Year 4 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**	**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.* • *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***	• 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.* • *Pupils should use relevant scientific language to discuss their ideas and communicate their findings in ways that are appropriate for different audiences.*	• 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.*

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.			

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 enquiries 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 *(in italics)* content-Disciplinary (skills)
Living things and their habitats **Prior vocabulary** Pond, garden, field, park, woodland, sea-shore, river, ocean, forest, rainforest, stones, rocks, logs, leaf litter, habitat, micro-habitat, living, dead, not living, alive, healthy, food, food chain, depend, source of food, shelter, grow, growth, healthy **New vocabulary** **Environment, non-flowering, plants, ferns, mosses, flowering plants, grasses,** **vertebrate animals: fish, birds, mammals, amphibians, reptiles** **invertebrate animals: snails, worms, slugs, spiders, insects** **human impact – litter, deforestation, population increase, nature reserves**	***This topic should be taught throughout the year.** **Pupils should be taught to:** • recognise that living things can be grouped in a variety of ways • explore and use classification keys to help group, identify and name a variety of living things in their local and wider environment • recognise that environments can change and that this can sometimes pose dangers to living things. • ***Pupils should use the local environment throughout the year to raise and answer questions that help them to identify and study plants and animals in their habitat. They should identify how the habitat changes throughout the year.*** • *Pupils should explore possible ways of grouping a wide selection of living things that include animals and flowering plants and non-flowering plants.* • *Pupils could begin to put vertebrate animals into groups such as fish, amphibians, reptiles, birds, and mammals; and invertebrates into snails and slugs, worms, spiders, and insects.* • *Note: Plants can be grouped into categories such as flowering plants (including grasses) and non-flowering plants, such as ferns and mosses.*	**Pupils should be taught to:** • report on findings from enquiries, including oral and written explanations, displays or presentations of results and conclusions. • make systematic and careful observations and, where appropriate, taking 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

	• *Pupils should explore examples of human impact (both positive and negative) on environments, for example, the positive effects of nature reserves, ecologically planned parks, or garden ponds, and the negative effects of population and development, litter or deforestation.*	

Implementation-activity examples and cultural capital opportunities	**Observing over time** • Survey different habitats several times over the course of a year, observing the plants and animals there and how they change. The habitats could include; a log pile, leaf pile, hedge, pond, tree, flowerbed, field. For resources to support surveying different habitats go to OPAL Explore Nature, https://www.imperial.ac.uk/opal/surveys/ and Tree tools for schools, https://www.treetoolsforschools.org.uk/menu/ Key questions • **How does the variety/number of invertebrates in a habitat change over the year?** • **How does the variety/number of plants within a habitat change over the year?** **Pattern Seeking** • See the observing over time investigations above. Pupils can identify patterns within the survey data that they collect. • Pupils could identify patterns in how the temperature of a school or local park pond change over the course of the year. See Comparative and Fair Testing below. Key questions • **Is there a pattern in how the variety/number of invertebrates within a habitat change over the course of the year?** • **Is there a pattern in how the variety/number of plants within a habitat change over the course of the year?** • **Is there a pattern in how the temperature of the water in a pond changes over the course of the year?** **Identifying and Classifying** • Use classification keys to name unknown living things. • Classify living things found in different habitats based on their features. Key question • **Can we use the classification keys to identify all the animals that we caught pond dipping/hedge surveying?** **Comparative and Fair Testing** • See the observing over time investigations above. Pupils could compare survey data from different habitats and identify similarities and differences. • Pupils could record the temperature of the school or local park pond during each season and compare and contrast the results. Key question • **How does the average temperature of the pond water change in each season?**

