain why lights need to be bright or dimmer according to need?
- Can they say what happens to the electricity when more batteries are added?
- Can they explain why their shadow changes when the light source is moved closer or further from the object?

Prior Learning	Being scientists	Vocabulary
<p>In Year 1:</p> <ul style="list-style-type: none"> <li>• Name the seasons and know about the type of weather in each season</li> <li>• May have some knowledge of where light comes from.</li> <li>• Will most likely have seen their shadows and may know they appear when it is sunny.</li> <li>• Some understanding of a reflection.</li> <li>• May understand they need light to be able to see thin</li> </ul>	<ul style="list-style-type: none"> <li>• The shiny coin problem. A coin is lost what would be the best way to find it, turn out the lights and see it shine or use a torch to see it reflect?</li> <li>• How does the distance from a light source affect how bright it looks?</li> <li>• How does being in darkness affect your sense of hearing? Is this how nocturnal animals survive?</li> <li>• What colour would be best to make a safety jacket from? How does the colour of a material affect how reflective it is?</li> <li>• What would be the best material to make a blind for a baby's room? How does the thickness or colour of a material affect how much light can pass through it.</li> <li>• How many pieces of tracing paper are as translucent as a single piece of white paper?</li> <li>• How does the size of a candle affect its brightness?</li> <li>• How does the shape of a mirror affect how the light reflects?</li> <li>• How does polishing a piece of dirty metal affect how light behaves when it hits it?</li> </ul>	<p>Light source, dark, reflect, ray, mirror, bounce, visible, beam, sun, glare, travel, straight, opaque, shadow, block, transparent, translucent</p>
<p>In Year 6:</p> <ul style="list-style-type: none"> <li>• Recognise that light appears to travel in straight lines.</li> <li>• Use the idea that light travels in straight lines to explain that objects are seen because they give out or reflect light into the eye.</li> <li>• Explain that we see things because light travels from light sources to our eyes or from light sources to objects and then to our eyes.</li> <li>• Use the idea that light travels in straight lines to explain why shadows have the same shape as the objects that cast them.</li> </ul>		

- Know how simple optical instruments work, e.g. periscope, telescope, binoculars, mirror, magnifying glass etc.

## Year 4 - Sound

### National Curriculum Objectives:

- Know how sound is made associating some of them with vibrating.
- Recognise that vibrations from sounds travel through a medium to the ear.
- Find patterns between the pitch of a sound and features of the object that produced it.
- Find patterns between the volume of a sound and the strength of the vibrations that produced it.
- Recognise that sounds get fainter as the distance from the sound source increases.

Pupils should explore and identify the way sound is made through vibration in a range of different musical instruments from around the world; and find out how the pitch and volume of sounds can be changed in a variety of ways. Pupils might work scientifically by: finding patterns in the sounds that are made by different objects such as saucepan lids of different sizes or elastic bands of different thicknesses. They might make earmuffs from a variety of different materials to investigate which provides the best insulation against sound. They could make and play their own instruments by using what they have found out about pitch and volume.

### Key Ideas:

- Sound travels from its source in all directions and we hear it when it travels to our ears.
- Sound travel can be blocked.
- Sound spreads out as it travels.
- Changing the shape, size and material of an object will change the sound it produces.
- Sound is produced when an object vibrates.
- Sound moves through all materials by making them vibrate.
- Changing the way an object vibrates changes its sound.
- Bigger vibrations produce louder sounds and smaller vibrations produce quieter sounds.
- Faster vibrations (higher frequencies) produce higher pitched sounds.

### Assessment

- Can they describe a range of sounds and explain how they are made?
- Can they associate some sounds with something vibrating?
- Can they compare sources of sound and explain how the sounds differ?
- Can they explain how to change a sound (louder/softer)?
- Can they recognise how vibrations from sound travel through a medium to an ear?
- Can they describe the relationship between the pitch of the sound and the features of its source/object that produces it?
- Can they find patterns between the volume of the sound and the strength of the vibrations that produced it, and the distance of the source?
- Can they investigate how different materials can affect the pitch and volume of sounds?

