Year 3 Science Curriculum

The National Curriculum for science intends that children's understanding of the nature, processes and methods of science is developed through different types of science enquiries that help them to answer scientific questions about the world around them. Within each year group, substantive (knowledge) content should be taught through practical opportunities that enable children to develop a range of 'Working Scientifically' skills. These skills, from the National Curriculum, are provided below and are then exemplified in relation to each science unit.

Year 3/4 Working Scientifically Skills			
Plan	**Do**	**Record/Report**	**Review**
• Ask relevant questions and use different types of scientific enquiries to answer them • Set up simple practical enquiries, comparative and fair tests • *Pupils in years 3 and 4 should be given a range of scientific experiences to enable them to raise their own questions about the world around them.* • *They should start to make their own decisions about the most appropriate type of scientific enquiry they might use to answer questions; recognise when a simple fair test is necessary and help to decide how to set it up; talk about criteria for grouping, sorting and classifying; and use simple keys. They should begin to look for naturally occurring patterns and relationships and decide what data to collect to identify them.*	• Make systematic and careful observations and, where appropriate, take accurate measurements using standard units, using a range of equipment, including thermometers and data loggers • *They should learn how to use new equipment, such as data loggers, appropriately.*	• Gather, record, classify and present data in a variety of ways to help in answering questions • Record findings using simple scientific language, drawings, labelled diagrams, keys, bar charts, and tables • Report on findings from enquiries, including oral and written explanations, displays or presentations of results and conclusions • *They should collect data from their own observations and measurements, using notes, simple tables and standard units, and help to make decisions about how to record and analyse this data.* • *With help, pupils should look for changes, patterns, similarities and differences in their data in order to draw simple conclusions and answer questions.*	• Use results to draw simple conclusions, make predictions for new values, suggest improvements and raise further questions • Identify differences, similarities or changes related to simple scientific ideas and processes • Use straightforward scientific evidence to answer questions or to support their findings • *With support, they should identify new questions arising from the data, making predictions for new values within or beyond the data they have collected and finding ways of improving what they have already done.*

• *They should help to make decisions about what observations to make, how long to make them for and the type of simple equipment that might be used.* • *They should also recognise when and how secondary sources might help them to answer questions that cannot be answered through practical investigations.* • ***These opportunities for working scientifically should be provided across years 3 and 4 so that the expectations in the programme of study can be met by the end of year 4. Pupils are not expected to cover each aspect for every area of study.***		• *Pupils should use relevant scientific language to discuss their ideas and communicate their findings in ways that are appropriate for different audiences.*	

Statutory content is specified below and is supported by reference to non-statutory guidance. Non-statutory guidance is shown in italics.

The six main types of enquiry are highlighted within each unit to ensure appropriate coverage across each year group.

Observing over time	Pattern Seeking	Identifying, Classifying and Grouping	Comparative and Fair testing	Researching using secondary sources	Exploring

Unit and vocabulary	Intent – statutory and non-statutory *(in italics)* content - substantive (knowledge)	Intent – statutory and relevant non-statutory content - Disciplinary (skills)
Plants **Prior vocabulary:** Leaf, leaves, blossom, petal, fruit, berry, root, bulb, seed, trunk, branch, stem, bark, stalk, water, light, damp, wet, dry, dark, light, hot, warm, cool, cold, grow, growth, healthy **New vocabulary:** Part, role, air, nutrients, soil, fertiliser, transported, life cycle, insect/wind pollination, seed formation, seed dispersal, wind dispersal, animal dispersal, water dispersal ***When covering the seed growing part of this topic make sure a strong link is made with the soils part of the rock topic. It provides an opportunity to cover or revisit what soil is made of**	**Pupils should be taught to:** • identify and describe the functions of different parts of flowering plants: roots; stem/trunk; leaves; and flowers. • explore the requirements of plants for life and growth (air, light, water, nutrients from soil, and room to grow) and how they vary from plant to plant. • investigate the way in which water is transported within plants. • explore the part that flowers play in the life cycle of flowering plants, including pollination, seed formation and seed dispersal. • *Pupils should be introduced to the relationship between structure and function: the idea that every part has a job to do. They should explore questions that focus on the role of the roots and stem in nutrition and support, leaves for nutrition and flowers for reproduction.*	**Pupils should be taught to:** • ask relevant questions and using different types of scientific enquiries to answer them. • set up simple practical enquiries, comparative and fair tests. • make systematic and careful observations and, where appropriate, take accurate measurements using standard units, using a range of equipment. • gather, record, classify and present data in a variety of ways to help in answering questions. • record findings using simple scientific language, drawings, labelled diagrams, keys, bar charts, and tables. • report on findings from enquiries, including oral and written explanations, displays or presentations of results and conclusions. • use straightforward scientific evidence to answer questions or to support their findings.

