

Spring Block 3

Light

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Light sources

Notes and guidance

In this small step, children learn about sources of light. This is the first time that children have explored light and therefore they may have some common misconceptions about light and how it is produced. In this step, children explore the difference between natural and artificial sources of light. They should be given opportunities to sort and group different light sources based on these two categories.

By the end of this step, children should give examples of natural light sources, such as the Sun and stars. Children may be more familiar with examples of artificial light sources, including torches, street lights, mobile phones and televisions. Children do not need to look at the dangers of the light produced by the Sun in this step, as this is covered in Step 2

Things to look out for

- As we see with our eyes, children may think that our eyes produce light, rather than light is reflected into our eyes allowing us to see.
- Children may think that the Moon is a source of light as it can be seen in the night sky.

Key questions

- What is a light source?
- Is _____ a natural or artificial light source?
- How do you know that it is a light source?
- How can you group these light sources?
How many ways can you think of?
- What are some advantages of artificial light sources?
- What are some disadvantages of artificial light sources?
- What are some advantages of natural light sources?
- What are some disadvantages of natural light sources?

National curriculum links

- Recognise that they need light in order to see things and that dark is the absence of light.
- **Working scientifically** – Identifying differences, similarities or changes related to simple scientific ideas and processes.

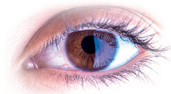
Light sources

Key vocabulary

- **light** – energy that is needed to see



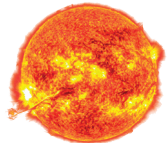
- **eyes** – the parts of the body that animals see with



- **light sources** – objects that give out light



- **natural light sources** – objects in nature that give out light



- **artificial light sources** – made by humans



Practical ideas

- Provide children with different objects that may or may not be light sources, such as a candle, torch, mobile phone, glass or shiny material. As a class, group them accordingly, discussing any misconceptions that may arise.



If lighting a candle, be aware of the naked flame within the classroom.

- Ask the children to sort and group pictures of non-light sources, natural light sources and artificial light sources.
- Children can explore areas around the school grounds and identify sources of light. They could list the different light sources observed and consider why there are more artificial light sources than natural light sources.

Factual knowledge

- Humans and other animals need light to see.
- Natural light sources are objects in nature that give out light, such as the Sun.
- Artificial light sources are made by humans.

The Sun

Notes and guidance

In this small step, children learn about some of the harmful effects of the Sun and explore ways to protect their eyes from the Sun's rays. It is important that children are aware of how to keep safe in the Sun and they should understand that they should never look directly into the Sun. They should also explore the different ways that they can keep their eyes safe during daylight hours.

Link this step to real-life contexts as much as possible by using scenarios such as “going to the beach” or “a trip to the park”. Encourage children to think about appropriate materials to protect their bodies and eyes from the harmful effects of the Sun. To extend learning, children may also want to think about why humans do not need to protect their eyes from the Sun during the night.

Children may have limited understanding about the Sun, therefore a discussion about its necessity for survival is essential within this step. Children should be aware that the Sun provides both heat and light to allow humans and other life to survive.

Things to look out for

- Children may only recognise sunburn as a harmful effect of the Sun.

Key questions

- What is a light source?
- What is a natural light source?
- What is an artificial light source?
- Is the Sun a natural or artificial light source?
- How can the Sun be helpful?
- How can the Sun be harmful?
- How can we protect our eyes from the Sun?
- Why should we be careful of spending time in the Sun?
- What are the positives of spending time in the Sun?

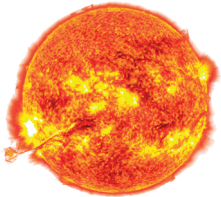
National curriculum links

- Recognise that light from the Sun can be dangerous and that there are ways to protect their eyes.
- **Working scientifically** – Recording findings using simple scientific language, drawings, labelled diagrams, keys, bar charts and tables.

The Sun

Key vocabulary

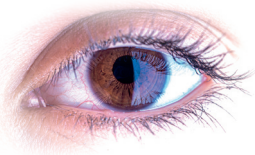
- **Sun** – our nearest star which gives out energy as heat and light



- **natural light sources** – objects in nature that give out light



- **eyes** – the parts of the body that animals see with



- **sunglasses** – glasses which protect eyes from sunlight



- **protect** – to keep something safe

Practical ideas

- Children could investigate how sunglasses protect their eyes from the Sun.

They should identify that the lenses in sunglasses are tinted and reduce the amount of bright light that passes through.

