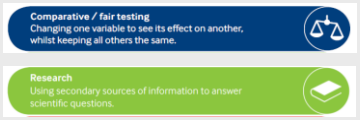
Mendell Primary School

Aspire Challenge Achieve

Medium Term Plan Science

<table>
<tr>
<td>Year Group: 6</td>
<td>Term: Summer 2
Teacher: Sarah Wearing / Dionne Sinatti</td>
<td>Subject lead: Sarah Bride</td>
<td rowspan="2">Overview: Light
• 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.
  </td>
<td rowspan="2">Key End Points: By the end of this unit children will be able to:
•Explain how the shape and size of a shadow are determined
• Explain how moving an object changes the size of its shadow
• Explain how we see light sources and non-light sources
• Explain how a periscope works
• Explain that light travels in a straight line
• Label the main parts of a human eye and explain their functions
• Explain my knowledge of reflection to place mirrors to make light follow a path
• Explain how white light is made up of a spectrum of different colours</td>
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<td colspan="2">Common Misconceptions:
Some children may think:
• we see objects because light travels from our eyes to the object.</td>
<td>Unit key Vocabulary:
As for Year 3 - Light, light source, dark, absence of light, transparent, translucent, opaque, shiny, matt, surface, shadow, reflect, mirror, sunlight, dangerous

Plus: straight lines, light rays</td>
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<td>Links to other learning:</td>
<td>Prior Learning:
Recognise that they need light in order to see things and that dark is the absence of light. (Y3 - Light)
• Notice that light is reflected from surfaces. (Y3 - Light)
• Recognise that light from the sun can be dangerous and that there are ways to protect their eyes. (Y3 - Light)
• Recognise that shadows are formed when the light from a light source is blocked by an opaque object. (Y3 - Light)
• Find patterns in the way that the size of shadows change. (Y3 - Light)
• Compare and group together everyday materials on the basis of their properties, including their hardness, solubility, transparency, conductivity</td>
<td>Future Learning:
The similarities and differences between light waves and waves in matter. (KS3)
• Light waves travelling through a vacuum; speed of light. (KS3)
• The transmission of light through materials: absorption, diffuse scattering and specular reflection at a surface. (KS3)
• 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. (KS3)
• Light transferring energy from source to absorber leading to chemical and electrical effects; photo-sensitive material in the retina and in cameras. (KS3)</td>
<td>High Quality Text:
The Darkest Dark—Chris Hadfield
Orion and the Dark—Emma Yarlet
Scientist to study:

Ibn al-Haytham (Alhazen) (Physicist & Mathematician who developed a theory that light travels in a straight line, and proved it by carrying out the first scientific experiment)
Ibn Sahl - (Mathematician who observed the paths of rays of light as they reflected off different mirrors)</td>
<td>Risk Assessment:</td>
<td>Teacher CPD:

Reach Out CPD - https://www.reachoutcpd.com/ sign up for free.