and to explore other properties of soil – see Rocks and Soils below for more information.		• use results to draw simple conclusions, make predictions for new values, suggest improvements, and raise further questions.
Implementation – activity examples and cultural capital opportunities	**Observing over time** • Observe what happens to plants over time when the leaves or roots are removed. • Observe the effect of putting cut white carnations or celery in coloured water. This experiment can be a little tricky to get to work. If it doesn't pupils can still observe what happens by watching the 'Water Colours' video on Explorify, https://explorify.uk/en/activities/whats-going-on/water-colours • Observe what happens to a plant over time when it is deprived of air by covering it with a clear plastic bag which is taped at the bottom. Key questions • **What happens to celery when it is left in a glass of coloured water?** • **How do flowers in a vase change over time?** • **What happens to a plant when its leaves and roots are removed?** • **What happens to a plant when it is deprived or air?** **Pattern Seeking** • Observe pollinators in the school grounds/local area and identify simple patterns e.g. do they visit some flowers more than others? Key question • **What colour flowers do pollinating insects prefer?** **Identifying and Classifying** • Collect and classify seeds in a range of ways, including by how they are dispersed. • Identify different pollinators in the school grounds/local area. Key questions • **How many different ways can you group our seed collection?** • **What pollinators visit the flowers in our school grounds/local area?**	

	Comparative and Fair Testing • Change the conditions that seeds/plants are in and observe what effect this has on their health/growth e.g. • Different types of soil. This provides an opportunity to link this topic with rocks (see below). • Different amounts of fertilisers • Varying the amount of space that roots can grow in, • Depriving them from air. • Varying amount of temperature/light • The above investigations will be closely linked to Observing Over Time (please see above). Ensure that pupils do not repeat investigations that they carried out in Year 2 into growing seeds/plants. Discuss the differences between a healthy and unhealthy plant. This could be supported by looking at photographs of unhealthy plants and comparing them to photographs of healthy plants. • Investigate wind seed dispersal by making different types of paper helicopter (various designs can be found on the internet or from the Royal Horticultural Society) and measure how far they travel when blown by a fan. • For more investigations into plant growth see BBC Terrific Scientific, https://www.bbc.co.uk/teach/terrific-scientific/KS2/z6q47nb Key questions • **Which conditions help seeds germinate faster?** • **Which conditions inhibit plant health/growth?** • **Which conditions increase plant growth/health?** • **Which type of 'seed' is blown the furthest?** **Researching using secondary sources** • Research different types of seed dispersal. • Research diseases that are affecting trees in the UK e.g. ash die back, tar spots, acute oak decline. • Research the functions of the different parts of parts. Key questions • **What are all the different ways that seeds disperse?** • **What diseases are affecting trees in the UK?** • **What is the function of a flowering plants: roots; stem/trunk; leaves; and flowers**

	Exploring and Problem Solving • Investigate how water is transported into plants by getting three clear plastic cups. Fill each cup with water and place them in a row. Fill the two cups on the outside with different food colouring e.g. in one cup put red, the other green. Do not put any food colouring into the middle cup. Fold two paper towels into upside down V-shaped arches and place them into the cups so they link them up. Make sure the ends are touching the bottoms of the cups. Wait for several hours. Water will end up in all of the cups and the colours will be mixed. This is an effective way of demonstrating 'capillary action' in plants. For more information about how to run this activity go to the Marvin and Milo 'Walk Water' activity, https://spark.iop.org/walking-water • Explore whether it is possible to nurse an unhealthy plant back to health. In advance create some unhealthy plants by depriving them of light, air etc. • Design/make a seed that will be able to disperse using a specific method e.g. wind, water, animal fur etc. • Explore/discuss the question, 'how can you tell if something is a plant?' See Explorify for more information, https://explorify.uk/en/activities/the-big-question/how-can-you-tell-if-something-is-a-plant • Challenge pupils to produce a short play to show the process of pollination. • Create a new species of flowering plant. • Based on their learning, challenge pupils to think of new questions they'd like to investigate about plants – where possible enable them to do investigations to answer them. Key questions • **Can we nurse an unhealthy plant back to health?** • **Can you design a seed that will be able to disperse via water/wind?** • **What else would you like to find out about plants?** **Cultural capital opportunities:** **Sustainable Development Goals**: Number 13 Climate Action, Number 15 Life on land **Climate change links:** Learn about the impact that increasing temperatures will have on the health of plants in the UK and beyond. **Visits/trips**: Westonbirt Arboretum. A local park, botanic garden, forest or wildlife area. **Visitors:** A horticulturalist, botanist, gardener (amateur or professional). See STEM Ambassadors, https://www.stem.org.uk/stem-ambassadors for support with finding visitors. Make sure pupils are exposed to a diverse range of scientists including scientists who are working today. See, • **The PSTT** https://pstt.org.uk/resources/curriculum-materials/ASJLM **&** https://pstt.org.uk/resources/curriculum-materials/Science-at-Work • **The Ogden Trust** https://www.ogdentrust.com/resources/research-cards-women-in-physics**,** • **STEM Sisters** http://www.hmdt.org.uk/hmdtmusic/stemsisters/the-stem-sisters-2/, • **Oxford Sparks** https://www.oxfordsparks.ox.ac.uk/justaddimagination **for resources to support this.** **Scientists:** George Washington Carver (American agriculturalist and inventor), Joseph Banks (English botanist and explorer). **Enrichment experiences:** Pupils could attempt to grow unusual/exotic plants. Pupils could interact with unusual/exotic seeds