Children could work in small groups and use torches to explore whether materials are suitable or unsuitable for sunglasses.



Remind children how to use a torch safely.

Material	Could it be used as sunglass lenses?	
	Yes	No
purple cellophane	✓	
black card		✓

Factual knowledge

- The Sun is a light source.
- Without the Sun, living things would not be able to live and grow on planet Earth.
- Light from the Sun can be dangerous.
- There are ways to protect your eyes from the Sun.

How we see

Notes and guidance

In this small step, children learn about the eye and how we see. Children should understand that light travels in straight lines. This can be modelled in the classroom using a torch beam on a surface.

In Year 3, children only need to be able to simply explain how we are able to see objects. They should identify that we are able to see an object because light reflects off it, enters our eyes, and the brain processes this information.

All everyday objects reflect light to some extent, but smooth, shiny surfaces (such as mirrors or polished metals) are better at reflecting light than others. In this step, children do not need to learn the names of the parts of the eye, as this is covered in Year 6

Things to look out for

- As we see with our eyes, children may think that our eyes produce light, rather than light is reflected into our eyes allowing us to see.
- Children may think that only shiny, smooth surfaces reflect light.

Key questions

- What is a light source?
- How does light travel?
- What is a reflection?
- Do all materials reflect light?
- Why do mirrors reflect light well?
- How can you see the _____ ?
- Are humans able to see without light?
How do you know?

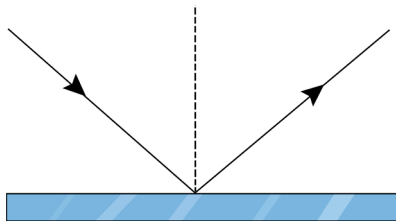
National curriculum links

- Notice that light is reflected from surfaces.
- **Working scientifically** – Recording findings using simple scientific language, drawings, labelled diagrams, keys, bar charts, and tables.

How we see

Key vocabulary

- **reflection** – the return of light from a material or surface



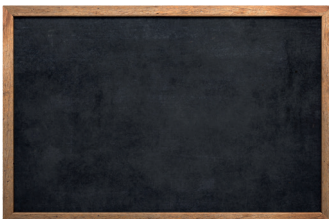
- **light sources** – objects that give out light



- **shiny** – a surface that reflects most light



- **dull** – a surface that does not reflect much light

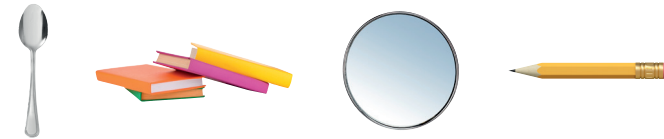


Practical ideas

- Give the children different objects, such as a spoon, book, pencil and a mirror.

Ask them whether they can see their reflection in the object.

Discuss why they are able to see their reflections in some objects and not others.



- Give children a mirror and a torch.

Children shine the torch beam into the mirror and identify the reflection on a nearby wall.

When they move the mirror, the reflected light moves position on the wall.

Children could draw what they have observed using a labelled diagram.

Factual knowledge

- Humans need light to see. Darkness is the absence of light.
- Light travels from a light source to an object.
- The light is then reflected from the object into our eyes.
- Reflection is the return of light from a material or surface.

Shadows

Notes and guidance

In this small step, children explore the concept of shadows. Children have already looked at how we see objects but they may have some misconceptions around shadow formation. They should learn that a shadow is formed when light is blocked by an opaque object. In Key Stage 1, children used the terms “opaque”, “transparent” and “translucent” to describe different materials. They will examine what the terms mean in more depth in the next two steps.

Within the classroom, provide children with a range of different activities to explore how changing the position of the light source from an object, and changing the object itself, can change the shadow formed. Children should recognise that the shape of the shadow is similar to the shape of the object. Later in the block, children will investigate what happens when the distance between a light source and an object changes.

Things to look out for

- Children may think a shadow is a reflection of the Sun.
- Children may think a shadow can only be created by the Sun rather than by other light sources.
- Children may think that all materials cast shadows.

Key questions

- How do we see objects?
- What is a light source?
- What is a shadow?
- How is a shadow formed?
- What does transparent/translucent/opaque mean?
- What could the shape of the shadow be if a light source is shone on this object?
- If this is the shadow, what could the object be?
- Can shadows be formed in the dark?

National curriculum links

- Recognise that shadows are formed when the light from a light source is blocked by an opaque object.
- **Working scientifically** – Gathering, recording, classifying and presenting data in a variety of ways to help in answering questions.

