Big Question: What is the dark?

Unit context

This unit is designed to expand pupils' knowledge of light sources, protecting themselves from the Sun, how light travels, the reflective properties of different materials, how shadows are formed, and how periscopes work. It is part of the physics sequence of learning and follows on from 'Seasons: Autumn and Winter' and 'Seasons: Spring and Summer' in Year 1. Pupils study further physics units throughout Key Stage 2 but do not study a specific unit on light again until Year 6.

This unit begins by looking at sources of light and whether those sources are natural or artificial. Pupils will then find out about the benefits and dangers of the Sun, and how to protect themselves from Sun damage to the skin and eyes. Pupils will move on to discover how light from a source allows us to see objects—that light travels from the source to the object, where it is then reflected back to our eyes. Pupils will learn about the terms *transparent*, *translucent*, and *opaque*, and investigate a range of materials before categorising them.

The unit then moves into exploring shadows—how they are formed and whether transparent, translucent, and opaque objects make the same types of shadow. Pupils will explore different objects, categorising them based on the shadows they form and whether they are able to see light passing through. Once pupils are aware that opaque objects form shadows, they will investigate varying the position, shape, and size of a shadow using torches.

The last part of the unit looks at the reflection of light. Pupils start by looking at the types of material that reflect light.

Teacher subject knowledge guide for Year 3, Unit 3: *Light and shadows*

Light

Without light, we wouldn't be able to see the world around us. A light source is an object that emits light. Light travels in straight lines, and cannot naturally bend around corners or objects. Some light sources are natural—for example, the Sun, a flame, and a firefly. Other light sources are artificial—for example, lamps, bulbs, and torches. **Artificial light sources** like traffic lights and car brake lights help to keep us safe by giving us warnings or instructions. Our main source of natural light on Earth comes from the Sun (which emits light in all directions). Earth's Moon is not a light source. We can see the Moon because sunlight **reflects** back to us from its surface. Light sources vary in **brightness**. For example, the Sun is much brighter than a torch.

The Sun

Without the Sun's energy there would be no life on Earth. Plants use sunlight to make their own food via the process of photosynthesis. We need sunlight for the body to produce vitamin D, which helps the body absorb calcium (to keep bones and teeth healthy). Although light from the Sun is vital for life, it can also be dangerous. There are two types of **ultraviolet (UV) rays** in sunlight: UVA and UVB. These rays can cause eye damage, including cataracts and eyelid cancers. Staring directly at the Sun can cause permanent damage to a person's sight. UVA rays cause skin ageing. UVB rays cause sunburn. The degree of damage depends on the intensity of the UV rays and the length of time that skin is exposed without protection. Location is also a factor—places where sunlight is more intense have an increased risk level.

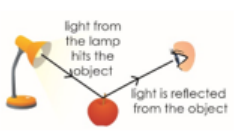
To stay protected from the Sun, we should wear sunglasses, sun hats, and sun cream. The Sun protection factor (SPF) in sun cream should be at least 50 to give children the best protection. Children's skin is much more sensitive than adults', and can burn more easily. The SPF number tells you how long the Sun's radiation (including some of the UVA) would take to damage your skin when using that product compared to the time without sun cream. Sun cream works by blocking and absorbing UV rays.

Mirrors

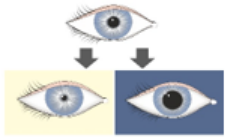
A **mirror** is made of a smooth pane of glass with a thin **reflective** layer at the back of it. There are plane (flat) and curved mirrors. In a plane mirror, the **image** is the same size as the object and the same way up. But it is 'back to front'. There are two types of curved mirror (convex and concave). A mirror that curves inwards is called a concave mirror. How you appear in a concave mirror depends on how close you are to it. Further away, you look smaller and upside down. If you are close to the mirror, you look bigger and the right way up. A mirror that curves outwards in the centre is called a convex mirror. Convex mirrors show things the right way up and smaller.

Periscopes are instruments used to look at objects which are not in the observer's direct line of sight. A periscope is a tube with parallel mirrors situated at both ends of the tube, at a 45° angle. High-quality periscopes use prisms rather than mirrors to reflect light, such as those in submarines, as the quality of reflection is higher (although it is impossible to detect this by looking at simple images).