ASE Plan Muharem work.</td>
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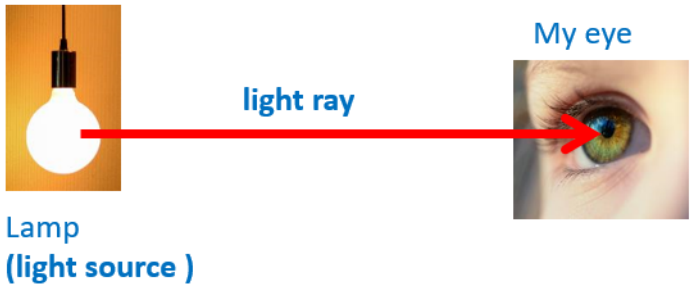
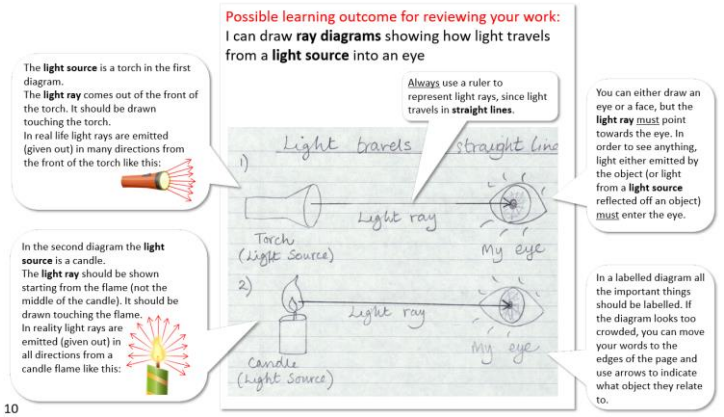
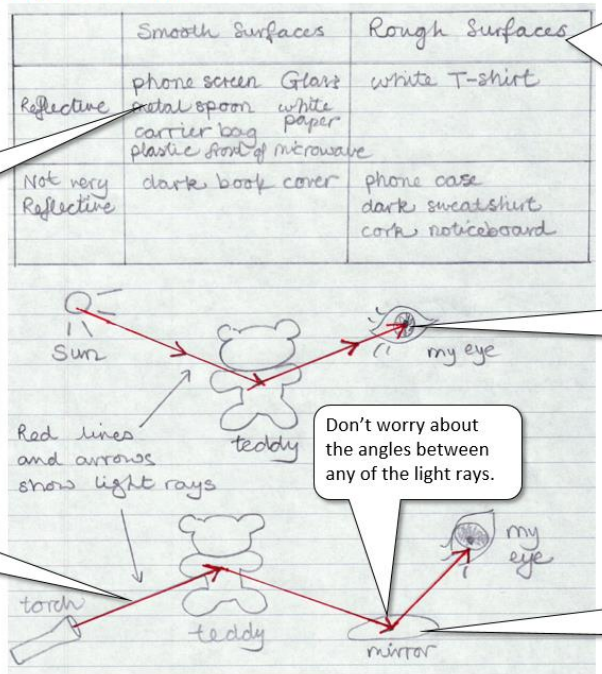
	(electrical and thermal), and response to magnets. **(Y5 - Properties and changes of materials)**	• Colours and the different frequencies of light, white light and prisms (qualitative only); differential colour effects in absorption and diffuse reflection. **(KS3)**			

	Learning Intention	Lesson Outline (Key Questions in colour)	Resources	Vocabulary	Lowest 20% Adaptations
1	L.I. I can draw ray diagrams showing how light travels from a light source into an eye.	**This is a Science lesson. In Science, we study nature and the behaviour of natural things. The skill we will be using this lesson is making observations and recording information** **Pre topic assessment** – What do the children already know about light? Children complete a thought shower of what they already know. Prompt questions: Complete vocabulary assessment on cover page for the unit and repeat in last lesson to show progression. Thought shower will also be added to in final lesson. **Big Question: How does light travel?** **Prior learning vocabulary**: opaque, transparent and translucent – assess the children's recall of meanings. **What do you already know about light and how it travels through materials? –** take initial feedback from the children. To support ideas ask the children to cover their eyes with their hands and then open their eyes. Talk or think about what you see and why. –possible response: Your hands are **opaque**. They block **light** travelling to your eyes, so it's **dark**. Now ask the children to uncover their eyes and look through a window. Talk or think about how things look and why. –possible response: Glass is **transparent**. Light passes through glass easily, so you see a clear **image**. Finally ask the children to hold two plastic cups, one over each eye. **What can you see now?** –possible response: The cups are **translucent**, meaning that they let some light through. What you see is cloudy or blurred. Share the following video about light with the children: https://www.youtube.com/watch?v=a8xt_m4iMYc **What do you already know about how light travels?** – show the children a range of images (see resource PowerPoint) showing light in different ways and ask them to think and talk about what these pictures tell you about how light travels. – take feedback from group discussions. Explain that the children will explore how light travels: Make a tube by rolling up a piece of paper. Hold it up to one eye like a telescope, and close or cover your other eye. Point this at a room light/lamp giving out light (*not the Sun*). Talk or think about what you can see through the tube. The children should realise that You can only see what is directly in line with the tube (and the inside of it). This is	non-opaque coloured plastic cups/bowls Access to a window and an indoor light Resource PowerPoint Classroom objects and materials. Torches	**Dark, image, light, light source, light ray, ray diagram, opaque, translucent, transparent, reflect, scatter, straight lines.**	

