Waterville Primary School Progression of Skills and Vocabulary in Science – Light

Year 3

KS1 National Curriculum

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.

Pupils should be taught:

- 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 an opaque object.
- Find patterns in the way that the size of shadows change.

Prior Learning

In Year 1:

- Name the seasons and know about the type of weather in each season.
- Identify, name, draw and label the basic parts of the human body and say which part of the body is associated with each sense.
- May have some knowledge of were 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.

Vocabulary:

Light, light source, dark, absence of light, transparent, translucent, opaque, shiny, matt, surface, shadow, reflect, mirror, sunlight, dangerous

Key skills to be taught

asking relevant questions and using different types of scientific enquiries to answer them

setting up simple practical enquiries, comparative and fair tests

gathering, recording, classifying and presenting data in a variety of ways to help in answering questions

reporting on findings from enquiries, including oral and written explanations, displays or presentations of results and conclusions

using results to draw simple conclusions, make predictions for new values, suggest improvements and raise further questions

identifying differences, similarities or changes related to simple scientific ideas and processes

using straightforward scientific evidence to answer questions or to support their findings.

Key Ideas	Possible Activities
What is light? Where does light come from?	• Show light sources in a dark room (Observe that light travels out from a light source). • Build idea of more light (energy); less light (energy). Build of energy transfer model. • Blindfold games. Need light to see (light enters eye, not the other way around). • Classify/sort sources of light into natural/man-made. • Sequence sources of light into brightest/dimmest. Use blocks to represent amount of light energy.
What materials reflect light?	• Demo: reflection using a torch (pin hole) and a mirror onto a screen. • Discuss why reflection changes as the angle of the mirror is changed. Play mirror games. • Use data-logger/app (Lux meter) to measure reflected light energy. • Make the best mirror. Start with crumpled tin foil. • Predict reflection from variety of materials/objects/light gates. Which is the most reflective? Order. Use blocks to represent reflected light energy
What materials let light through?	• Demonstrate opaque, translucent, transparent materials. Use blocks to account for energy transfer (use reflected and transmitted light energy) • Fair test. What happens to the amount of light passing through when we darken the water? Measure light intensity (data logger) transmitted through water when adding increasing drops of dilute food colouring. • Which material/object/light-gate lets most light through? Order. Use blocks represent transmitted light energy.
What is a shadow?	• Shine torch/projector on a screen. Place object between. Notice shadow is similar shape to object. • 'Jump on shadows' game. Make shadow puppets. • Link shadow to absence of transmitted light energy. • Fair test. What happens to the shadow when the light source rotates around an object? Link to math challenge • Fair test: What happens to the size of the shadow when an object moves closer to a light source? Link to math challenge e.g. reading scales on a ruler
Why can strong light be dangerous?	• Explain dangers to the eyes & skin. Discuss use of sunglasses and sun screen. Mention UV light. • Demo: Use very strong light source. • Develop sun safety posters. Research. • Show safe ways to look at the sun • Investigate: what happens to our eyes when we shine a light into them (observe, develop descriptive language) • Make sun glasses using various grades of translucent materials (plus opaque & transparent). Which are best?

Next steps In Year 6:

- 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

Waterville Primary School Progression of Skills and Vocabulary in Science – Light and how it travels

Year 6

KS1 National Curriculum

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).

Pupils should be taught:

- 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.

Prior Learning

Linked Learning:

- 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

Vocabulary:

Light, light source, dark, absence of light, transparent, translucent, opaque, shiny, matt, surface, shadow, reflect, mirror, sunlight, dangerous, straight lines, light rays

Key skills to be taught

planning different types of scientific enquiries to answer questions, including recognising and controlling variables where necessary

Taking measurements, using a range of scientific equipment, with increasing accuracy and precision, taking repeat readings when appropriate

Recording data and results of increasing complexity using scientific diagrams and labels, classification keys, tables, scatter graphs, bar and line graphs

Using test results to make predictions to set up further comparative and fair tests reporting and presenting findings from enquiries,

Identifying scientific evidence that has been used to support or refute ideas or arguments.

Key Ideas	Possible Activities
How does light travel?	• Light passes from light source (luminous) into the eye. Measure luminosity using data logger (light probe). Order in terms of light intensity. Light is energy. • Demo: create after image in eye; create image in air (projector in dark room; wave meter rule quickly in front) light & pupil size; blind spot; light spectrum (spinning coloured disc/prism) • Light travels in straight lines. Show how to draw light rays. • Explore: shadow puppets. Explain how they are the same shape as the object. • 3 pieces of card with holes in (need to line up for light to pass onto screen). • Fair test; Does light intensity change when a torch is shone through a longer tube (line with foil)? Measure with light probe of data logger. • Create a rainbow: place small mirror at an angle in bowl of water; shine strong torch light to bounce onto white card (can get same effect by holding glass of water up to strong sunlight)
What happens when light hits an object?	• We can see non-luminous objects because light reflects off them into our eyes. Explore different materials – develop words absorbed, reflected and transmitted light. Use energy transfer. • Shine torch through different objects. Observe or measure transmitted light using light probe. Explain using energy transfer model. • Shine torch through a range of materials. Relative accounting of absorbed, reflected & transmitted light using blocks. Order into most reflective/transmitting. • Fair test – How does the light intensity of transmitted light change by increasing sheets of tissue paper? (Increase intensity of light source for fixed number of sheets). Use data logger
How can we see around corners?	• Make light dance on the wall by using fixed light sources and holding/moving a plane mirror. Create a story. Explain movement. Draw diagram. • Make a periscope. Draw diagram. Image you are a ray of light – describe journey. • Mirror writing; hinged/facing mirrors (multiple images) • Set up mirrors to get fixed light source to move through a maze of boxes on the desk to reach a screen. • Make light move through a maze on the wall. Blindfold – move beam through maze by following instructions. • Fair test: Does light intensity decrease with increasing number of reflections? Use data logger.
How do shadows form?	• Create shadow puppets. Explain why shadow is the same shape using light travelling in straight lines. • Emphasise concept of light as energy travelling in strong lines. Shadows show absence of light energy that can't be reflected into our eyes. Calculate & measure height using the height of the shadow (Measure someone's height and shadow; use proportion to calculate a range of objects) • Fair test – Does the size of shadow change by changing the distance of an object and the torch (fixed).

Next steps 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.
- 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