	Researching using secondary sources • Use secondary sources to find out about how environments may naturally change. • Use secondary sources to find out about human impact, both positive and negative, on environments. • Research ways that they (the pupils) could actively improve the local environment and support/enhance local wildlife. • Pupils could research about invasive species and the impact that they have on habitats. Key questions • **How do environments naturally change?** • **How can humans have a positive or negative impact on an environment?** • **Why are people cutting down the rainforests and what effect does that have?** • **What are invasive species? What impact do they have?** **Exploring and Problem Solving** • Create a simple identification key for mini-beasts based on observable features. • Challenge pupils to identify ways that they can have a positive impact on the local environment. • Challenge pupils to identify ways that the school could encourage more wildlife to live in the school grounds. Where possible carry out their ideas. • Explore the question, 'who is overwintering in our school and why?' See Explorify for more information, https://explorify.uk/en/activities/the-big-question/who-is-overwintering-in-our-school-and-why Key questions • **How could we make our school grounds better for wildlife?** • **How could we encourage a greater variety of animals to come and live in our school grounds?** **Cultural capital opportunities** **Sustainable Development Goals**: Number 13 Climate Action, Number 15 Life on land **Climate change links:** Learn about how climate change is affecting habitats in the UK and beyond. **Visits/trips**: A local park, botanic garden, wildlife area, forest, accessible field, river or pond. **Visitors:** An entomologist. An outreach officer from a local wildlife trust. An environmentalist or representative from an environmental charity. A gardener (amateur or professional) or park keeper. See STEM Ambassadors, https://www.stem.org.uk/stem-ambassadors **Scientists:** Cindy Looy (Environmental Change and Extinction) Jaques Cousteau (Marine Biologist). ***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.** • **Enrichment Experiences:** Pupils could explore exotic habitats by taking part in live lessons from the North Pole and the Caribbean coral reefs. See Encounter Edu for more information, https://encounteredu.com/

Subject Links	
	English • Pupils could write a letter to their local MP/council about a local (or global) environmental issue asking them to take action. • Pupils could design their own ID guides and write instructions for how to use them. Related texts • The Vanishing Rainforest (Richard Platt) • The Morning I Met a Whale (Michael Morpurgo) • Journey to the River Sea (Eva Ibbotson) **Maths** • Surveying different habitats provides opportunities for collecting, presenting and interpreting data. It also provides opportunities for pupils to use and apply their measuring skills. **DT** • Design and make things to improve the local environment e.g. bird and bat boxes, bug hotels etc. **PSHE** • Pupils could learn about the importance of looking after the local environment. **Geography** • Pupils could learn about different habitats around the world. **History** • Pupils could learn about how our knowledge and understanding of habitats has changed and developed over time. **Music** • Pupils could learn about music that has been inspired by nature e.g. Beethoven's, Symphony No. 6, 'Pastoral'.

Unit and Vocabulary	Intent - statutory and non-statutory *(in italics)* content – Substantive (knowledge)	Intent –statutory and relevant non-statutory *(in italics)* content-Disciplinary (skills)
Animals including humans **Prior vocabulary:** names of common, animals: fish, amphibians, reptiles, birds, mammals, carnivores, herbivores, omnivores, human, body, senses, see, hear, feel, smell, taste, habitat, local environment, pet, wild animal, insect, minibeast, food, eat, head, neck, body, arms, legs, ears, eyes, nose, mouth, tongue, hands, feet, fingers, toes, elbows, knees, hair, teeth, grow, healthy, offspring, adults, young, water, air, survive, exercise, hygiene, egg, chick, chicken, caterpillar, pupa, moth, butterfly, tadpole, frog frog spawn, lamb, sheep, calf, cow, foal, horse **New Vocabulary:** **Nutrition, diet, skeleton, muscles, protection, support, movement, bones, skull, shell, digestive system, stomach, small intestine, large intestine, oesophagus, types of teeth: molar, premolar, incisor, canine, saliva**	**Pupils should be taught to:** • describe the simple functions of the basic parts of the digestive system in humans. • identify the different types of teeth in humans and their simple functions. • construct and interpret a variety of food chains, identifying producers, predators and prey. • *Pupils should be introduced to the main body parts associated with the digestive system, for example, mouth, tongue, teeth, oesophagus, stomach and small and large intestine and explore questions that help them to understand their special functions.*	**Pupils should be taught to:** • 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** • Over the course of a day/two days discuss at what stage of the digestive process the pupil's breakfast/lunch is e.g. ○ Food normally takes 1 – 3 hours to digest in the stomach. ○ It then takes 6 – 8 hours to move through the small intestine. ○ What is left can then be in the large intestine for anywhere between 12 – 47 hours before being expelled. ○ In total food takes on average between 19 and 58 hours to digest.	