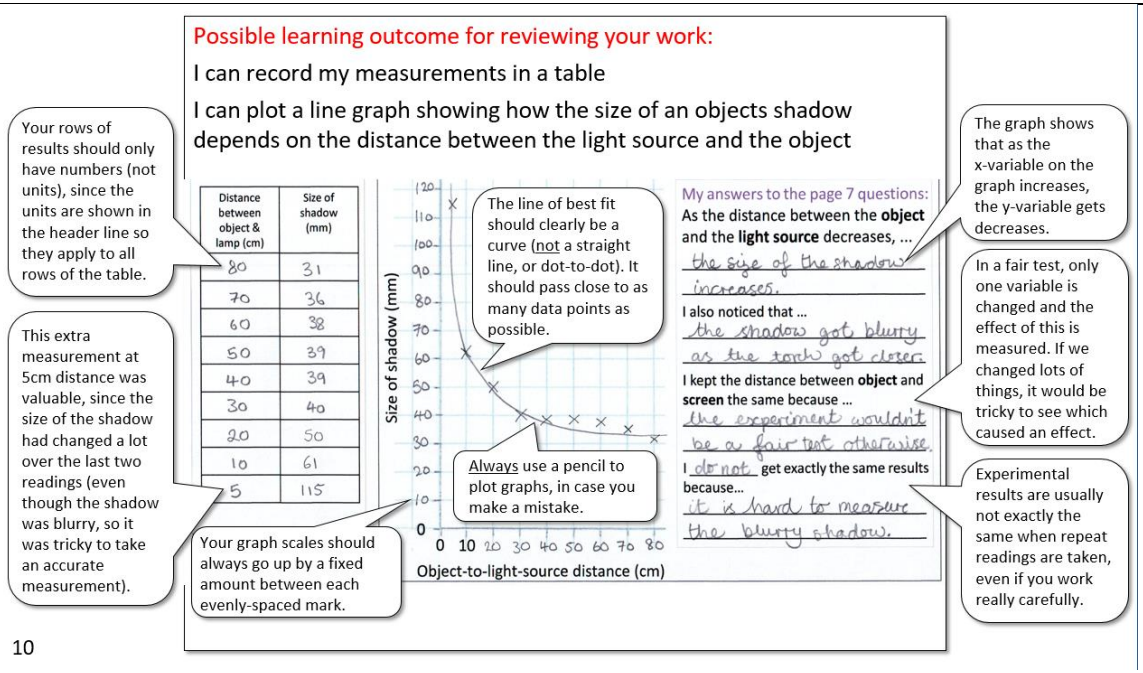
		because light travels in a **straight line**, so the only light entering your eye has travelled along the tube. That's why we can't see round corners. Model to the children how to show this in a ray diagram to show the path of light travelling from a light source to your eye:  **Ask the children what they think the arrow represents?** **Task:** Draw two labelled **ray diagrams** showing how a **light ray** travels in **straight lines** from a **light source** to your eyes. In 1) use a torch for the light source and in 2) a candle. **Taking it further**: Observe a model of light travelling though different types of material**.** Allow the children time to explore what happens to a ray of light when it hits an opaque, translucent and transparent object. Can the children draw ray diagrams to explain their findings? Outcome example:			

					
2	L.I. I can record the results of a reflection investigation in a Carroll diagram. I can draw ray diagrams to show how non-luminous objects are seen directly, and when they are seen reflected in a mirror.	**This is a Science lesson. In Science, we study nature and the behaviour of natural things. The skill we will be using this lesson is making observations and communicating results.** **Prior learning:** **How does light travel?** **Name three light sources?** **What part of the body does light enter?** **Word of the week: reflection** **Big Question: How is light reflected?** **What do you already know about the reflection of light?** Jot down a list of the following and talk or think about what they are made of: • Five shiny objects (e.g. a metal spoon) • Five matt objects (e.g. a piece of paper) • Five luminous objects (e.g. a candle) Show the children three images: the moon, high vis jacket and cats eyes and ask them to think or talk about whether each of these is **luminous** or a good **reflector**? Take feedback from the class – see suggested responses on the resource PowerPoint. The moon, hi-vis jacket and cat's eyes are all excellent reflectors; they do not emit light. Watch:www.bbc.co.uk/bitesize/clips/zs3ygk7 **Task:** Investigate the reflective properties of objects.	Torches Resource PowerPoint Teddy bear or similar object. mirrors	**Carroll diagram, light, light source, luminous, matt, mirror, ray diagram, reflect, scatter, shiny, straight lines, surface.**	