Subject Links	
	English • Write instructions for how to grow and look after plants. • Write a script for a 'Gardening TV Programme' which pupils then perform. • Write science themed poems about different plants/trees. • Write a diary entry in the character of a plant or tree. Related texts • The Hidden Forest (Jeannie Baker) • George and Flora's Secret Garden (Jo Elworthy) **Maths** • Measure the growth rates of plants under different conditions. • Estimate/measure how much water has travelled up into the celery/white carnations. • Create a square grid containing 100 squares. Plant one seed per square and see how many germinate. This can then be presented as a fraction or percentage. Repeat for different types of seeds and compare germination rates. **Computing/Technology** • Set up filming devices to record pollination/number of pollinators that visit a plant/flowerbed. **DT** • Design and make new types of seed. **PSHE** • Learn about the importance of protecting and valuing the natural world. **Geography** • Learn about different vegetation zones around the world. **History** • Learn about how our knowledge and understanding of plants has changed over time. • Learn about the history of botany.

Unit and vocabulary	Intent – statutory and non-statutory *(in italics)* content - substantive (knowledge)	Intent – statutory and relevant non-statutory content - Disciplinary (skills)
Animals including humans **Prior vocabulary:** Food types, fruit, vegetable, bread, rice, potato, pasta, milk, dairy foods, fat, sugar, meat, fish, egg, beans, water **New vocabulary:** Nutrition, nutrients, carbohydrates, sugars, protein, vitamins, mineral, dietary fibre, fat, water, balanced diet, skeleton, muscles, support, protect, protection, move, movement, skull, ribs, spine, vertebra, joints, sockets, bones, tendons	**Pupils should be taught to:** • identify that animals, including humans, need the right types and amount of nutrition, and that they cannot make their own food – they get nutrition from what they eat. • identify that humans and some other animals have skeletons and muscles for support, protection and movement. • *Pupils should continue to learn about the importance of nutrition and should be introduced to the main body parts associated with the skeleton and muscles, finding out how different parts of the body have special functions.*	**Pupils should be taught to:** • ask relevant questions and use different types of scientific enquiries to answer them. • make systematic and careful observations and, where appropriate, take accurate measurements using standard units, using a range of equipment. • gather, record, classify and present data in a variety of ways to help in answering questions. • record findings using simple scientific language, drawings, labelled diagrams, keys, bar charts, and tables. • report on findings from enquiries, including oral and written explanations, displays or presentations of results and conclusions.

Implementation – activity examples and cultural capital opportunities	**Observing over time**
	• Look at photographs of the human skeleton from embryo to old age and identify changes.
	Key question
	• **How does our skeleton change over time? (from birth to death)**
	
	Pattern Seeking
	• Investigate patterns related to the human body e.g.
	  ○ Can people with longer legs jump further?
	  ○ Can people with longer legs run faster?
	  ○ Can people with bigger hands catch better?
	  ○ Is your arm span = to your height?
	  ○ Is the length of your nose = to the length of your nose?
	  ○ Is the length of your forearm the same as the length of your foot?
	Key question
	• **Do male humans have larger skulls than female humans?**	

	Identifying and Classifying • Classify food in a range of ways. • Go on a 'skeleton hunt'. Carry out a survey of living things in the school grounds/local area and classify animals that they find based on whether they have endo, exo or hydrostatic skeletons. • Compare photographs of different animal's skeletons, identifying similarities and differences. • Sort photographs of animal skeletons based on their observable features. • Label the names of different bones in the human body. Key questions • **How do the skeletons of different animals compare?** • **What types of skeleton can we find in our school grounds?** • **How can we sort this food into different groups?** **Comparative and Fair Testing** • Compare the skeletons of boys/girls, children/adults and identify differences/patterns. Key question • **How does the skull circumference of a girl compare with that of a boy?** **Researching using secondary sources** • Research the types of food that contain the different nutrients. • Research the amount of nutrients contained in fast food. Key question • **Why do different types of vitamins keep us healthy and which foods can we find them in?** **Exploring and Problem Solving** • Challenge pupils to use junk modelling resources to build a structure to shelter a tomato. Drop a heavy weight onto their structures to see if they have protected the tomato. Relate to our skeletons providing protection for our major organs. • Challenge pupils to use playdoh/modelling clay and art straws to build towers to support a tennis ball. Relate to our skeletons providing support/structure for our bodies. • Make models of skeletons use natural objects or art straws. • Make a giant skeleton in the school hall or playground. • Make simple bionic hands (using card, straws, Sellotape and string) to demonstrate how our muscles work. Instructions for making a bionic hand can be found on the Stem Learning website, https://www.stem.org.uk/resources/elibrary/resource/446379/building-bionic-hand • Make a simple model of the arm to demonstrate how our muscles work. • Plan a daily diet to contain a good balance of nutrients. • Use food labels to explore:

	○ The nutritional content of a range of food items. ○ How much fat do different types of pizza contain? How much sugar is in soft drinks? How much salt is in different types of bread? • Explore the question, 'what is a balanced diet for us and the planet?' See Explorify for more information, https://explorify.uk/en/activities/the-big-question/what-is-a-balanced-diet-for-us-and-the-planet • Discuss, 'what if you only ate chips? See Explorify for more information, https://explorify.uk/en/activities/what-if/you-only-ate-chips Key question • **What should I eat in a day to get a good balance of nutrients?** **Cultural capital opportunities** **Sustainable Development Goals**: Number 3 Good health and well being, Number 13 Climate Action, Number 15 Life on land **Climate change links:** Learn how the production of certain types of food produces large amounts of greenhouse gases e.g. beef for beef burgers. Learn how certain diets are more environmentally friendly than others e.g. vegetarian/vegan. **Visits/trips**: A local professional sports team (to visit their medical facilities and talk to their medical team). A doctor's surgery or healthy clinic. A local restaurant (Pizza Express for example run a school visits initiative). A local food market, supermarket or greengrocers. **Visitors:** A doctor, nurse, radiographer, physiotherapist, sport scientist/coach, dietician, nutritionist or chef. **Scientists:** Adelle Davis (20th Century Nutritionist), Marie Curie (Radiation / X-Rays) **Enrichment experiences:** • Pupils could explore the actual skeletons of animals. • Pupils could learn about famous historical skeletons e.g. Charles Byrne (the 'Irish Giant'), Lindow Man and Richard III. • Pupils could look at X-rays
Subject Links	**English** • Write adverts to promote healthy types of food. • Write a 'how to guide' to eating healthily. Related texts • The Story of Frog Belly Rat Bone (Timothy Basil Ering) • Funnybones (Janet and Allan Ahlberg) • I Will Never Not Ever Eat a Tomato (Lauren Child) • Goldilocks and the Three Bears (Samantha Berger) **Maths** • This topic provides ample opportunities for pupils to use and apply their measuring skills and knowledge of m, cm, mm. See Pattern Seeking and Comparative/Fair Testing.

	• When investigating the salt/sugar content of different foods they could present this as a fraction of the foods total weight. **DT** • Cook healthy meals. **PSHE** • Learn about the importance of eating a healthy, balanced diet. **Geography** • Learn about the diets of different people around the world. **History** • Learn about how skeletons are a vital source of archaeological evidence, providing an invaluable insight into how our ancestors lived, for example. Skeletons can tell us about the diet and health of people from the past. • Learn about some of the scientific procedures used to investigate skeletons. • Learn about some famous skeletons and burials e.g. Sutton Hoo, **Music** • Learn about Danse Macabre by Saint Saens. **Art** • Pupils could make collages/models to show a healthy diet. • Pupils could paint/make models of skeletons. **PE** • PE lessons provide lots of opportunities for pupils to think about how they're skeletons/muscles are moving/working.

Unit and vocabulary	Intent – statutory and non-statutory *(in italics)* content - substantive (knowledge)	Intent – statutory and relevant non-statutory content - Disciplinary (skills)
Rocks and soils **Prior vocabulary:** None **New vocabulary:** Rock, stone, pebble, boulder, soil, fossil, grain, crystal, layers, hard, soft, texture, absorb water, let water through, marble, chalk, granite, sandstone, slate, sandy soil, clay soil, chalky soil, peat ***When covering the soils part of this topic make sure a strong link is made with the plants topic. During the plants topic, pupils could grow seeds in different types of soil and observe what effect this has (see Comparative and Fair Testing below).**	**Pupils should be taught to:** • compare and group together different kinds of rocks on the basis of their appearance and simple physical properties. • describe in simple terms how fossils are formed when things that have lived are trapped within rock. • recognise that soils are made from rocks and organic matter. • *Linked with work in geography, pupils should explore different kinds of rocks and soils, including those in the local environment.*	**Pupils should be taught to:** • ask relevant questions and using different types of scientific enquiries to answer them. • set up simple practical enquiries, comparative and fair tests. • make systematic and careful observations and, where appropriate, take accurate measurements using standard units, using a range of equipment, including thermometers and data loggers. • gather, record, classify and present data in a variety of ways to help in answering questions. • record findings using simple scientific language, drawings, labelled diagrams, keys, bar charts, and tables. • report on findings from enquiries, including oral and written explanations, displays or presentations of results and conclusions. • use results to draw simple conclusions, make predictions for new values, suggest improvements and raise further questions. • use straightforward scientific evidence to answer questions or to support their findings.