	Key question • **Where is your breakfast/lunch at the moment?** **Pattern Seeking** • Explore sugar and energy content of different foods and identify patterns. • Explore the average size of different mammals and the average amount of faeces that they produce each day and identify simple patterns. Key questions • **Are foods that are high in energy always high in sugar?** • **Does the average size of a mammal affect the average amount of faeces that it produces each day?** **Identifying and Classifying** • Explore the school grounds/local area identifying plants/animals. Classify what pupils find as either producers, prey or predators and identify where they get their energy from. Based on their findings create food chains. • Pupils use mirrors/photographs to identify/name their teeth. • Identify whether an animal is a herbivore, omnivore or carnivore by examining a photograph of its teeth. Key questions • **What are the names for all the organs involved in the digestive system?** • **How can we organise teeth into groups?** • **What food chains can we identify in our school grounds/local area?** • **By examining a photograph of this animal's teeth can you identify whether it is a herbivore, omnivore or carnivore?** **Comparative and Fair Testing** • Compare the teeth of herbivores, omnivores and carnivores identifying similarities and differences. Key question • **How are the teeth of herbivores, omnivores, and carnivores the same/different?** **Researching using secondary sources** • Research the function of the parts of the human digestive system. • Research the digestive system of other animals, identifying similarities and differences. • After a survey of the school grounds, pupils research where the plants/animals that they found get their energy from (e.g. what they eat) and use this to create food chains. • Research the function of different teeth. Key questions • **What is the function of the parts of the human digestive system?** • **Do other animals have a digestive system like humans?** • **Where do the living things we found on our survey get their energy from? What do they eat? Are they producers, predators, or prey?**

	• **What are the functions of different teeth? Why do we have different teeth?** **Exploring and Problem Solving** • Challenge pupils to make models of the teeth of a carnivore, herbivore and omnivore. For more guidance on how to do this see the 'Terrific Teeth' activity which is part of the PSTT, Science for One, Playdough activity card which can be found here, https://pstt.org.uk/resources/curriculum-materials/Science-for-One • Demonstrate the process of digestion, https://www.google.com/search?q=demonstrating+the+process+of+digestion+ks2&rlz=1C1DIMC_enGB832GB832&oq=demonstrating+the+process+of+digestion+ks2&aqs=chrome..69i57j33i22i29i30.9237j1j15&sourceid=chrome&ie=UTF-8#kpvalbx=_gwdcYcWKJ42egQaz0LS4CA19 • Challenge pupils to produce a role play that demonstrates the process of digestion. • Challenge pupils to create a giant model of the digestive system in the hall/on the playground. They could use cones, skipping rope and other PE equipment. • Explore with pupils the question, 'How long is the gut?' See Explorify for more information, https://explorify.uk/en/activities/the-big-question/how-long-is-the-gut • Explore with pupils the scenario, 'What if we didn't have any teeth?' See Explorify for more information, https://explorify.uk/en/activities/what-if/we-had-no-teeth Key questions • **How could you demonstrate the process of digestion?** • **How could you make a giant model of the digestive system?** **Cultural capital opportunities** **Sustainable Development Goals**: Number 15 Life on land **Climate change links:** Learn about the impact that climate change is having on food chains. **Visits/trips**: A local dentists. A local farm, vets or animal sanctuary where pupils can observe a range of different teeth at first-hand. **Visitors:** A dentist. A vet. A Gastroenterologist**.** See STEM Ambassadors, https://www.stem.org.uk/stem-ambassadors **Scientists:** Ivan Pavlov (Digestive System Mechanisms), Joseph Lister (Discovered Antiseptics) **Enrichment Experiences:** Pupils could learn about animals with unusual digestive systems like Hippos or Alligators.
Subject Links	**English** • Write a short science fiction story about a team of scientists being miniaturised and going on a journey into a humans digestive system. • Write a diary entry for a piece of food that is eaten and digested. Related texts • Human Body Odyssey (Werner Holzwarth) • Crocodiles Don't Brush Their Teeth (Colin Fancy) • Wolves (Emily Gravett)

	Maths • Learning about the length of time it takes for food to be digested (see Observing over time above) can be used to reinforce pupils' knowledge of time and could be a stimulus for problem solving e.g. you ate your breakfast at 08:30 - at what time will it be in your large intestine? Pupils could also convert digestion times from hours into minutes and seconds. • Pupils could use string/measuring tape to measure how long their small/large intestine is (approximately 5 metres and 1.5 metres) and the total length of their digestive system (approximately 9 metres). • Exploring the average amount of faeces that different mammals produce and identifying patterns in the data (see Pattern Seeking above) provides opportunities to reinforce pupils' knowledge of Kg and g. • Pupils could identify what fraction of their teeth are molar, canines and incisors. Pupils could identify what fraction of a tiger's or cow's teeth are molars, canines and incisors. **DT** • Make models of the human digestive system. • Make models of the digestive systems of other animals. **History** • Learn about how our knowledge of the human digestive system has changed over time.