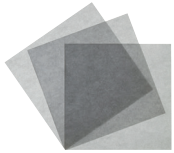
Shadows

Key vocabulary

- **opaque** – an object or material that does not allow any light to pass through it



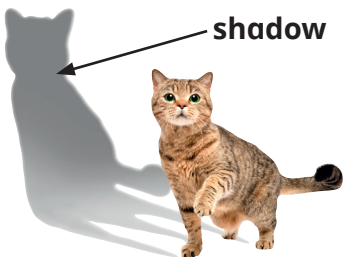
- **translucent** – an object or material that allows some light to pass through it



- **transparent** – an object or material that allows all light to pass through it



- **shadow** – a dark area caused by an object blocking a source of light



Practical ideas

- Provide children with a variety of objects with different shapes and sizes, such as toys, blocks and other classroom objects. Set up a light source, such as a torch, in an area. Have children hold the objects between the light source and a surface, such as a large piece of paper or a whiteboard, creating shadows.

Ask them to trace the outlines of the shadows created by different objects. Compare the shapes of the objects and their shadows.

- Children could create their own shadow puppets to explore how opaque materials create shadow by blocking the path of light.
- Take children outside to draw around their shadows on the playground.



Draw round their shadows at different times during the day to explore how their shadow changes.

Factual knowledge

- Humans need light to see objects.
- Light travels from a light source to an object.
- The light is then reflected into our eyes.
- Shadows are formed when the light from a light source is blocked by an object.

Opaque, translucent or transparent?

Notes and guidance

In the previous small step, children looked at the concept of shadow formation for the first time. They identified that shadows are formed when light from a light source is blocked by an object, creating an area of darkness where the light does not reach. They also used the terms “opaque”, “translucent” and “transparent” to describe different materials.

In this small step, children build on their understanding of these terms and carry out a short investigation to explore these concepts further. Children initially identify whether objects are opaque, translucent or transparent before observing whether light is able to pass through these objects or not. Then they pick which objects cast the clearest and most defined shadows. They should identify that translucent objects do not form clear and defined shadows when a light source is shone at them, as light can pass through, and that opaque materials form clear and defined shadows as light does not pass through them.

Things to look out for

- Children may think that translucent objects would cast clear, defined shadows because they are not completely transparent.

Key questions

- What does “opaque” mean?
- What does “translucent” mean?
- What does “transparent” mean?
- Is _____ a transparent, translucent or opaque material?
How do you know?
- Why do you think _____ is a transparent/translucent/opaque material?
- If you were going to make a _____ would you want it to be opaque, translucent or transparent?

National curriculum links

- Recognise that shadows are formed when the light from a light source is blocked by an opaque object.
- **Working scientifically** – Asking relevant questions and using different types of scientific enquiries to answer them.

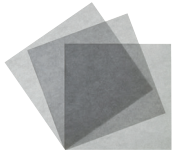
Opaque, translucent or transparent?

Key vocabulary

- **opaque** – an object or material that does not allow any light to pass through it



- **translucent** – an object or material that allows some light to pass through it



- **transparent** – an object or material that allows all light to pass through it



- **shadow** – a dark area caused by an object blocking a source of light



Practical ideas

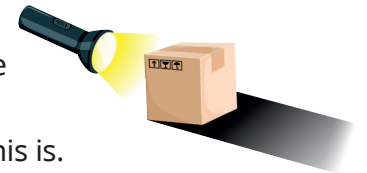
- In small groups, give children opaque, translucent and transparent materials and a torch.

Children should initially observe each material closely to determine whether the objects are opaque, translucent or transparent.

They should then investigate whether each type of material forms shadows when the light from a torch is shone at them.

Encourage children to determine which objects form the clearest and most defined shadows. They should explain why they think that is.

Ask children to identify whether some materials did not form shadows and ask them to explain why they think this is.



Factual knowledge

- Opaque materials do not let light rays pass through.
- Translucent materials allow some light to pass through but do not form clear, defined shadows.
- Transparent materials allow light to pass through.
- Shadows are formed when the light from a light source is blocked by an object.

Plan – shadow experiment

Notes and guidance

In this small step, children plan a fair test to investigate how the distance between an object and a light source affects the size of the shadow it forms. They plan to explore whether an object closer to the light source, or further away, forms a larger shadow.

This step introduces the enquiry question for this block. A discussion of the term “distance” is essential before planning this experiment. Children do not need to use the terms “independent”, “dependent” and “controlled variables”, but they should discuss what they will change, measure and keep the same.