		Investigate **reflection** by shining a torch on various objects/surfaces around the room to see how bright the circle of light looks on each of them. Children could investigate one of these allow groups of children to decide0000: • If smooth surfaces are always more reflective than rough ones? • If white/pale surfaces are always more reflective than black/dark ones? • If some surfaces reflect equally brightly when the torch is held at different angles to them, or not? Record results using a **Carroll diagram** to group data according to the 'yes/no' question you investigated and how reflective or not the objects/surfaces were. - Label your **Carroll diagram** to match the question you are investigating. - Write the name of each object or surface you tested in a square of the **Carroll diagram**. - Draw a **ray diagram** showing how light travels to enable you to: 1) see a toy teddy, and 2) see the reflection of a toy teddy in a **mirror**. Outcome example:			

		Possible learning outcome for reviewing your work: I can record the results of my reflection investigation in a **Carroll diagram**. I can draw **ray diagrams** to show how **non-luminous** objects are seen directly and when they are seen reflected in a mirror.  You will probably find that: • Smooth **surfaces** are usually reflective and rough surfaces are not very reflective. • White/pale surfaces are usually quite reflective and black/dark surfaces are not. • **Mirrors** and **shiny** surfaces are reflective and reflect more light in some directions than others. **Matt** surfaces are not very reflective and reflect (or, in reality, **scatter**) light equally in all directions. The first light ray should travel in a straight line starting at the **light source** and travelling to the object. Don't worry about the angles between any of the light rays. The header row of the **Carroll diagram** should have matching labels for the chosen investigation • 'Smooth' and 'Rough' • 'White/pale' and 'Black/dark', • 'Reflects more light in some directions than others' and 'Reflects equally in all directions'. Another light ray should travel in a straight line into the eye in both diagrams. This diagram is very like the first one, but with a mirror added between the object and the eye.			
3	L.I. I can plot a line graph showing how the size of an objects shadow depends on the distance between the light source and the object.	**This is a Science lesson. In Science, we study nature and the behaviour of natural things. The skill we will be using this lesson is setting up a simple test and communicating results.** **Prior learning:** **What features do good reflectors have?** **What does luminous mean?** **Name three reflectors.** **What do matt surfaces do to light rays?** **Big Question: Does distance affect the size of a shadow?** **What do we already know about shadows?** Show the children a range of shadow pictures form the resource PowerPoint. Ask the following questions using some year 3 prior knowledge.	torch/desk lamp, tape measure/rulers, metal forks, masking tape/blu tack, empty plastic bottles, squared paper.	**fair test, line of best fit, light source, object, opaque, Screen, shadow, transparent, translucent, variable.**	

		• What's needed to make a **shadow**? • Where are the shadows seen? • Are they the same shape and colour as the object that produced them? • How do shadows from **opaque**, **transparent** and **translucent** objects compare? • What changes the size of shadows? Share feedback and check for misconceptions – teacher CPD answers on resource PowerPoint. Show the class two different images and ask: **What are the objects? What are the light sources? What is the screen made of in each case?** **Screen:** A **screen** is a surface on which a shadow is seen. **Task: Exploring shadows:** 1. Fix a blank sheet of paper to a wall using masking tape or blu tack. 2. Place your fork (the object) in the top of the water bottle and position this about 20cm in front of the wall. 3. Support your torch at the height of the fork, to cast a shadow directly behind it onto the paper. 4. Darken your room, if possible. 5. Position your torch 80cm away from your object. 6. Draw the length/width of the fork (or one of its prongs), on the paper and note, above this, the distance between the object and light source. 7. Move your light source closer to the object in 10cm steps, marking the shadow size each time on your paper. 8. After your 10cm take an additional reading at 5cm, then remove your paper and measure the size of each drawn shadow in mm. 9. Record the light-source-to-object distances and their shadow sizes in a table of results and plot a line graph Ask the children to record their measurements in a table and then communicate their measurements in a line graph showing how the size of an object's shadow depends on the distance between the light source and the object. Draw a **line of best fit** for your data and describe the pattern you see in your results. • Did you observe any other differences in the shadow? • Why do you need to keep the distance between the **object** and the **screen** the same? • Repeat some of your measurements (20, 40, 60, 80 cm) and see if you get the same results. If not, why not? Outcome example:			

