

Light and Sound

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.

Note: Pupils should be warned that it is not safe to look directly at the Sun, even when wearing dark glasses.

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*.

Prior Learning	Seasons	Vocabulary			
<p>In Early Years:</p> <ul style="list-style-type: none"> • Developing an understanding of change. • Observe and explain why certain things may occur (e.g leaves falling off trees, weather changes). • Look closely at similarities, differences, patterns and change. • Comments and questions about the place they live or the natural world. 	<p>Longitudinal Studies</p> <p>Children should 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> <table border="1" style="width: 100%; border-collapse: collapse; margin-top: 10px;"> <tr> <td style="width: 33%; padding: 5px;"> 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 other countries as a minium) Track rain fall and temperature in different areas of the school grounds. </td> <td style="width: 33%; padding: 5px;"> Investigate the properties of leaves(which leaf is the stongest? Which is most effective at shade cover? Which is most effective at directing water? Which turns brown the quickest? What do you notice about the different leaves? Use IS car4ds to identify trees in grounds. What purpose do leaves serve for the tree? Why do you think leaves turn brown in winter? Sticky cards - collect colours from outdoors. (Why did you choose that object to add to your card? Why did you select that colour? Would you be able to select that colour in a different season? </td> <td style="width: 33%; padding: 5px;"> And down came the rain (what effect does rain have on the environment? How might it be changed in different soil types? How does it differ in a nature trail? What would the effect be on the environment if there was too much rain? What effect would there be on the environment if there wasn't enough rain? </td> </tr> </table>	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 other countries as a minium) Track rain fall and temperature in different areas of the school grounds.	Investigate the properties of leaves(which leaf is the stongest? Which is most effective at shade cover? Which is most effective at directing water? Which turns brown the quickest? What do you notice about the different leaves? Use IS car4ds to identify trees in grounds. What purpose do leaves serve for the tree? Why do you think leaves turn brown in winter? Sticky cards - collect colours from outdoors. (Why did you choose that object to add to your card? Why did you select that colour? Would you be able to select that colour in a different season?	And down came the rain (what effect does rain have on the environment? How might it be changed in different soil types? How does it differ in a nature trail? What would the effect be on the environment if there was too much rain? What effect would there be on the environment if there wasn't enough rain?	<p>Seasons, spring, summer, autumn, winter, windy, sunny, overcast, snow, rain, temperature</p>
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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.

Note: Pupils should be warned that it is not safe to look directly at the Sun, even when wearing dark glasses.

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.

Prior Learning	Light		Vocabulary
<p>In Year 1:</p> <ul style="list-style-type: none"> Name the seasons and know about the type of weather in each season May have some knowledge of where light comes from. Will most likely have seen their shadows and may know they appear when it is sunny. Some understanding of a reflection. May understand they need light to be able to see things. 	<p>Chapter 1: Light and sight</p> <p>We can only see things when there is light and the light had to come from somewhere. All light originally comes from a light source</p> <ul style="list-style-type: none"> 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? How does the distance from a light source affect how bright it looks? How does being in darkness affect your sense of hearing? Is this how nocturnal animals survive? 	<p>Chapter 2: What light does when it hits materials</p> <p>When light hits an object it can do a number of things</p> <ul style="list-style-type: none"> If the object is transparent it will go through it and we will be able to see through it. If the object is opaque it will block the light and no light will get through. If the object is perfectly reflective light will bounce back off it and we will see reflections of objects. <p>If the material is translucent it will allow light through but we won't be able to see through it.</p> <ul style="list-style-type: none"> Give children lots of objects and a torch and they decide if they are transparent, opaque, translucent or reflective (Do they notice that many materials exhibit more than one property or partial properties. Encourage them to think about how they might display this information). What colour would be best to make a safety jacket from? How does the colour of a material affect how reflective it is? 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. How many pieces of tracing paper are as translucent as a single piece of white paper? How does the size of a candle affect its brightness? How does the shape of a mirror affect how the light reflects? How does polishing a piece of dirty metal affect how light behaves when it hits it? 	<p>Light source, dark, reflect, ray, mirror, bounce, visible, beam, sun, glare, travel, straight, opaque, shadow, block, transparent, translucent.</p>

In Year 5:

- 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.

Year 4 – Sound

National Curriculum Objectives:

- Know how sound is made associating some of them with vibrating.
- Know what happens to a sound as it travels from its source to our ears.
- Know the correlation between the volume of a sound and the strength of the vibrations that produced it.
- Know how sound travels from a source to our ears.
- Know the correlation between pitch and the object producing a sound.

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 it's sound.
- Bigger vibrations produce louder sounds and smaller vibrations produce quieter sounds.
- Faster vibrations (higher frequencies) produce higher pitched sounds.