Implementation – activity examples and cultural capital opportunities	**Observing over time**
	• Visit a local graveyard or old building to observe how types of rock change over a long period of time.
	Key question
	• **How do rocks change over a long period of time?**
	
	Pattern Seeking
	• Explore a range of sedimentary, igneous and metamorphic rocks and identify simple patterns.
	Key questions
	• **Is there a pattern to which rocks are sedimentary?**
	• **Is there a patten to which rocks react to vinegar and which don't?**
	• **Is there a pattern to which rocks contain crystals and which don't?**
	• **Is there a pattern in where we find volcanos on planet Earth?**
	
	Identifying and Classifying
	Group rocks based on different features. Where possible allow pupils to:
	• Devise their own sorting criteria.
	• Use ID guides/keys to identify different rocks.
	• Closely observe a soil sample (using hand lens if possible) and identify its constituent parts.
	• Collect soil samples from around the school grounds/local areas and compare them. Identify similarities and differences.
	• Classify soils in a range of ways based on their appearance.
	• Sort living things/objects based on whether they could lead to a fossil forming or not. See 'Fossil Detectives' which is part of the PSTT Big Jurassic Classroom resource, https://pstt.org.uk/resources/curriculum-materials/big-jurassic-classroom
	Key questions
	• **Can you use the identification key to find out the name of each of the rocks in your collection?**
	• **How can you sort these rocks into different groups?**
	  ○ **Which rocks fizz when you drip vinegar on them?**
	  ○ **Which rocks contain crystals?**
	  ○ **Which rocks are hard/soft?**
	• **What is soil made of?**
	• **Are all soils the same?**

Comparative and Fair Testing

- Grow the same type of seed in different types of soil and observe what affect this has on growth rates/plant health.
- Carry out comparative tests on a range of rocks to identify which is hardest (by scratching them with a nail) and most permeable (by soaking them in water and measuring how much has been absorbed).
- Investigate how long water takes to drain through different types of soil. If necessary create different types of soil by adding sand, gravel etc.

Key questions

- **Which type of rock is the hardest/most absorbent?**
- **Through which soil does water drain the quickest?**
- **In which type of soil does a seed grow quickest?**

Researching using secondary sources

- Research the properties of different types of rocks and how they form.
- Research how fossils form.

Key questions

- **What types of rock are there?**
- **What is a sedimentary/igneous/metamorphic rock?**
- **How do fossils form?**

Exploring and Problem Solving

- Explore different ways of making model fossils.
- Explore ways of presenting/demonstrating the process of fossilisation e.g. drama/roleplay, modelling.
- Based on their learning, challenge pupils to think of new questions they'd like to investigate about rocks and fossils – where possible enable them to do investigations to answer them.

Key questions

- **How can we portray how fossils were formed?**
- **What else could you investigate about rocks?**

	Cultural capital opportunities: **Sustainable Development Goals**: Number 15 Life on land **Climate change links:** Pupils could learn about how rocks provide a record of how the Earth's climate has changed in the past. Pupils could learn about how rocks may be used in future to store carbon dioxide that has been removed from the Earth's atmosphere (carbon capture). **Visits/trips**: A local natural history museum, a quarry or mine. A place where it is possible to find fossils. **Visitors:** A geologist, a stone mason. See STEM Ambassadors, https://www.stem.org.uk/stem-ambassadors for help with finding visitors. **Scientists:** Charles Lyell (Scottish Geologist), Inge Lehmann (Earth's Mantle) **Enrichment experiences:** Pupils could handle and examine fossils.
Subject Links	**English** • Write a biography for a piece of rock. • Write a comic strip or story about a prehistoric animal or plant dying, becoming fossilised and then discovered. **Maths** • Investigations into the permeability of different types of rock provide opportunities for pupils to use and apply their knowledge about capacity, litres and millilitres. • Pupils could measure out how long different dinosaurs were on the school playground. Pupils could use their maths skills to recreate the fossilised footsteps of an Iguanodon. They could then use a mathematical formula to work out whether the Iguanodon was walking, trotting or running when it left the footsteps millions of years ago. For information about how to run this activity go the Fossil Detectives activity on the Big Jurassic Classroom part of the PSTT website, https://pstt.org.uk/resources/curriculum-materials/big-jurassic-classroom **DT** • Make models of fossils. See The Big Jurassic Classroom for guidance on this. https://pstt.org.uk/resources/curriculum-materials/big-jurassic-classroom **Geography** • Learn about the different types of rock that make up the UK with a particular focus on the rocks that are beneath the school. See Geology Resources, Beneath your feet - Geological Map Search Tool. Brought to you by Geology Resources