How we see things



We see an object because light bounces off it and into our eyes. This process is called **reflection**. Different coloured objects reflect different frequencies of light; this is why we see objects as coloured. The **pupils** in our eyes are small gaps that let in the light. This light passes to the retina, a layer of light-sensitive cells, which produces a nervous signal that is carried to the brain. The pupils in our eyes get larger when it is dark to allow more light in, and reduce in size when in brighter light to limit the amount of light entering the eye.

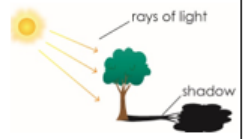


Different colours cause different proportions of the incident light to be reflected. Dark and dull colours are poor reflectors (they absorb light), whereas bright and shiny colours are good reflectors. The texture of a surface also affects its reflectivity. Rough or **matt** surfaces provide a poor reflection of light towards an observer. This is because they scatter the incident light in different directions. Smooth surfaces reflect light at a consistent angle, and therefore can produce a clear image of an object.

Materials vary in how they transmit light. Materials like air, distilled water, and clear glass are **transparent**. When light encounters a transparent material, almost all of it passes directly through. Materials such as wood, stone, and metals are **opaque** to visible light—they block light from traveling through them. The incident light is either reflected by the object or absorbed. Materials like frosted glass and some plastics are called **translucent**. When light strikes translucent materials, only some of the light passes through; the remainder is reflected. This is why translucent objects are easier to see than transparent objects. Translucent materials cause light to change direction many times as it passes through and the light is scattered. Therefore, we cannot see clearly through translucent materials. Viewing an object through a translucent material causes the object to appear fuzzy or unclear.

Shadows

Whenever light is not able to go through an object, it creates a dark area behind the object. The region where the light cannot reach is called a **shadow**. The closer an object is to the source of light, the bigger the shadow.



Shadows take the outline shape of the object, but the size of the shadow is usually different to the size of the object. This is caused by the relative height of the light source to the object, as well as the distance from the light source to the object. For example, at midday, the Sun is directly overhead and shadows are shorter. In the morning and afternoon, shadows are longer as the Sun appears at a lower angle in the sky. Shadows formed from sunlight can be used to tell the time using a **sundial**—the shadow points to the hours of the day like the hands of a clock face.

Opaque objects create clear, dark shadows. Transparent objects create no shadows as the light passes through them completely. Translucent objects create a shadow that is fainter than the shadow formed by an opaque object, because it allows some light to pass through it.

YEAR 3 SCIENCE PLANNING – LIGHT

Links to previous and future learning

Links to previous and future learning' heading to match Geography and History: The knowledge from previous and future units which closely link with this current unit are shown below. For more information about how this unit fits into the wider sequence of learning, please see the Science progression document.

Year 1	Year 5
Unit 4: Spring and summer • There are four seasons in a year: spring, summer, autumn, and winter. • There are 12 months in a year. • There are different months in each season. • Each season looks and feels different. • As the season changes from winter to spring, the days get longer and we have more daylight. • In spring the temperature gets warmer. • Spring weather can vary from warm and sunny to cold and rainy. • Summer is the warmest season in the UK and has the highest temperatures. • Summer has the most daylight hours. • In the summer, it is important to stay safe in the Sun.	**Unit 1: Earth and space** • The Sun is a star. • A star is a huge ball of burning gas that gives off light and heat. • Earth is a planet. • A planet is a large, nearly spherical object that orbits the Sun. • Earth takes 365¼ days (one year) to complete one orbit of the Sun. • Light and heat from the Sun are necessary for life on Earth to exist. • Earth spins around (rotates) on its axis. • Earth takes 24 hours (one day) to fully rotate once. • The parts of Earth facing the Sun experience daytime. • The parts of Earth facing away from the Sun experience night-time.