Unit and Vocabulary	Intent - statutory and non-statutory *(in italics)* content – Substantive (knowledge)	Intent –statutory and relevant non-statutory *(in italics)* content-Disciplinary (skills)
States of Matter Solid, liquid, gas, temperature, heat (heating), cool (cooling), water cycle, evaporation, condensation, melting, freezing	**Pupils should be taught to:** • compare and group materials together, according to whether they are solids, liquids or gases. • observe that some materials change state when they are heated or cooled, and measure or research the temperature at which this happens in degrees Celsius (°C). • identify the part played by evaporation and condensation in the water cycle and associate the rate of evaporation with temperature. • *Pupils should explore a variety of everyday materials and develop simple descriptions of the states of matter (solids hold their shape; liquids form a pool not a pile; gases escape from an unsealed container).* • *Pupils should observe water as a solid, a liquid and a gas and should note the changes to water when it is heated or cooled.* • *Note: Teachers should avoid using materials where heating is associated with chemical change, for example, through baking or burning.*	**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, taking 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.
Implementation-activity examples and cultural capital opportunities	**Observing over time** • Put different liquids in containers and leave them on a sunny windowsill. Monitor how the levels of the liquids change over time. Link this to the process of evaporation. Include different types of water e.g. salty, mineral, tap. Include liquids like coke, cooking oil and perfume. • Get pupils to wet their hand and place it on a paper towel. Observe the process of evaporation rapidly as the paper towel quickly 'dries'.	

- Fill a plastic container with warm (but **not** boiling) water. Place a bowl, containing ice cubes, on top. Leave for a few minutes and then examine the underside of the bowl which will be covered with water. Discuss how the water got there in the context of evaporation/condensation/the water cycle. Alternatively put some water in a sealable bag or plastic container that is then covered with clingfilm. Place in a sunny spot and observe the water cycle over a number of days/weeks.

Key questions

- **Which material is best for keeping our hot chocolate warm?**
- **How does the level of water in a glass change when left on the windowsill? How does the level of other liquids change when left on the windowsill?**

Pattern Seeking

- Freeze different amounts of ice and observe how long they take to melt, identifying simple patterns.
- Add different amounts of salt to containers of tap water. Place on a sunny windowsill and observe how quickly they evaporate, identifying simple patterns.

Key questions

- **Is there a pattern in how long it takes different sized ice lollies to melt?**
- **How does evaporation rate change as you add more salt to your water?**

Identifying and Classifying

- Provide pupils with a range of bathroom products e.g. hair gel, shaving foam, deodorant, talcum powder, sponges, mouthwash, toothpaste (ensure that they're not provided with any dangerous bathroom products and discuss how to handle them safely). Challenge them to sort the products into solids, liquids and gases.
- Provide pupils with cards with different properties on them (e.g. 'keeps its shape'). They then sort them into either solid, liquid or gas.
- Go on a solid, liquid, gas 'scavenger hunt' around the school buildings/grounds/local area. Challenge pupils to identify as many as they can of each.
- Provide pupils with difficult to classify solids like rice, salt or sand. Explore why they're difficult to classify. Ensure children understand that they are solids but that they behave in some ways like a liquid e.g. you can pour them.
- Explore difficult to classify solids with the Royal Society of Chemistry 'bashing biscuits' activity, https://edu.rsc.org/primary-science/solids-primary-science-video-demonstrations/914.article
- Challenge pupils to identify examples of evaporation/condensation and the water cycle in the world around them e.g. condensation within a car, evaporation/condensation at a swimming pool etc.