	History • Learn about the difference between prehistory and history and how dinosaurs belong to the prehistoric era. • Learn about the different time periods of the pre-historic age. See The Big Jurassic Classroom for resources to support this, https://pstt.org.uk/resources/curriculum-materials/big-jurassic-classroom • Learn about how the Jurassic coast formed and developed over time. See The Big Jurassic Classroom again for resources to support this. **Art** Learn about ancient cave paintings and produce their own versions.

Unit and vocabulary	Intent – statutory and non-statutory *(in italics)* content - substantive (knowledge)	Intent – statutory and relevant non-statutory content - Disciplinary (skills)
Light **Prior vocabulary:** Light, transparent, opaque, translucent **New vocabulary:** Light source, torch, candle, sun, bulb, dark, darkness, absence of light, reflect, reflective, mirror, shiny, matt, surface, shadow, block, direct, direction, sunlight, dangerous	**Pupils should be taught to:** • 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. • *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.* • *Note: Pupils should be warned that it is not safe to look directly at the Sun, even when wearing dark glasses.*	**Pupils should be taught to:** • ask relevant questions and use different types of scientific enquiries to answer them. • set up simple practical enquiries, comparative and fair tests. • make systematic and careful observations and, where appropriate, take accurate measurements using standard units, using a range of equipment, including thermometers and data loggers. • gather, record, classify and present data in a variety of ways to help in answering questions. • record findings using simple scientific language, drawings, labelled diagrams, keys, bar charts, and tables. • report on findings from enquiries, including oral and written explanations, displays or presentations of results and conclusions. • use results to draw simple conclusions, make predictions for new values, suggest improvements and raise further questions. • use straightforward scientific evidence to answer questions or to support their findings. • identify differences, similarities or changes related to simple scientific ideas and processes

Implementation – activity examples and cultural capital opportunities	**Observing over time**
	• Investigate how the length of a shadow changes over the course of a day.
	• Use dataloggers (or download a light-meter app onto a tablet/smartphone) and investigate:
	  ○ The brightness of the Sun over the course of a day.
	  ○ Where the brightest place in the classroom/school is.
	Key questions
	• **How does my shadow change over the day?**
	• **Is the Sun the same brightness all day?**
	• **Which is the brightest place in our classroom?**
	
	Pattern Seeking
	• Explore how the length of shadows change by moving objects towards or away from a light source and identify simple patterns. This investigation is closely linked to the comparative test detailed below.
	Key question
	• **Are you more likely to have bad eyesight and to wear glasses if you are older?**
	
	Identifying and Classifying
	• Give pupils a range of materials (some of which are transparent, translucent and opaque). Ask them to sort the materials based on how much light they let through.
	Key question
	• **Which materials are transparent, opaque and translucent?**
	
	Comparative and Fair Testing
	• Investigate what effect moving an object closer to or further away from a fixed light source has on the size of the shadow. Pupils could also experiment with moving the light source instead of the object.
	• Give pupils different materials (some of which are transparent, translucent, and opaque). Use dataloggers (or download a light-meter app onto a tablet/smartphone) to investigate which materials reflect the most/least light and which materials let the most/least amount of light through.
	Key questions
	• **How does the distance between the shadow puppet and the screen affect the size of the shadow?**
	• **Which material reflects the most light?**
	• **Which material lets the most light travel through it?**
	
	Researching using secondary sources
	• Research how ‘cat’s eyes’ work on a road.
	Key question
	• **What are ‘cat’s eyes’? How do they work?**