Working Scientifically **During years 3 and 4, pupils should be taught to use the following practical scientific methods, processes and skills. Across each unit and throughout the year there should be a balance of skills taught.**					
A. Asking questions and recognising that they can be answered in different ways	**B. Making observations and taking measurements**	**C. Engaging in practical enquiry to answer questions**	**D. Recording and presenting evidence**	**E. Answering questions and concluding**	**F. Evaluating and raising further questions and predictions**
Asking relevant questions and using different types of scientific enquiries to answer them 1. The children consider their prior knowledge when asking questions. They independently use a range of question stems. Where appropriate, they answer these questions. 2. The children answer questions posed by the teacher. 3. Given a range of resources, the children decide for themselves how to gather evidence to answer the question. They recognise when secondary sources can	**Making systematic and careful observations and, where appropriate, taking accurate measurements using standard units, using a range of equipment, including thermometers and data loggers** 1. The children make systematic and careful observations. 2. They use a range of equipment for measuring length, time, temperature and capacity and standard units for their measurements.	**Setting up simple practical enquiries, comparative and fair tests** 1. The children select from a range of practical resources to gather evidence to answer questions generated by themselves or the teacher. 2. They follow their plan to carry out: observations and tests to classify; comparative and simple fair tests; observations over time; and pattern seeking. ***Explanatory note*** *A comparative test is performed by changing a variable that is qualitative e.g. the type of material, shape of the parachute.*	**Gathering, recording, classifying and presenting data in a variety of ways to help in answering questions** **Recording findings using simple scientific language, drawings, labelled diagrams, keys, bar charts, and tables** 1. The children sometimes decide how to record and present evidence. They record their observation e.g. using photographs, videos, pictures, labelled diagrams or writing. They record their measurements e.g. using tables, tally charts and bar charts (given	**Using straightforward scientific evidence to answer questions or to support their findings.** 1. Children answer their own and others' questions based on observations they have made, measurements they have taken or information they have gained from secondary sources. The answers are consistent with the evidence. **Identifying differences, similarities or changes related to simple scientific ideas and processes** 2. Children interpret their data to generate simple	**Using results to draw simple conclusions, make predictions for new values, suggest improvements and raise further questions** 1. They identify ways in which they adapted their method as they progressed or how they would do it differently if they repeated the enquiry. 2. Children use their evidence to suggest values for different items tested using the same method e.g. the distance travelled by a car on an additional surface. 3. Following a scientific experience, the children ask further questions which can be answered by extending the same enquiry.

be used to answer questions that cannot be answered through practical work. They identify the type of enquiry that they have chosen to answer their question.		*This leads to a ranked outcome.* *A fair test is performed by changing a variable that is quantitative e.g. the thickness of the material or the area of the canopy. This leads to establishing a causative relationship.*	templates, if required, to which they can add headings). They record classifications e.g. using tables, Venn diagrams, Carroll diagrams. 2. Children are supported to present the same data in different ways in order to help with answering the question.	comparative statements based on their evidence. They begin to identify naturally occurring patterns and causal relationships. **Using results to draw simple conclusions, make predictions for new values, suggest improvements and raise further questions** 3. They draw conclusions based on their evidence and current subject knowledge	

YEAR 3 SCIENCE PLANNING – LIGHT

Unit overview		
	Key knowledge	**Key vocabulary**
Lesson 1: ***What is a light source?***	• Objects that give off light are called light sources. • Light travels from a light source. • Light sources can be natural or artificial. • Light sources can vary in brightness. • Darkness is the lack of light. **Working scientifically** • Make careful observations. • Record findings using simple scientific language, drawings, and labelled diagrams.	• artificial **light source** • brightness • darkness • natural **light source** • ray
Lesson 2: ***How can we protect ourselves from the Sun?***	• Staring directly at the Sun damages your eyes. • UV rays can result in sunburn, ageing, and illness. • Wearing appropriate clothing such as a hat and sunglasses, using sun cream, and avoiding direct sunlight at the hottest points in the day are ways of protecting yourself from the Sun. **Working scientifically** • Use a range of equipment. • Make careful observations. • Record findings using simple scientific language, drawings, and labelled diagrams. • Use results to draw simple conclusions and make predictions.	• **ultraviolet (UV) light**
Lesson 3: ***How does light travel?***	• Light travels in straight lines. • When looking at a light source, the light travels straight into your eye. • When seeing an object, light travels to the object and then reflects into your eye. **Working scientifically** • Use a range of equipment. • Make careful observations. • Record findings using simple scientific language, drawings, and labelled diagrams. • Use models to represent a scientific concept or process.	• iris • pupil • reflect