Children have looked at measuring in metres, centimetres and millimetres within maths, so a discussion of which unit of measurement is most appropriate for this investigation can be used as a reflection point to recap these concepts.

Things to look out for

- When choosing an object for this experiment, encourage children to choose an object that has a simple shape, such as a cube or block, rather than a complex outline such as a toy or figure.

Key questions

- What unit of measurement will you use to record the size of the shadow?
- What unit of measurement will you use to record the distance of the light source to the object?
- What will you change in this experiment?
- What will you measure in this experiment?
- What will you keep the same?
- How will you record your results?
- What do you predict will happen in the experiment?

Enquiry question

- How does the distance between the light source and the object affect the size of a shadow?

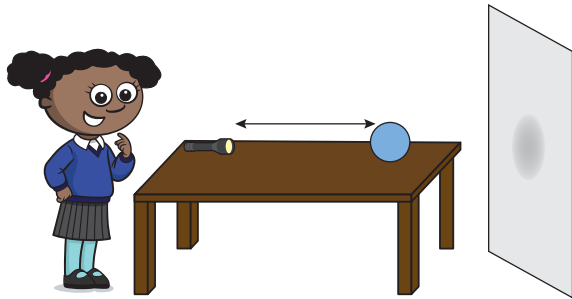
National curriculum links

- Find patterns in the way that the size of shadows change.
- **Working scientifically** – Setting up simple practical enquiries, comparative and fair tests.

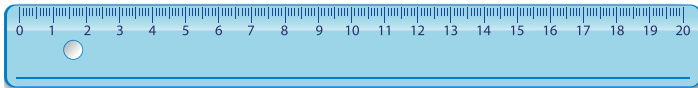
Plan – shadow experiment

Experiment variables

- **independent variable** (what will change) – the distance the object is from the light source



- **dependent variable** (what will be measured) – the size of the shadow

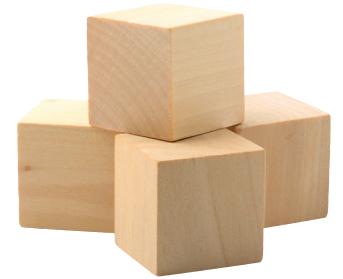


- **controlled variables** (what is kept the same) – the light source, the object used to create the shadow, the distance from the object to the wall.



Equipment needed

- torches
- tape measures/rulers
- opaque objects, e.g. wooden blocks
- A3 paper to provide a background for the shadow formation



Practical activity

- Put children into small groups.
Give each group the equipment needed for the experiment.
Children should identify what the equipment is and why it is used in the experiment.
Children predict what they think will happen to the shadow when the torch is closer to the object.

Planning sentence stems

- I predict that ...
I think this will happen because ...
- We are changing the _____ .
- We are measuring the _____ .
- We are keeping the _____ the same.

Investigate – shadow experiment

Notes and guidance

In this small step, children carry out a fair test to explore how the distance from a light source affects the size of an object's shadow. Children should be encouraged to set up practical equipment and make systematic and careful observations throughout.

In Year 3, children may find it difficult to measure either the width or length of the shadow. To allow for a more accurate measurement, children may choose to stick A3 paper to a classroom wall during the experiment to allow them to draw around the shadow at each interval and then measure the shadow size from the drawn outline. When undertaking the experiment, try to minimise the amount of light within the classroom to ensure the shadow is as clear as possible.

Things to look out for

- Children may struggle to maintain a consistent distance from the object to the wall. Place the object on a table to allow the object to remain in a consistent position.
- Ensure children are using the same object for each test to ensure they gather accurate data.

Key questions

- What is your experiment plan?
- What are you changing?
- What are you measuring?
- What are you keeping the same?
- What changes, if any, have you noticed?

Enquiry question

- How does the distance between the light source and the object affect the size of a shadow?

National curriculum links

- Find patterns in the way that the size of shadows change.
- **Working scientifically** – Gathering, recording, classifying and presenting data in a variety of ways to help in answering questions.