		<ul style="list-style-type: none"> <li>● Can they plan and set up a fair test and isolate variables, explaining why it was fair and which variables have been isolated?</li> <li>● Can they decide which information needs to be collected and decide the best way for collecting it?</li> <li>● Can they evaluate what they have found using scientific language, drawings, labelled diagrams, bar charts and tables?</li> </ul> <p><u>Greater Depth</u></p> <ul style="list-style-type: none"> <li>● Can they explain why sound gets fainter or louder according to the distance?</li> <li>● Can they explain how pitch and volume can be changed in a variety of ways?</li> <li>● Can they work out which materials give the best insulation for sound?</li> </ul>
Prior Learning	Being scientists	Vocabulary
<p>In KS1:</p> <ul style="list-style-type: none"> <li>● May have some understanding that objects make different sounds.</li> <li>● Some understanding that they use their ears to hear sounds.</li> <li>● Know about their different senses.</li> </ul>	<p>Given a variety of objects (e.g. water in bottles, elastic bands, rulers, tuning forks, those wind up music box things). Children try and change the pitch of the notes and try and summarise what they have found.</p> <ul style="list-style-type: none"> <li>● If the volume of a sound decreases with distance what happens to it? If it spreads out how could you prove it?</li> <li>● How does the size of an ear trumpet affect the volume of sound detected</li> </ul> <p>How does the type of material affect how well it blocks sound?</p> <ul style="list-style-type: none"> <li>● How does the thickness of a material affect how well it blocks sound?</li> <li>● Which materials vibrate better and produce louder sounds? Can we identify any patterns?</li> <li>● Which materials make the best string telephone components? Tin cans, plastic cups, paper cups; or for the cable wire, string or elastic. Predict and test</li> </ul> <p>Blow up a balloon with a 10p coin inside it. Swirl the balloon so the coin rolls around the inside (not slides). See clip <a href="https://www.youtube.com/watch?v=aAMW_3kWUe">https://www.youtube.com/watch?v=aAMW_3kWUe</a> Challenge children to use their knowledge of pitch and volume to investigate what made the squealing noise.</p>	<p>Amplitude, volume, quiet, loud, ear, pitch, high, low, particles, instruments, wave</p>

	<ul style="list-style-type: none"> <li>• Make a straw oboe. See clip <a href="https://www.youtube.com/watch?v=yCmXhDZhqKQ">https://www.youtube.com/watch?v=yCmXhDZhqKQ</a> There are many exciting investigations this can be used for, a simple one is how does the length of the tube affect the pitch and volume?</li> <li>• Partially fill a glass bottle (or use test tubes) with water. Tap it to make a sound and blow across it to make a sound. What is vibrating to make the sound in each case? Plan and carry out an investigation to find out.</li> <li>• Can you predict the relative pitch of tuning forks from the patterns of ripples they make when struck and placed in water</li> </ul>	
<p>In KS3:</p> <ul style="list-style-type: none"> <li>• frequencies of sound waves, measured in hertz (Hz); echoes, reflection and absorption of sound</li> <li>• sound needs a medium to travel, the speed of sound in air, in water, in solids</li> <li>• sound produced by vibrations of objects, in loud speakers, detected by their effects on microphone diaphragm and the ear drum; sound waves are longitudinal</li> <li>• auditory range of humans and animals</li> </ul>		

## Year 6 – Light and how it travels.

### National Curriculum Objectives:

- Recognise that light appears to travel in straight lines.
- Use the idea that light travels in straight lines to explain that objects are seen because they give out or reflect light into the eye.
- Explain that we see things because light travels from light sources to our eyes or from light sources to objects and then to our eyes.
- Use the idea that light travels in straight lines to explain why shadows have the same shape as the objects that cast them.
- Know how simple optical instruments work, e.g. periscope, telescope, binoculars, mirror, magnifying glass etc.

Pupils should build on the work on light in year 3, exploring the way that light behaves, including light sources, reflection and shadows. They should talk about what happens and make predictions. Pupils might work scientifically by: deciding where to place rear-view mirrors on cars; designing and making a periscope and using the idea that light appears to travel in straight lines to explain how it works. They might investigate the relationship between light sources, objects and shadows by using shadow puppets. They could extend their experience of light by looking at a range of phenomena including rainbows, colours on soap bubbles, objects looking bent in water and coloured filters.