YEAR 3 SCIENCE PLANNING – LIGHT

Lesson 4: ***Does light travel through all materials?***	• Transparent materials allow all light to pass through them. • Opaque materials allow no light to pass through them. • Translucent materials allow some light to pass through them. **Working scientifically** • Use a range of equipment. • Make careful observations. • Record findings using simple scientific language, drawings, and labelled diagrams.	• **opaque** • translucent • transparent
Lesson 5: ***How are shadows formed?***	• Shadows are formed when light is blocked by an object. • Shadows are areas where there is no light. • Opaque objects form the clearest and darkest shadows. • Transparent objects do not form shadows. • Translucent objects form faint shadows. **Working scientifically** • Use a range of equipment. • Make careful observations. • Record findings using simple scientific language, drawings, and labelled diagrams.	• opaque • **shadow** • translucent • transparent
Lesson 6: ***How can we vary the size and position of shadows?***	• The closer an object is to a light source, the bigger the shadow becomes. • The height of a light source above an object affects the size of the shadow produced. • Sundials use shadows to tell the time of day. **Working scientifically** • Use a range of equipment. • Make careful observations. • Record findings using simple scientific language, drawings, and labelled diagrams. • Use results to draw simple conclusions and make predications.	• **shadow** • sundial

Lesson 7: ***What types of material reflect light?***	• Some materials are more reflective than others. • Non-reflective materials are rough and dark or dull. • Reflective materials are smooth and shiny. **Working scientifically** • Use a range of equipment. • Make careful observations. • Record findings using simple scientific language, drawings, and labelled diagrams.	• absorb • matt • non-reflective • reflect • **reflective** • shiny

YEAR 3 SCIENCE PLANNING – LIGHT

Detailed lesson Planning

Lesson question	Key knowledge	Teaching and Activities	Key vocabulary
Lesson 1: ***What is a light source?***	• Objects that give off light are called light sources. • Light travels from a light source. • Light sources can be natural or artificial. • Light sources can vary in brightness. • Darkness is the lack of light. **Working scientifically** • Make careful observations. • Record findings using simple scientific language, drawings, and labelled diagrams.	'What is a light source?', 'Are all light sources the same?'. To extend pupils' thinking, you could ask pupils to decide on the main difference between light from, for example, the Sun or a lit candle and a light bulb or TV screen. What is a light source? Why do we need them? Define-***a light source - any device serving as a source of illumination.*** Can you name any light sources? Show children images ask them it a light source? Sun, light bulb, torch- Include ones that provoke discussion windows, mirror. Concept cartoon light in a cave  Dark is the absence of light. If there is no light from a light source, it will be dark. Think about times when it is dark, or places where it is dark. Which sources of light are absent, or switched off? Reflect back to Creswell Crags cave trip- when all light sources were removed could you see? Discuss feelings with the absence of light Explain the difference between man-made and natural light sources. Luminous means give us light Activity draw and label different light sources which are sorted into man-made e.g. lamp and natural e.g. sun. Talk through some examples that may cause confusion, such as a mirror, window, and—particularly—the Moon.	• artificial **light source** • brightness • darkness • natural **light source** • ray