Key questions

- **Can you group these materials and objects into solids, liquids, and gases?**
- **How would you sort these objects/materials based on their temperature?**
- **Is sand a solid or a liquid? How can you justify your answer?**

	Comparative and Fair Testing • Carry out comparative tests to investigate what effects melting and evaporation rates. These investigations will have a strong element of Pattern Seeking and Observing Over Time (see above). • Freeze different liquids (e.g. coke, milk, ketchup, orange juice, cooking oil) and observe/record how long they take to become a solid and how long they take to melt back to a liquid. Key questions • **How does the mass of a block of ice affect how long it takes to melt?** • **Do different liquids take the same amount of time to freeze?** • **How does the colour of the liquid that has been frozen affect how quickly it melts?** • **How does the surface area of water affect how long it takes to evaporate?** • **Does seawater evaporate faster than fresh water?** **Researching using secondary sources** • Research non-Newtonian liquids and how they are used in everyday life. • Research the different stages of the water cycle. Key questions • **What are non-Newtonian liquids?** • **What are the different stages of the water cycle?** **Exploring and Problem Solving** • Explore solids and liquids by making cornflour slime which is a non-newtonian liquid. See the Science Museum, Oozing Oobleck activity, https://learning.sciencemuseumgroup.org.uk/resources/oozing-oobleck/ • Use drama to explore the water cycle. • Challenge pupils to come up with a role play to demonstrate the water cycle. • Introduce pupils to the particle model (in very simple terms) using drama. See the 'Melt, Boil' activity in the British Science Week Move It pack that can be freely downloaded from, https://www.stem.org.uk/resources/elibrary/resource/34390/move-it • Explore the properties of gases by using vinegar and bicarbonate of soda to inflate a balloon or surgical glove, https://edu.rsc.org/primary-science/irreversible-changes-and-the-freaky-hand/4013614.article • Pupils often think that gases have no mass. Address this misconception by weighing inflatables, then inflating them and weighing them again. Alternatively weigh a bottle of fizzy drink. Allow it to go flat and then weigh it again. • Explore the question, 'How does smell travel?' See Explorify for more guidance, https://explorify.uk/en/activities/the-big-question/how-do-smells-travel • Design ways of stopping ice lollies from melting. See the Explorify Mission Survive activity called 'ice lollies', https://explorify.uk/en/activities/mission-survive/ice-lollies • Explore the question, 'What if water didn't evaporate?' See Explorify for more guidance, https://explorify.uk/en/activities/what-if/water-didn-t-evaporate • Explore the question, 'What if water couldn't freeze?' See Explorify for more guidance, https://explorify.uk/en/activities/what-if/water-couldnt-freeze

	• Further explore the properties of liquids using the Royal Society of Chemistry resources, https://edu.rsc.org/primary-science/liquids-primary-science-video-demonstrations/915.article • Further explore the properties of gases using the Royal Society of Chemistry resources, https://edu.rsc.org/primary-science/gases-primary-science-video-demonstrations/916.article • Further explore the properties of solids using the Royal Society of Chemistry resources, https://edu.rsc.org/primary-science/solids-primary-science-video-demonstrations/914.article Key question • See above **Cultural capital opportunities** **Sustainable Development Goals**: Number 13 Climate Action, Number 15 Life on land **Climate change links:** Learn about how climate change is increasing the rates at which glaciers, ice shelves and the polar ice caps are melting, Colorado Phet simulations. **Visits/trips**: A local science centre. **Visitors:** A chemist or materials scientist. See STEM Ambassadors, https://www.stem.org.uk/stem-ambassadors **Scientists:** Anders Celsius (Celsius Temperature Scale) Daniel Fahrenheit (Fahrenheit Temperature Scale/Invention of the Thermometer) **Enrichment experiences:** • Explore the question 'are cats solids or liquids' in the context of the Ig Nobel 2017 prize winner. An internet search based on this question will produce lots of information.
Subject Links	**English** • Write a 'day in the life' diary entry for a raindrop. • Write a short science fiction story based on the premise, 'what if water stopped evaporating?' Related texts • Once Upon a Raindrop: The Story of Water (James Carter) • Sticks (Diane Alber) **Maths** • Comparative and pattern seeking investigations above will provide opportunities for pupils to use and apply their measuring skills. **DT** • Make simple solar stills to demonstrate the water cycle. **Geography** • Identify areas in the world that have very high and very low rates of evaporation.

	History • Learn about how our knowledge of solids, liquids and gases have changed over time. **PE** • During a PE lesson warm-up pupils could be either particles in a solid, liquid or gas.