Investigate – shadow experiment

Key vocabulary

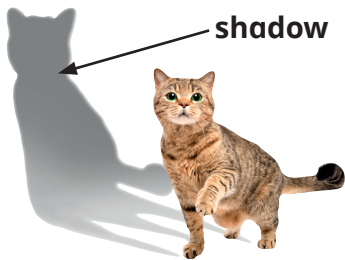
- **light sources** – objects that give out light



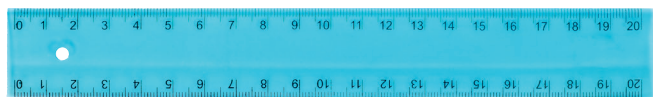
- **opaque** – an object or material that does not allow any light to pass through it



- **shadow** – a dark area caused by an object blocking a source of light

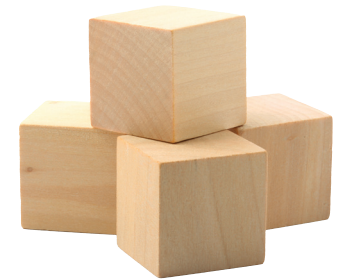


- **distance** – how far two points are away from each other



Equipment needed

- torches
- tape measures/rulers
- opaque objects, e.g. wooden blocks
- A3 paper to provide a background for the shadow formation



Method

1. Stick a piece of A3 paper to a wall in the classroom.
2. Position an object 40 cm away from the A3 paper on a table.
3. Ensure the object does not move by sticking it to the table with sticky tack.
4. Place the torch 20 cm away from the object and draw around the outline of the shadow on the piece of paper.
5. Measure the size of the shadow at this distance.
6. Move the torch to 40 cm away from the object and draw around the outline of the shadow on the piece of paper.
7. Measure the size of the shadow at this distance.
8. Move the torch to 60 cm away from the object and repeat drawing and measuring the shadow.
9. Encourage children to identify any patterns between distance and size of the shadow.

Evaluate – shadow experiment

Notes and guidance

In this small step, children evaluate their shadow experiment. This is the second time within the Year 3 curriculum that children have looked at creating an evaluation for an experiment. Therefore, they may need help in this step, for example, by providing scaffolds for their evaluations.

In this step, children should be given the opportunity to answer the enquiry question and discuss how the distance from a light source affects the size of the shadow. They should conclude that the closer an object is to a light source, the larger the shadow it produces. In Year 3, they should simply identify patterns in the size of the shadows. Why shadows change size due to light travelling in straight lines is explored in Year 6

In Year 3, children only need to draw simple conclusions based on how the size of shadows change due to the distance between the object and light source. Children should also provide an answer to the enquiry question.

Things to look out for

- Children may believe that by simply repeating the number of measurements, reliability of results improves. However, if there are already errors in the investigation, repeating it will just generate more unreliable results.

Key questions

- What happened to the size of shadow when the torch was closer to/further away from the object?
- What conclusions can you make from your data?
- If you were to repeat this experiment, how could you improve your results?
- What would happen to your results if you used a dimmer/brighter light source?
- What questions do you have for a further investigation?

Enquiry question

- How does the distance between the light source and the object affect the size of a shadow?

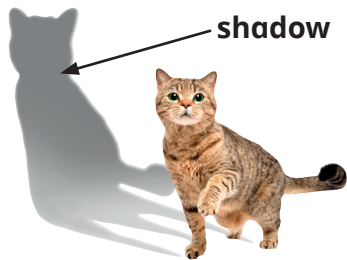
National curriculum links

- Find patterns in the way that the size of shadows change.
- **Working scientifically** – Using results to draw simple conclusions, make predictions for new values, suggest improvements and raise further questions.

Evaluate – shadow experiment

Key vocabulary

- **shadow** – a dark area caused by an object blocking a source of light



- **opaque** – an object or material that does not allow any light to pass through it



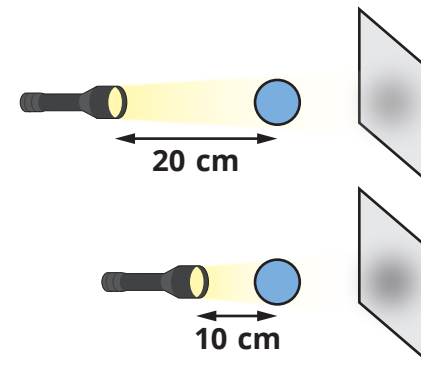
- **conclusion** – what has been found out during an investigation based on measurements and observations

Distance between torch and object (cm)	Width of shadow at its widest point (cm)
20	32
40	16
60	11

- **evaluation** – to consider the quality of the results and suggest improvements to the investigation

Practical ideas

- Children could explore whether doubling the distance from the torch halves the size of the shadow.



- Children could repeat the experiment using a different object, to test whether their results and conclusion remain the same. It may be useful to collate the class results to identify any unusual results.

Evaluation sentence stems

- I predicted that ...
My prediction was correct/incorrect because ...
- From looking at our results, I can see that ...
- This happened because ...
- In a future investigation, I would like to find out ...