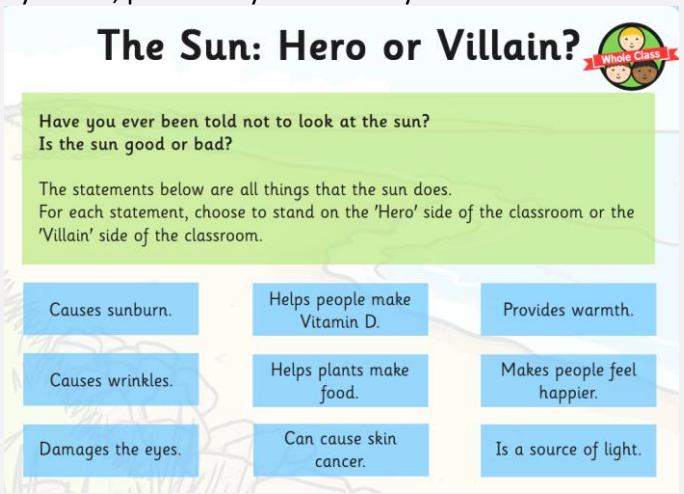
		Show pupils the images of different warning lights on the slide. Discuss together as a class what they are used for. Can they think of any others? This provides an opportunity to discuss pedestrian crossing safety with pupils – and that a red light usually signifies 'stop' or 'danger', while green usually represents 'safe' or 'go'. Discuss how some lights are brighter (emit more light) than others – why might that be?	
Outcomes / assessment	**Disciplinary and substantive concept/s**	**Key term**	**Key takeaway**
Learning review and exit questions	**DC4:** Make careful observations. **DC5:** Record findings using simple scientific language, drawings, and labelled diagrams. **SC:** Light is needed to see things. **SC:** Darkness is the absence of light.	light source	Objects that give off light are called **light sources**.

Common misconceptions

The following points are common misconceptions to be aware of when teaching this lesson.

- Bright objects always emit their own light. In fact, shiny objects, like mirrors, and pale coloured objects reflect light.
- The Moon is a light source. This is incorrect. The Moon reflects sunlight.
- Darkness can cancel out light. No. Darkness is an absence of light.

YEAR 3 SCIENCE PLANNING – LIGHT

Lesson question	Key knowledge	Teaching and Activities	Key vocabulary
Lesson 2: ***How can we protect ourselves from the Sun?***	• Staring directly at the sun damages your eyes. • UV rays can result in sunburn, ageing, and illness. • Wearing appropriate clothing such as a hat and sunglasses, using sun cream, and avoiding direct sunlight at the hottest points in the day are ways of protecting yourself from the Sun. **Working scientifically** • Use a range of equipment. • Make careful observations. • Record findings using simple scientific language, drawings, and labelled diagrams. • Use results to draw simple conclusions and make predictions.	: Ask: 'When do you think light can be dangerous?'. • Pupils read about the benefits of the Sun and how dangerous it can be Another type of light that the sun emits is called UV light. UV light is invisible to humans, but we can see and feel its effects. • **Discuss** how to protect themselves from it. This is a good opportunity to discuss playing in the Sun safely. For example, you could mention the 'Slip! Slop! Slap! campaign. Explain that extended exposure to the Sun can cause sunburn, which is very painful and may cause longer term skin damage. Longer term exposure can lead to skin ageing (where skin loses its elasticity) and illnesses such as skin cancer. This is a good time to remind pupils that they also need to drink plenty of water to keep properly hydrated, particularly in hot sunny weather.  	• **ultraviolet (UV) light**

		Pupils draw a picture of a child playing in the sun, labelling all the steps they have taken to protect themselves from the Sun. **Investigation cross curricular art** This investigation is carried out through art and a small study of Anna Atkins and cynotope paper. Model a pair of sunglasses for pupils. Ask: 'Why might these be important?'. Discuss with pupils that sunglasses (usually) contain UV filters, so they protect your eyes from the Sun's UV rays as you cannot put sun cream onto your eyes. These are therefore just as important to wear in the summer as sun cream for exposed parts of the body.	
Outcomes / assessment	**Disciplinary and substantive concept/s**	**Key term**	**Key takeaway**
Knowledge quiz 3.1 Learning review and exit questions	**DC3:** Use a range of equipment. **DC4:** Make careful observations. **SC:** Light from the Sun can be dangerous, and eyes should be protected from sunlight.	ultraviolet (UV) light	**Ultraviolet (UV) light** can result in sunburn, skin ageing, and illness.

