

ACET Junior Academies'

Scheme of Work for Science

Big Idea – Electricity, Light & Sound

Year 3 – Light



About this unit:

PoS – Light

This is another unit, like magnets, which can seem like a 'stand-alone' topic, with few links to the rest of the curriculum. However, like magnets, it contains some concepts which are fundamental to students' understanding of science at KS3, 4 and beyond. There is some repetition in the unit, but it's important that the concepts are understood by the students, and that they really get to explore light and how it works. The idea that light travels in straight lines can seem easy to teach, but students should be given the opportunity to explore this, and how it can be applied in different contexts. Students can easily state 'light travels in straight lines', but struggle to apply that knowledge. There are plenty of opportunities here for students to explore light without worrying that they're finding out the 'correct facts' – they will just be working like a scientist to find out what happens when they do different things.

Students will be exploring light again in Y6, where they will look at how shadows change, and investigate the patterns involved more thoroughly. In Y3, students need constant reinforcement and exploration of the fact that light travels in straight lines, and how that affects reflections and shadows.

Important information – our eyes see light, which either shines directly, or is reflected into them. We often teach about 'light', but students think that the images/things that we see are somehow different. Try and emphasise at each stage that anything we can see is just light of different colour going in to our eyes. This is a difficult concept to grasp, and does not need to be taught to Y3 – however beware of them thinking that 'light' and 'what they see' are two different things.

Unit structure

This unit is structured around seven science enquiries:

1. Investigating light
2. Investigating reflections
3. Can reflections be useful?
4. Investigating shadows
5. Investigating shadows made by the sun
6. How did the Egyptians use the sun?
7. Can you tell a story with shadows?

Links to previous and future National Curriculum units

- Y6 - Light

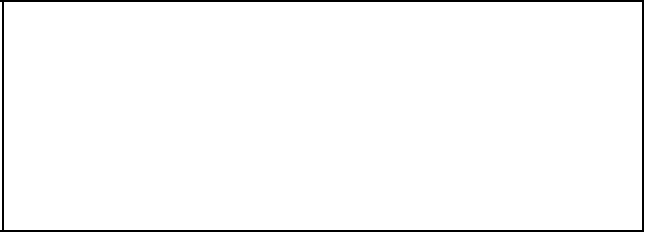
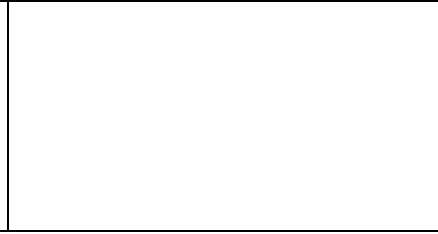
Enquiry 1: Investigating light			
Links to previous learning	Scientific skills	Assessment criteria	Curricular links
Y1 - Seasons	EA – Pattern seeking Asking questions Making predictions Observing & measuring Key concepts: We can only see when there is some light. The more light there is, the better we can see.	Can your children: - Tell you that when there is no light, we can't see - State that we can see better when there is more light	Horizontal: Vertical: Y6 - Light
Key terms		Common misconceptions	
Light, dark, see, more, less		<i>Students don't understand that our eyes are just sophisticated light detectors. When we see objects, we're seeing the light that is bouncing off them.</i>	
Suggested activities		Resources	Useful links
<p>A good place to start is that light is the opposite of dark.</p> <p>Recap from 'materials' – what words would you use to describe the objects in 'resources'? Focusing in particular on their surfaces – are they rough or smooth?</p> <p>Get the students to cover their eyes – what can they see? Nothing – because there's no light. If they can see anything, it's because they are letting light in between their fingers. If possible, go to a dark room to illustrate that we can't see in the dark. Slowly increase light levels, taking note of what can be seen. This is simple, but a really good demonstration of the fact that we need light in order to be able to see.</p> <p>Make a dark box, and investigate what can be seen when you put different objects inside (see 'resources'), and when you vary how much light enters. <i>Students should see that when there is no light, you can't see anything, regardless of what is there. Once there is a little light present, some objects are easier to see than others. Greater depth students can explore this. Most students just need to understand that we can't see without light.</i></p>		<p>Dark woolly jumper, shiny shoes, tissue paper, wooden block, smooth plastic – a variety of objects of different colours and surfaces, which are small enough to fit in your dark box (see activities).</p> <p>How to make a dark box</p>	<p>https://www.bbc.co.uk/bitesize/clips/zjkc87h A good series of images that lead to reinforcement of the idea that we see light. Some light is created by the object we see, and some is reflected.</p>