	Exploring and Problem Solving • Challenge pupils to apply their learning about light and shadows to make shadow puppets and put on a shadow puppet play. • Identify which material should be used to make reflective, protective clothing to be worn during the dark evenings. • Set pupils the challenge of creating a lightproof den. See Explorify for more information, • https://explorify.uk/en/activities/problem-solvers/lightproof-your-secret-den • Explore shadows which are connected to and disconnected from the object e.g. shadows of clouds and children in the playground. • Based on their learning, challenge pupils to think of new questions they'd like to investigate about light – where possible enable them to do investigations to answer them. Key questions • **Which material should we use to make reflective clothing out of? Why?** • **How can you create a lightproof den?** • **Are shadows always connected to an object?** • **What else could you investigate about light?** **Cultural capital opportunities:** **Sustainable Development Goals**: Number 13 Climate Action **Climate change links:** Pupils could learn about solar power and visit a solar farm. **Visits/trips**: Pupils could be taken to see a shadow puppet show. Pupils could walk through a forest to experience how the light interacts with the trees. **Visitors:** An opticians/optometrist, lighting engineer or materials scientist. See STEM Ambassadors, https://www.stem.org.uk/stem-ambassadors for help with finding visitors. **Scientists:** Euclid (Ancient Greek mathematician), Ibn Sahl (Persian mathematician and Physicist), Roger Bacon (English Monk and early scientist), Willebrord Snellius (Dutch astronomer and mathematician), Isaac Newton (English physicist), Christiaan Huygens (Dutch physicist, mathematician, astronomer and inventor). **Enrichment experiences:** Pupils could explore prisms, pinhole cameras and kaleidoscopes.
Subject Links	**English** • Write poems inspired by Sunlight or shadows. Related texts • The Owl Who Was Afraid of the Dark (Jill Tomlinson) • The Dark (Lemony Snicket) • The Firework-Maker's Daughter (Philip Pullman)

	Maths
	• Investigations into changing shadow length provides lots of opportunities for pupils to use and apply their measuring skills and knowledge of m, cm, mm.
	
	Computing/Technology
	• Use dataloggers/light meter apps on tablets/smartphones to take light readings. Present these readings using graphing computer programmes.
	
	DT
	• Make sets and shadow puppets for a shadow puppet play.
	
	PSHE
	• Learn about the dangers of:
	  ○ Looking directly at the sun.
	  ○ Skin cancer and exposure to sunlight.
	  ○ Cycling, walking in the dark without high visibility clothing.
	
	History
	• Learn about the historical development of different light sources. See The Ogden Trust for resources to support this, https://www.ogdentrust.com/resources/scientific-ideas-over-time-timeline-card-sort-game-light-sources
	• Learn about ancient civilisations that worshipped the Sun like the Ancient Egyptians or Mayans.
	
	Music
	• Learn about pieces of music that were inspired by The Sun and light e.g. Richard Strauss's, Alpine Symphony Op. 64 or Ferde Grofé, Grand Canyon Suite: I Sunrise; IV Sunset
	
	Art
	• Explore how painters like Turner and Monet depicted the Sun and light in their paintings.
	• Use different artistic techniques/styles to represent The Sun and Sunlight.

Unit and vocabulary	Intent – statutory and non-statutory *(in italics)* content - substantive (knowledge)	Intent – statutory and relevant non-statutory content - Disciplinary (skills)
Forces and magnets **Prior vocabulary:** Push, pushing, pull, pulling **New vocabulary:** Force, twist, contact force, non-contact force, magnetic force, magnet, strength, bar magnet, ring magnet, button magnet, horseshoe magnet, attract, repel, magnetic material, non-magnetic material, metal, iron, steel, poles, north pole, south pole	**Pupils should be taught to:** • compare how things move on different surfaces. • notice that some forces need contact between two objects, but magnetic forces can act at a distance. • observe how magnets attract or repel each other and attract some materials and not others. • compare and group together a variety of everyday materials on the basis of whether they are attracted to a magnet and identify some magnetic materials. • describe magnets as having two poles. • predict whether two magnets will attract or repel each other, depending on which poles are facing. • *Pupils should observe that magnetic forces can act without direct contact, unlike most forces, where direct contact is necessary (for example, opening a door, pushing a swing). They should explore the behaviour and everyday uses of different magnets (for example, bar, ring, button and horseshoe).*	**Pupils should be taught to:** • ask relevant questions and use different types of scientific enquiries to answer them. • set up simple practical enquiries, comparative and fair tests. • make systematic and careful observations and, where appropriate, take accurate measurements using standard units, using a range of equipment. • gather, record, classify and present data in a variety of ways to help in answering questions. • record findings using simple scientific language, drawings, labelled diagrams, keys, bar charts, and tables. • report on findings from enquiries, including oral and written explanations, displays or presentations of results and conclusions. • use results to draw simple conclusions, make predictions for new values, suggest improvements and raise further questions. • use straightforward scientific evidence to answer questions or to support their findings. • identify differences, similarities or changes related to simple scientific ideas and processes.