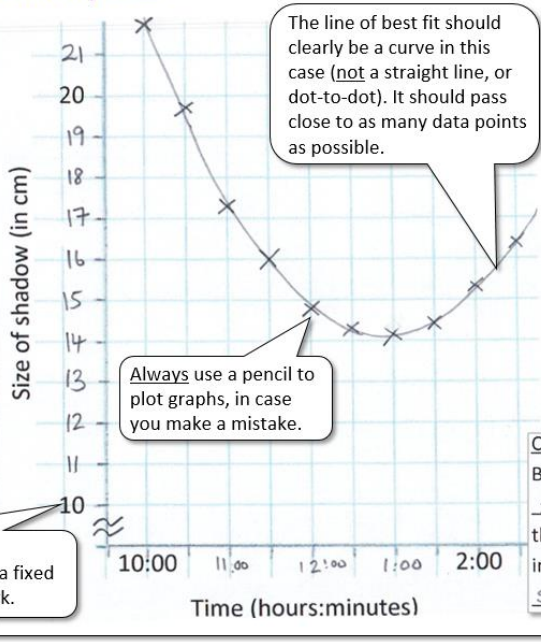
					
4	L.I. I can observe and record the size of shadows through the day. plot a line graph of results taken to one decimal place. draw a conclusion from my data.	**This is a Science lesson. In Science, we study nature and the behaviour of natural things. The skill we will be using this lesson is setting up a simple test, communicating results and evaluating.** **Prior learning:** Ask the children to fill in the blanks: **The size of the object's shadow _____as the distance between the light source and the object decreases. This is because light travels in _____ _____, so objects _____ to the light source _____ light travelling in a greater range of different directions.** Think or talk about... • **What causes shadows on a sunny day?** Use 4 scientific words or phrases to explain them. • **What time of day do you think each of these photographs was taken?** – Pictures on resource PowerPoint. • **Why do the size and direction of outdoor shadows change over time on a sunny day and what has this got to do with our planet Earth rotating on its axis?** Let's investigate how shadows change during the day.	A sunny day and morning start (before 10am) paved/concrete area away from buildings plastic bottle/something pointy ~20cm tall	**Axis, calibrate, line of best fit, opaque, rotate, screen, shadow, sundial.**	

		1. Starting in the morning, find a sunny place with a paved/hard surface at least 10 steps away from any buildings and mark a star on the ground with chalk or pencil. 2. With your water bottle/object standing on the star, mark a cross at the top of its shadow. 3. Check the time. 4. Measure the distance between the star and cross, in centimetres and to one decimal place. 5. Record this (as the size of the shadow) and the time from step 3 in a table (see page 5 of resources). 6. Plot this point on your line graph (see page 5). **Scientists normally plot their data as they go along so they can see any patterns emerging or if a particular result doesn't seem to fit this (and may need checking).** 7. Repeat steps 2-6 every half hour or so until mid-afternoon. 8. Draw a smooth line of best fit for your data. This curve should go as close as possible to as many of your data points as possible. 9. Make conclusions about your data and investigation. Outcome example:	chalk or a pencil ruler/tape measure squared paper		

Possible learning outcome for reviewing your work:

I can observe and record the size of shadows throughout the day
I can plot a line graph of results taken to one decimal place
I can draw a conclusion from my data

Time (hours:mins)	Size of shadow (cm)
10:00	21.7
10:30	19.8
11:00	17.3
11:30	16.0
12:00	14.8
12:30	14.3
1:00	14.1
1:30	14.5
2:00	15.3
2:30	16.4



Your rows of results should only have numbers (not units), since the units are shown in the header line so they apply to all rows of the table

The line of best fit should clearly be a curve in this case (not a straight line, or dot-to-dot). It should pass close to as many data points as possible.

Always use a pencil to plot graphs, in case you make a mistake.

During British summertime (when the clocks are one hour ahead of Greenwich Mean Time - GMT), the sun is highest in the sky at 1:00 (rather than noon), so the shadows are shortest then.

The y-axis does not start at zero here.
Your graph scales should always go up by a fixed amount between each evenly-spaced mark.

Conclusion
Because the shadow is shortest at 1:00 pm, this means the sun is highest in the sky at this time in the summer (season).

8

Exit Pass: Think about your investigation do you have any further questions about shadows from completing this investigation? Evaluate your simple test – how could it be improved or changed.

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