Prior Learning	How sound is made, travels and can be changed.			Vocabulary
In KS1: <ul style="list-style-type: none"> • May have some understanding that objects make different sounds. • Some understanding that they use their ears to hear sounds. • Know about their different senses. 	Chapter 1: Describing sounds <ul style="list-style-type: none"> • Sounds can be made in many different ways and individual sounds have the properties of pitch and volume. • When a sound is made it immediately spreads out in all directions. As it travels its volume decreases but its pitch remains the same. 	Chapter 2: How sounds are made and travel. <ul style="list-style-type: none"> • Sound is made when an object is made to vibrate (move backwards and forwards or up and down). • As the material vibrates it makes whatever it is in contact with vibrate, including air. As the air vibrates it makes whatever it is in contact with vibrate also, which might be a wall or even your eardrum. Sound moves through materials vibrating making other materials they are in contact with vibrate. 	Chapter 3: Why does pitch and volume change? <ul style="list-style-type: none"> • Pitch and volume are determined by how the material vibrates: <ul style="list-style-type: none"> ➢ Pitch is determined by how fast an object vibrates, i.e. the frequency of vibration. The higher the frequency the higher the pitch. ➢ Volume is determined by how big the movement of each vibration is (the amplitude of vibration). The bigger the amplitude the higher the volume. • Smaller objects and tighter strings and surfaces tend to vibrate with a higher frequency. 	Amplitude, volume, quiet, loud, ear, pitch, high, low, particles, instruments, wave.
	<ul style="list-style-type: none"> • 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. • If the volume of a sound decreases with distance what happens to it? If it spreads out how could you prove it? • How does the size of an ear trumpet affect the volume of sound detected? 	<ul style="list-style-type: none"> • How does the type of material affect how well it blocks sound? • How does the thickness of a material affect how well it blocks sound? • Which materials vibrate better and produce louder sounds? Can we identify any patterns? • 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. 	<ul style="list-style-type: none"> • Blow up a balloon with a 10p coin inside it. Swirl the balloon so the coin rolls around the inside (not slides). See clip https://www.youtube.com/watch?v=aAMW_3kUUhE Challenge children to use their knowledge of pitch and volume to investigate what made the squealing noise. • Make a straw oboe. See clip https://www.youtube.com/watch?v=yCmXhDZhqKQ 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? • 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. • Can you predict the relative pitch of tuning forks from the patterns of ripples they make when struck and placed in water? 	
In KS3: <ul style="list-style-type: none"> • frequencies of sound waves, measured in hertz (Hz); echoes, reflection and absorption of sound • sound needs a medium to travel, the speed of sound in air, in water, in solids • sound produced by vibrations of objects, in loud speakers, detected by their effects on microphone diaphragm and the ear drum; sound waves are longitudinal □ auditory range of humans and animals. 				

Year 5 – Light and how it travels.

National Curriculum Objectives: Recognise that light appears to travel in straight lines.

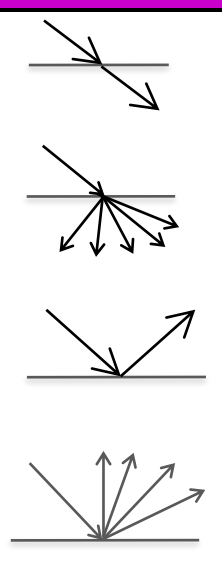
- Use the idea that light travels in straight lines to explain that objects are seen because they give out or reflect light into the eye.
- Explain that we see things because light travels from light sources to our eyes or from light sources to objects and then to our eyes.
- Use the idea that light 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 a range of phenomena including rainbows, colours on soap bubbles, objects looking bent in water and coloured filters (they do not need to explain why these phenomena occur).

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.

Prior Learning	How light behaves and how we see.			Vocabulary	
<p>In Year 3:</p> <ul style="list-style-type: none"> • 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. 	<p>Chapter 1: How light travels</p> <ul style="list-style-type: none"> • When light is emitted from a light source it travels in straight lines until it hits an object. This can be represented by an arrow. • Shadows form when light hits an opaque object, the area behind is in darkness because light can only travel in straight lines 	<p>Chapter 2: How light behaves when it hits objects</p> <ul style="list-style-type: none"> • When light hits a transparent object it goes through it in a straight line so we can see a clear image through it. When light hits a translucent material it goes through it but is scattered, this means light can pass through but we can't see an image through it. • When light hits a mirrored surface it reflects off it in straight lines, so we can see an image in the reflective material Some times when light hits a material it reflects off it in many different directions (it is scattered). In this case light will be reflected but no image will be seen in the material Shiny surfaces are better reflectors and rough surfaces scatter light more. Opaque objects don't allow any light to pass through them. 		<p>Chapter 3: How we see. Animals see objects when light is reflected off the object and enters the eye through the pupil. The pupil changes its size to allow enough, but not too much light into the eye. Too much light damages the eye and too little results in poor quality images.</p>	<p>Light source, dark, reflect, ray, mirror, bounce, visible, beam, sun, glare, travel, straight, opaque, shadow, block, transparent, translucent.</p> <p>Reflect Absorb Emit Scattered Refraction</p>
	<ul style="list-style-type: none"> • Drawing upon idea about light taught in years 3 or 4: <ol style="list-style-type: none"> How does the size of an object affect the size of the shadow? How does the distance between the light and the object affect the size of the shadow? How does the distance between the object and the screen affect the size of the shadow? • How would a solar eclipse be different if: <ol style="list-style-type: none"> The moon was a different size? The earth spin faster or slower? The sun was large or smaller. If the earth and moon were the same size but further away in the solar system. <p>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?</p>	<ul style="list-style-type: none"> • How does the amount aluminium foil is scrunched affect how much light is scattered? • How does the amount of polishing affect how well a piece of metal scatters light? • How perfect are our mirrors? Do some scatter more light than others? • 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? 	<ul style="list-style-type: none"> • How does the eye adapt to different light conditions? • Predict how nocturnal animals are adapted to living in low light conditions; check predictions through research. • Set up some mirrors so you can see a candle that is hidden behind several corners. • Give children a periscope that doesn't work very well, they work out what is wrong and try to correct it. 		

In KS3: the similarities and differences between light waves and waves in matter

- light waves travelling through a vacuum; speed of light
- the transmission of light through materials: absorption, diffuse scattering and specular reflection at a surface Science
- 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 □ light transferring energy from source to absorber leading to chemical and electrical effects; photo-sensitive material in the retina and in cameras □ colours and the different frequencies of light, white light and prisms (qualitative only); differential colour effects in absorption and diffuse reflection.