YEAR 3 SCIENCE PLANNING – LIGHT

Lesson question	Key knowledge	Teaching and Activities	Key vocabulary
Lesson 3: ***How does light travel?***	• Light travels in straight lines. • When looking at a light source, the light travels straight into your eye. • When seeing an object, light travels to the object and then reflects into your eye. **Working scientifically** • Use a range of equipment. • Make careful observations. • Record findings using simple scientific language, drawings, and labelled diagrams. • Use models to represent a scientific concept or process.	• Ask: 'How do we see things?'. Encourage pupils to sketch a diagram to visualise what they are thinking on a wb • **Read**: about the parts of the eye and how we see objects (on the teaching slides). Provide pupils with mirrors so they can locate the pupil in their own eye and identify the colour of their iris. • Reinforce that light must go in to our eyes, in order for us to see. We know light doesn't come out of our eyes as we don't have eyeballs that glow in the dark Explain Light travels in a straight line. When light hits an object, it is reflected (bounces off). If the reflected light hits our eyes, we can see the object. Watch clip and pause on the diagram. Using the image emphasise to children the process of how we are able to see- https://www.bbc.co.uk/bitesize/topics/zbssgk7/articles/zp7f8mn **Investigation:** Start the investigation by asking pupils to cover the face of their torch, but to leave a central slit. Pupils then shine this over a large sheet of pale paper; they will see light travelling in a straight line. Show pupils how to draw a simple ray diagram to represent light rays. They then draw their own diagrams in their pupil workbooks to represent the light's movement. (It is very important that pupils draw ray lines in pencil using a ruler and adding an arrow to show the direction of light travel.) *Activity 2-* Model an example on the wb. Draw a labelled diagram to show how we see an object like an apple *Children to*	• iris • pupil • reflect

		show arrows on lines to show the direction of travel of light and that light travels in straight lines *Activity 4* *Plenary-* Fill in the blanks with a partner. The light source_____ on to an object into your eye. Light travels in _____ lines. • **Read**: Pupils read about how the pupils of your eyes change in size when it is light or dark (on the teaching slides). They then use mirrors to observe the behaviour of their eyes when the light in the classroom is turned on and off. • **Retrieval**: Pupils identify which levels of light the images of eyes on the teaching slides are in.	
Outcomes / assessment	**Disciplinary and substantive concept/s**	**Key term**	**Key takeaway**
Knowledge quiz 3.2 Learning review and exit questions	**DC3:** Use a range of equipment. **DC4:** Make careful observations. **DC5:** Record findings using simple scientific language, drawings, and labelled diagrams. **DC8:** Use models to represent a scientific concept or process. **SC:** Light is reflected from surfaces.	light	Light travels in straight lines.

Common misconceptions

The following points are common misconceptions to be aware of when teaching this lesson.

- Light comes out of your eyes and reflects off objects so we can see them. In fact, light reflects off of objects and enters the eye.
- Light can go around corners. We can change the direction of light, by reflecting it, but it still moves in straight lines.

YEAR 3 SCIENCE PLANNING – LIGHT

Lesson question	Key knowledge	Teaching and Activities	Key vocabulary
Lesson 4: ***Does light travel through all materials?***	• Transparent materials allow all light to pass through them. • Opaque materials allow no light to pass through them. • Translucent materials allow some light to pass through them. **Working scientifically** • Use a range of equipment. • Make careful observations. • Record findings using simple scientific language, drawings, and labelled diagrams.	Ask: 'Does light travel through all materials?'. Demonstrate one example of an object that is transparent, one that is translucent, and one that is opaque. *Introduction*- Light is a beam of energy that travels in a wave from a source. A wave of light can only travel in a straight line. Waves of light are called light rays. Explain/demonstrate when an object passes in front of a beam of light, the light can be blocked, making a shadow. This is because light can only travel in a straight line, so it cannot travel around the card. Some objects, like the card, block light well and don't let any get through. These objects are called opaque. Other things let some light through but scatter the light so we can't see through them properly. These things are called translucent. Transparent objects let light travel through them easily. Share definitions on IWB- **Opaque objects let no light through.** **Translucent objects let some light through.** **Transparent objects let all light through**. Can you think of some items that are opaque, translucent and transparent?	• **opaque** • translucent • transparent

		• **Investigation**: Pupils test a range of materials for their opaqueness by shining a torch through them. They record their findings in the table Pupils look at the real-life examples of transparent, translucent, and opaque objects on the slides and explain why it is necessary for them to be as they are. Pupils choose one object to draw and explain why it is translucent, opaque, or transparent. For more of a challenge, ask pupils to pick an object made of a variety of materials, some parts of which are transparent and/or translucent, and/or opaque. Look around your classroom for ideas!	
Outcomes / assessment	**Disciplinary and substantive concept/s**	**Key term**	**Key takeaway**
Knowledge quiz 3.3 Learning review and exit questions	**DC3:** Use a range of equipment. **DC4:** Make careful observations. **DC5:** Record findings using simple scientific language, drawings, and labelled diagrams.	opaque	Transparent materials allow all light to pass through them whereas ***opaque*** materials allow no light to pass through them.