Implementation – activity examples and cultural capital opportunities	**Observing over time** • Magnetise a pin or sewing needle by stroking it with a magnet in the same direction for 40 times. Observe how long it stays magnetised for. Key question • **If we magnetise a pin, how long does it stay magnetised for?** **Pattern Seeking** • Investigate the strength of different sized/shaped magnets and identify simple patterns. The strength of a magnet could be tested by seeing how many paperclips it picks up or at what distance a paperclip is attracted to it. Key question • **Does the size and shape of a magnet affect how strong it is?** **Identifying and Classifying** • Classify materials according to whether they are magnetic or non-magnetic. • Go on a magnetic materials scavenger hunt in the school grounds/local area. Key question • **Which materials are magnetic?** **Comparative and Fair Testing** • Investigate how far toy cars/balls roll over different surfaces. • Observe how spinning tops move on different surfaces. • Carry out comparative tests into how the shape/size of a magnet effects its strength. See Pattern Seeking above. In addition to using paperclips pupils could also test the strength of magnets by seeing how many pieces of paper can be placed between them and a magnetic surface before the magnetic is no longer attracted. Key questions • **How does the mass of an object affect how much force is needed to make it move?** • **Which magnet is strongest?** • **Which surface is best to stop you slipping?** • **How do different surfaces affect how toy cars/balls/spinning tops move?** **Researching using secondary sources** • Research how a compass works. • Research how magnets are used in our everyday lives. Key questions • **How does a compass work?** • **How are magnets used in our everyday lives? What machines contain/use magnets?**

	Exploring and Problem Solving • Challenge pupils to design and make games using magnets and magnetic materials e.g. fishing or racing games. • Explore whether fridge magnets have poles. • Based on their learning, challenge pupils to think of new questions they'd like to investigate about forces and magnets – where possible enable them to do investigations to answer them. Key questions • **How could we make a game using magnets/magnetic materials?** • **How can we find out if fridge magnets have poles?** • **What else could you investigate about forces and magnets?** **Cultural capital opportunities:** **Sustainable Development Goals**: Number 13 Climate Action **Climate change links:** Pupils could learn about how 'maglev' trains (which use electromagnets) are potentially environmentally friendly forms of transport. **Visits/trips**: A local science centre. A local recycling centre where magnets are used to separate materials. **Visitors:** A physicist or materials scientist. See STEM Ambassadors, https://www.stem.org.uk/stem-ambassadors for help with finding visitors. **Scientists:** William Gilbert (Theories on Magnetism) **Enrichment experiences:** Pupils could learn about and make simple electromagnets. Use super strong neodymium magnets to extract iron from cereal. See CLEAPSS for guidance on this activity, http://primary.cleapss.org.uk/Resource/P050-Iron-for-breakfast.aspx **Ensure all of CLEAPSS health and safety guidance is followed when using neodymium magnets.** Pupils could learn about and make ferrofluid – magnetic liquid!
Subject Links	**English** • Pupils could write short science fiction stories based on the premise of a child waking up to discover that they have magnetic fingers. Related texts • The Iron Man (Ted Hughes) • Mrs Armitage: Queen of the Road (Quentin Blake) • Mr Archimedes' Bath (Pamela Allen) **Maths** • Investigations into how far toy cars/balls roll over different surfaces and the strength of magnets provide ample opportunity for pupils to use and apply their measuring skills and knowledge of cm & mm. **DT** • Design and make simple games that use magnets/magnetic materials.

	PSHE **Geography** • Learn about the magnetic poles of the Earth. • Learn how the Earth's magnetic fields cause the Aurora Borealis. **History** • Learn how Tudor sailors used compasses and 'lodestones' to navigate. Pupils could learn about the 3 compasses that were recovered from the wreck of The Mary Rose. **Music** • Learn about electromagnets in speakers. **Art** • Use magnets, paperclips and paint to produce pieces of art. **PE** • Explore how it feels to move over different surfaces.

Criteria to assess readiness for next year groups	***Remember the working scientifically criteria need to be achieved by the end of LKS2.** **Working at the expected standard** **Working scientifically** The pupil can, using appropriate scientific language from the national curriculum: • ask relevant questions and use different types of scientific enquiries to answer them • set up simple practical enquiries, comparative and fair tests • make systematic and careful observations and, where appropriate, take accurate measurements using standard units, using a range of equipment, including thermometers and data loggers • gather, record, classify and present data in a variety of ways to help in answering questions • record findings using simple scientific language, drawings, labelled diagrams, keys, bar charts, and tables • report on findings from enquiries, including oral and written explanations, displays or presentations of results and conclusions • use results to draw simple conclusions, make predictions for new values, suggest improvements and raise further questions • identify differences, similarities or changes related to simple scientific ideas and processes • use straightforward scientific evidence to answer questions or to support their findings **Science Content** The pupil can: • name and describe the functions of the main parts of the musculoskeletal system [year 3]. • name, locate and describe the functions of the main parts of plants, including those involved in transporting water and nutrients [year 3] • describe the requirements of plants for life and growth [year 3] • describe how fossils are formed [year 3] • group and identify rocks [year 3], in different ways according to their properties, based on first-hand observation • use the idea that light from light sources, or reflected light, travels in straight lines and enters our eyes to explain the formation [year 3] and size of shadows [year 3] • describe the effects of simple forces that act at a distance (magnetic forces, including those between like and unlike magnetic poles) [year 3]