Enquiry 2: Investigating reflections			
Links to previous learning	Scientific skills	Assessment criteria	Curricular links
	EA – Comparative/fair testing Asking questions Making predictions Setting up tests Observing and measuring Key concepts: Reflect means to bounce off something. Light reflects best off shiny things.	Can your children: <ul style="list-style-type: none"> - State that reflect means to 'bounce off' something - Compare the reflectiveness of a black, white and shiny object 	Horizontal: Vertical: Y6 - Light
Key terms		Common misconceptions	
Light, reflect, bounce, white, black, shiny			
Suggested activities		Resources	Useful links
<p>Place one piece of white card (A) so it stands vertically on the table. This card will not move. Shine the torch on it - does it reflect? Put the other piece of white card (B) about 10cm away – can you see light on it?</p> <p>Discuss/help the students understand that the light on the second piece of card is reflected from the first one. The light is 'bouncing' off the first white surface, and on to the second.</p> <p>Move the second white card (B) away – how far can you move it before you no longer see the light?</p> <p>Cover the first piece (A) with shiny wrapping paper. Compare how the light is reflected on the second card (B). Repeat with the aluminium foil. Students should gain an understanding that some surfaces are more reflective than others. This is a good opportunity for measuring distances, and discussing how to carry out an investigation so that we get meaningful results. What do they have to keep the same each time? – they should ONLY be changing the surface of card A, everything else should stay the same.</p> <p>2a – possible link with bike/walking safety. How easily are you seen at night? They could do the investigation above with a black top, a light coloured top, and a reflective coat. Greater depth – get them to consider the distances – think about how far away a car would have to be before it saw you (relate to the fact that cars have headlights).</p>		<p>Two white cards, 10x10cm, a torch, a 30cm ruler, shiny wrapping paper and aluminium foil for each group.</p> <p>Maybe plastecine to hold the cards vertically. The room needs to be relatively dark.</p>	

Enquiry 3: Can reflections be useful?			
Links to previous learning	Scientific skills	Assessment criteria	Curricular links
	EA – Problem solving Asking questions Making predictions Key concepts: Light only travels in straight lines. We can use mirrors to make light go in different directions.	Can your children: - State that light only travels in straight lines - Explain how you could use mirrors to see round a corner	Horizontal: Vertical: Y6 - Light
Key terms		Common misconceptions	
Light, straight lines, bend, corner, reflect			
Suggested activities		Resources	Useful links
<p>Consider pictures/photos of reflections. Compare reflections in still water to choppy water. Light is always reflected from smooth surfaces, but some are better at reflecting than others.</p> <p>How are mirrors useful? – think of as many ways as possible. Does a mirror show what we really look like? Show the students a photograph of themselves, compared to looking in the mirror (or get some pictures that show the same thing). Let the students explore how left/right are not represented in a mirror as they are in reality.</p> <p>How to use mirrors – can you see the back of your own head? Can you work out how to see the back of your head – you may need a friend to help! Why do cars have mirrors? Why do they have three – couldn't they just have one?</p> <p>The students should have plenty of time to explore mirrors, and to use their own words to explain what mirrors can do – and what they can't do.</p> <p><i>Outcomes for this lesson.</i> Students should begin to see that light can't bend – it only travels in straight lines. This is why you need multiple mirrors.</p> <p>We can't see around corners – because the light from round the corner can't bend to get in our eyes. <i>This is a difficult concept – don't worry about getting students to understand this – but keep reinforcing that what we 'see' is light going in to our eyes. If we can't see somewhere, it's because we</i></p>		Pictures of objects and their reflections. Some pictures showing poor reflections – such as in disturbed water	https://learning-resources.sciencemuseum.org.uk/wp-content/uploads/2019/02/SMG-Learning-Activities-360-Periscope.pdf

can't see the light from there. We just want students to make the link between light/sight, rather than believing that what we see is unrelated to light.

Make a periscope so that you can see what is around the corner. Use the periscope to show that the mirrors let the light travel in straight lines between them to our eyes.



Enquiry 4: Investigating shadows			
Links to previous learning	Scientific skills	Assessment criteria	Curricular links
	EA – Pattern seeking Asking questions Making predictions Observing & measuring	Can your children: - State that shadows are made because light travels in straight lines - Explain why the shape of a shadow may change.	Horizontal: Vertical: Y6 - Light
	Key concepts:		
	Shadows are made because light travels in straight lines. The shape of a shadow will change if you change the angle of the light, because different parts of the object are blocking the light.		
Key terms		Common misconceptions	
Light, shadow, object, blocking, straight line, shape, travels			
Suggested activities		Resources	Useful links
<p>This will need a slightly dark/dim room. Review the fact that light can't bend. Hold up a thick piece of card between a lamp and a plain wall (this may work with a projector and screen). What can you see? What is a shadow?</p> <p>The light is blocked from getting through, and because it can only travel in straight lines, there is no light behind the card. How could light get through? You can cut a hole in the card to show that light will go through, but only in the shape of the hole.</p> <p>When demonstrating this, be sure to have the light source pointing directly at the card, in order to get clear, straight edges. You can explore what happens if you hold the light source at an angle – the shape of the shadow changes. This is because light is passing the edge of the object at an angle – it's still going in straight lines.</p> <p>Students should have two objects – one a regular shape, like a block, the other an irregular shape, like a model dinosaur. Students should explore what happens when they move a torch around – different angles, closer, further. Encourage them to put in to words what they discover. They can draw around the objects – this is a great way of getting them to draw a relatively complicated object like a dinosaur. They can choose how to set it up themselves, so that they get the size/clarity of image they want.</p>		Torches/lamps Small objects – some regular size, some irregular	https://senresourcesblog.com/2018/11/01/dinosaur-shadow-drawing-fun-activity-to-encourage-children-to-draw/