Common misconceptions

The following points are common misconceptions to be aware of when teaching this lesson.

- All translucent materials are coloured, like stained glass windows. Frosted glass is a good example of a translucent material that is not coloured.

YEAR 3 SCIENCE PLANNING – LIGHT

Lesson question	Key knowledge	Learning resources	Key vocabulary
Lesson 5: ***How are shadows formed?***	• Shadows are formed when light is blocked by an object. • Shadows are areas where there is no light. • Opaque objects form the clearest and darkest shadows. • Transparent objects do not form shadows. • Translucent objects form faint shadows. **Working scientifically** • Use a range of equipment. • Make careful observations. • Record findings using simple scientific language, drawings, and labelled diagrams.	Discuss what pupils think is happening in the picture of a shadow puppet. How is the shadow being made? • **Read**: about how shadows are formed. This is a good point to address possible misconceptions from the talk task. Some pupils believe shadows are 'made of darkness'. Remind pupils that darkness is an absence of light, and so a shadow is an area where light cannot reach. • **Write what is a shadow**? A shadow is formed when light travelling in straight lines is blocked by an opaque material. Light cannot travel round corners • **Investigation**: Make the room dark. With the object hidden (you may wish to stand behind a screen), shine a bright light onto an object, projecting the shadow onto the whiteboard. Pupils guess the object the teacher is using to create the shadows. Use a few opaque and translucent objects; ask pupils to work out why the shadows from opaque objects are different to those from translucent objects. If it a sunny day, take pupils outside to look at shadows on the playground. They could draw around one another's shadows using chalk. This is a good opportunity to address the misconception that shadows always appear behind a person; challenge pupils to show you that they can make their shadow appear in front of them. • **Read:** the information on how the type of material an object is made from affects how dark or faint its shadow is. • **Investigation**: Pupils use a range of classroom objects to predict how clear a shadow they will make, and then observe the shadows produced. They record their findings by ordering the objects based on the shadows that they formed, from no shadow to a dark shadow. Discuss the difference in materials and their opacity.	• opaque • **shadow** • translucent • transparent

YEAR 3 SCIENCE PLANNING – LIGHT

Outcomes / assessment	Disciplinary and substantive concept/s	Key term	Key takeaway
Knowledge quiz 3.4 Learning review and exit questions	**DC3:** Use a range of equipment. **DC4:** Make careful observations. **DC5:** Record findings using simple scientific language, drawings, and labelled diagrams. **SC:** Shadows are formed when the light from a light source is blocked by an opaque object.	shadow	**Shadows** are formed when light is blocked by an object.

Common misconceptions

The following points are common misconceptions to be aware of when teaching this lesson.

- Your shadow is always behind you. You can demonstrate this to show that this is not the case.
- Shadows are where dark is stronger than light. In fact, darkness is an absence of light.

YEAR 3 SCIENCE PLANNING – LIGHT

Lesson question	Key knowledge	Teaching and Activities	Key vocabulary
Lesson 6: ***How can we vary the size and position of shadows?***	• The closer an object is to a light source, the bigger the shadow becomes. • The height of a light source above an object affects the size of the shadow produced. • Sundials use shadows to tell the time of day. **Working scientifically** • Use a range of equipment. • Make careful observations. • Record findings using simple scientific language, drawings, and labelled diagrams. • Use results to draw simple conclusions and make predications.	Experiment- using an object e.g. a pencil change the position of the Lightsource (torch high up, low down, far away, close, above) and measure/draw the effect the movement of the Lightsource has on the shadow. Discuss importance of a fair test for the experiment- only changing one element (position of light source) and the others remain the same. Ask: 'What do you know about shadows?'. This is an opportunity to recap the previous lesson but also to discuss the size and position of shadows. You could also discuss that a brighter light will cause a clearer shadow. Explore shadows which are connected to and disconnected from the object e.g. shadows of clouds and children in the playground. https://www.youtube.com/watch?v=lOIGOT88Aqc- watch clip and discuss what they have found out about shadows. Discuss what a sundial is and watcg Sundial History and Basics - YouTube Explain Earth is moving not the sun! **Investigate – distance from light source – affect on shadow – fair test**	• **shadow**