### Key Ideas:

- Animals see light sources when light travels from the source into their eyes.
- Animals see objects when light is reflected off that object and enters their eyes.
- Light reflects off all objects (unless they are black). Non shiny surfaces scatter the light so we don't see the beam.
- Light travels in straight lines

### Assessment:

- Can they recognise that light appears to travel in straight lines?
- Can they use the idea that light travels in straight lines to explain that objects are seen because they give out or reflect light into the eye?
- Can they explain that we see things because light travels from light sources to our eyes or from light sources to objects and then to our eyes?
- Can they use the idea that light travels in straight lines to explain why shadows have the same shape as the objects that cast them?
- Can they use a graph to answer scientific questions?
- Can they link what they have found out to other science?
- Can they suggest how to improve their work and say why they think this?
- Can they record more complex data and results?
- Can they draw conclusions from their work?
- Can they report findings from investigations through written explanations and conclusions using appropriate scientific language?

### Greater Depth

- Can they explain how different colours of light can be created?
- Can they use and explain how simple optical instruments work? (periscope, telescope, binoculars, mirror, magnifying glass, Newton's first reflecting telescope)
- Can they explore a range of phenomena, including rainbows, colours on soap bubbles, objects looking bent in water and coloured filters?

Prior Learning	Being scientists	Vocabulary
<p>In Year 3:</p> <ul style="list-style-type: none"> <li>● Recognise that they need light in order to see things and that dark is the absence of light.</li> <li>● Notice that light is reflected from surfaces.</li> <li>● Recognise that light from the sun can be dangerous and that there are ways to protect their eyes.</li> <li>● Recognise that shadows are formed when the light from a light source is blocked by a solid object.</li> <li>● Find patterns in the way that the sizes of shadows change</li> </ul>	<p>Drawing upon idea about light taught in years 3 or 4:</p> <p>a) How does the size of an object affect the size of the shadow?  b) How does the distance between the light and the object affect the size of the shadow?  c) How does the distance between the object and the screen affect the size of the shadow?</p> <ul style="list-style-type: none"> <li>● How would a solar eclipse be different if: <ul style="list-style-type: none"> <li>a) The moon was a different size?</li> <li>b) The earth span faster or slower?</li> <li>c) The sun was large or smaller. d) If the earth and moon were the same size but further away in the solar system.</li> </ul> </li> <li>● Two trees in a field, one in front of the other as below. Predict if where the shadows overlap will be darker, lighter or the same as where they don't and plan an investigation to find out. (Give them card and a torch). To what extent is solid card a good model for a tree? Adapt the experiment to make it a better model; does this affect your conclusion?</li> </ul> <p>How does the amount aluminium foil is crunched affect how much light is scattered?</p> <ul style="list-style-type: none"> <li>● How does the amount of polishing affect how well a piece of metal scatters light?</li> <li>● How perfect are our mirrors? Do some scatter more light than others?</li> <li>● What happens to light when it is shone through water? How is it affected by putting glitter in the water, or salt in the water, or talc in the water?</li> </ul> <p>How does the eye adapt to different light conditions?</p> <ul style="list-style-type: none"> <li>● Predict how nocturnal animals are adapted to living in low light conditions; check predictions through research.</li> <li>● Set up some mirrors so you can see a candle that is hidden behind several corners.</li> <li>● Give children a periscope that doesn't work very well, they work out what is wrong and try to correct it.</li> </ul>	<p>Light source, dark, reflect, ray, mirror, bounce, visible, beam, sun, glare, travel, straight, opaque, shadow, block, transparent, translucent. Reflect Absorb Emitted Scattered Refraction</p>
<p>In KS3:</p> <ul style="list-style-type: none"> <li>● the similarities and differences between light waves and waves in matter</li> <li>● light waves travelling through a vacuum; speed of light</li> <li>● the transmission of light through materials: absorption, diffuse scattering and specular reflection at a surface Science</li> <li>● use of ray model to explain imaging in mirrors, the pinhole camera, the refraction of light and action of convex lens in focusing (qualitative); the human eye</li> <li>● light transferring energy from source to absorber leading to chemical and electrical effects; photo-sensitive material in the retina and in cameras</li> <li>● colours and the different frequencies of light, white light and prisms (qualitative only); differential colour effects in absorption and diffuse reflection</li> </ul>		