Enquiry 5: Investigating shadows made by the sun			
Links to previous learning	Scientific skills	Assessment criteria	Curricular links
	EA – Pattern seeking Asking questions Making predictions Observing and measuring Interpreting & communicating data Key concepts: The sun is a very powerful light, and looking at it can damage our eyes, even from behind the clouds. Our shadows change during the day and the year, because the angle of the sun changes.	Can your children: <ul style="list-style-type: none"> - Describe the dangers of looking at the sun - Describe how our shadows change during the day 	Horizontal: Art Vertical: Y5 – Earth and Space Y6 - Light
Key terms		Common misconceptions	
Suggested activities		Resources	Useful links
<p>The sun can be dangerous – relate to the use of sunscreen in the summer. Reinforce the idea that our eyes see light – but that the light directly from the sun is too much, and can damage them. Students should understand that damage can occur without feeling pain – relate to sunburn, and how you don't notice it happening. Discuss methods of protecting our eyes – sunglasses and clouds do NOT protect our eyes from the sun – if you can see it's there, you shouldn't look at it.</p> <p>**Go outside and take photographs of the students and their shadows. Do this 2-3 times at different times of the day (make sure the student and photographer are in the same positions) and compare their shadows.</p> <p>Draw around the shadow of a stationary object in an undisturbed, sunny area, in chalk at the beginning of the day. Go out at regular intervals during the day and draw around the shadow. Observe how it changes.</p> <p>State that the Earth is moving in relation to the Sun. This is like changing the angle of the torch shining on something – this could be demonstrated with a globe.</p> <p>Students can draw themselves in chalk. This can be outside, or inside on large paper, using a lamp – you could just draw a profile of their heads, using a lamp. Use the sun/lamp to draw the shadows, then get the students to colour them in. Get them to consider how realistic the proportions are. Is it important to consider where the light is shining from?</p> <p>Can they tell you what the pattern is that they have discovered?</p>		Photographs of the students taken at different times of the day, in the same place. Chalk Lamps Globe	

Enquiry 6: How did the Egyptians use shadows?			
Links to previous learning	Scientific skills	Assessment criteria	Curricular links
	EA – Research Asking questions	Can your children: - Describe what happens to shadows when the angle of a light changes - State that Egyptians used sundials to tell the time	Horizontal: Vertical: Y5 – Earth & Space Y6 - Light
	Key concepts:		
	The sun changes position, which changes the shape of shadows. Egyptians used sundials to tell the time.		
Key terms		Common misconceptions	
Light, shadow, straight line, change, angle, Sun, Earth			
Suggested activities		Resources	Useful links
<p>Using the previous lesson, explore how the Egyptians used sundials.</p> <p>Students should be encouraged to ask questions, and think about what it is they want to research – and how to do it.</p> <p>There is no need to teach in detail the movements of the Earth – the students need to understand that it moves in relation to the Sun, and that this, just like moving the angle of a torch, changes the shadows.</p>			

Enquiry 7: Can you tell a story with shadows?			
Links to previous learning	Scientific skills	Assessment criteria	Curricular links
	EA – Problem solving Asking questions Making predictions	Can your children: - Explain how to make a shadow clearer - Explain how to make a shadow bigger	Horizontal: Vertical: Y6 - Light
	Key concepts:		
	Shadows are clearer when an object is furthest from the light source. Shadows are bigger when an object is closest to the light source.		
Key terms		Common misconceptions	
Light, shadow, straight line, block, bigger, smaller, clearer, fuzzy			
Suggested activities		Resources	Useful links
<p>Make a simple story that can be illustrated using shadow puppets.</p> <p>Students should be given the opportunity to make some characters bigger/scarier than others, and should explore how to do this themselves. They should notice that when a shadow gets bigger, the outline gets fuzzier.</p> <p><i>GD – students could explore the fact that when an object is a long way from a light source, light reflected from other places can get behind the object, which makes it look fuzzy.</i></p>			