		Investigate height of light source – affect on shadow – children to record results and write a conclusion **Discuss how footballers have 4 shadows when flood lights are in – why? Model with torches** Plenary – can they draw the shadows of the objects – shadows are not always behind – they are the same shape and do not have a colour. They are also connected in a mirror image	
Outcomes / assessment	**Disciplinary and substantive concept/s**	**Key term**	**Key takeaway**
Knowledge quiz 3.5 Learning review and exit questions	**DC3:** Use a range of equipment. **DC4:** Make careful observations. **DC5:** Record findings using simple scientific language, drawings, and labelled diagrams. **DC7:** Use results to draw simple conclusions and make predictions. **SC:** There are patterns in the way that the size of shadows change.	shadow	The closer an object is to a light source, the bigger the shadow becomes.

Common misconceptions

The following points are common misconceptions to be aware of when teaching this lesson.

- Your shadow is always in the same place. Your shadow moves, depending on where the light is coming from.
- The Sun moves through the sky during the day. **I**t is the rotation of Earth which causes this apparent motion.

YEAR 3 SCIENCE PLANNING – LIGHT

Lesson question	Key knowledge	Teaching and Activities	Key vocabulary
Lesson 7: ***What types of material reflect light?***	• Some materials are more reflective than others. • Non-reflective materials are rough and dark or dull. • Reflective materials are smooth and shiny. **Working scientifically** • Use a range of equipment. • Make careful observations. • Record findings using simple scientific language, drawings, and labelled diagrams.	Start by dimming the lights in the room and shining a torch onto a mirror, a white piece of paper, and then a piece of dark card. The more reflective the surface the more visible it is, as more light is reflected (less is absorbed). Extend this piece of work to compare matt surfaces with shiny surfaces; different types of fabric work well for this—for example, satin and cotton in the same colour. Share that smooth, shiny, and pale coloured objects are the best reflectors of light; rough, matt, or dark coloured objects absorb light. At this point, address the misconception that only mirrors or shiny objects reflect light, if required. Remind pupils that to see an object, it must reflect some light into your eyes. Only black objects don't reflect light. Some surfaces and materials reflect light well. Other materials do not reflect light well. Reflective surfaces and materials can be very useful: Reflective strips on coats or bags mean you can be seen at night. They are also useful for fire-fighters or builders who may work in a dark and dangerous environment. 'Cat's Eyes' help drivers see the road by reflecting light from headlamps. Mirrors let us see ourselves, and are also useful in cars, to allow drivers to see behind them. Retroreflectors are used for road signs so that drivers can see the signs from their car. Can you think of any other uses?	• absorb • matt • non-reflective • reflect • **reflective** • shiny

		• **Investigation:** Pupils investigate how reflective a range of materials are by shining a torch onto the material and observing how much of the light is reflected. • **Write**: Pupils design a backpack to be as safe as possible when walking home from school in the winter, applying their learning from this lesson. They should add labels describing why they used each material within their design.	
Outcomes / assessment	**Disciplinary and substantive concept/s**	**Key term**	**Key takeaway**
Knowledge quiz 3.7 Learning review and exit questions	**DC3:** Use a range of equipment. **DC4:** Make careful observations. **DC5:** Record findings using simple scientific language, drawings, and labelled diagrams. **SC:** Light is reflected from surfaces.	reflective	**Reflective** materials are smooth and shiny.

Common misconceptions

The following points are common misconceptions to be aware of when teaching this lesson.

- Only mirrors or shiny objects reflect light. In fact, only black objects do not reflect light.
- Materials are always fabrics.