Unit and Vocabulary	Intent - statutory and non-statutory *(in italics)* content – Substantive (knowledge)	Intent –statutory and relevant non-statutory *(in italics)* content-Disciplinary (skills)
Sound Sound, vibration, vibrate, pitch, volume, insulation	**Pupils should be taught to:** • identify how sounds are made, associating some of them with something vibrating. • recognise that vibrations from sounds travel through a medium to the ear. • find patterns between the pitch of a sound and features of the object that produced it. • find patterns between the volume of a sound and the strength of the vibrations that produced it. • recognise that sounds get fainter as the distance from the sound source increases. • *Pupils should explore and identify the way sound is made through vibration in a range of different musical instruments from around the world; and find out how the pitch and volume of sounds can be changed in a variety of ways.*	**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, taking 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** • Use a datalogger/downloaded sound-meter app onto a tablet/smartphone to record noise levels in the classroom or other parts of the school over the course of a day. Key questions • **How does the level of noise in our classroom/hall/playground change over the course of a day?** • **When is our classroom the quietest/loudest?** **Pattern Seeking** • Carry out a comparative test (see below) to identify patterns in how sounds change depending on whether you're moving closer to them or further away. • While on a learning walk explore how sounds change when they are moving closer to pupils or further away. Pupils could listen to aeroplanes flying overhead or cars driving past the school. • Using dataloggers/downloaded sound-meter app onto a tablet/smartphone to record sound levels at different parts of the school at different times of the day and identify patterns in how the volume of sound changes. • Explore how pitch changes in different instruments and identify simple patterns. Pupils could also explore how pitch changes in jars filled with different amounts of liquid when tapped. Key questions • **Is there a link between how loud it is in school and the time of day?** ○ **If there is a pattern, is it the same in every area of the school?** **Identifying and Classifying** • Go on a 'sound walk' around the school grounds/local area. Identify the source of any sounds, whether the sounds are human-made or natural and if they have a purpose or are incidental e.g. a car horn to give a warning or the noise made by a passing car. • Can we identify the birds that are living in/visiting our school grounds/local area based on their birdsong? The RSPB has an excellent resource for identifying the song of different birds, https://www.rspb.org.uk/birds-and-wildlife/bird-songs/what-bird-is-that/ Key questions • **How can we sort the sounds that we heard on our sound walk? Which sounds where human-made/natural?** • **How can we sort the sounds that we heard based on whether they have a purpose or not?** • **Can we identify the birds living in/visiting the school grounds by their birdsong?**

	Comparative and Fair Testing • Place different materials between a datalogger/downloaded sound-meter app onto a tablet/smartphone to identify which material is best at blocking a sound. Play the same sound each time. Pupils could use their findings to make their own ear defenders (see Exploring and Problem Solving below). • Pupils use a datalogger/downloaded sound meter app to take noise level readings at regular intervals (e.g. every 3 metres) as they move away from a sound. • Explore whether pupils can hear better with one ear or two. Key questions • **How does the volume of a drum change as you move further away from it?** • **How does the length of a guitar string/tuning fork affect the pitch of the sound?** • **Are two ears better than one?** • **Which material is best to use for muffling sound in ear defenders?** **Researching using secondary sources** • Research how different animals hear. • Research how and why different animals make sounds e.g. why do birds/whales sing, lions roar, bats squeak/? • Research how different scientists/thinkers from the past advanced our knowledge and understanding of sound. See the Ogden Trust for resources to support this, https://www.ogdentrust.com/resources/research-cards-sound Key questions • **Do all animals have the same hearing range?** • **How and why do different animals make sound?** **Exploring and Problem Solving** • Explore how sounds are made, travel and change using 'ear gongs'. See the Science Museum, https://learning.sciencemuseumgroup.org.uk/resources/ear-gongs/ • Explore ways of making a sound louder. See the Explorify, 'Make sound louder' activity, https://explorify.uk/en/activities/problem-solvers/make-sound-louder • Challenge pupils to design and make their own ear defenders. See the Explorify, 'Protect your ears' activity, https://explorify.uk/en/activities/problem-solvers/protect-your-ears • Explore recreating sounds. See the Explorify 'What's that sound?' activity, https://explorify.uk/en/activities/problem-solvers/what-s-that-sound • Explore what happens to a sound in a vacuum. See https://www.bbc.co.uk/programmes/p0119bxr • Challenge pupils to use junk modelling materials to make their own musical instrument and then identify how it makes sound. Pupils could then group their musical instruments based on how they make sound e.g. percussion, wind, string etc. Key questions • **What happens to the sound of a ringing alarm clock in a vacuum?** • **How does the musical instrument that you've made make sound? What is vibrating?**

	Cultural capital opportunities **Climate change links:** Learn about how climate change/pollution is leading to changes in how birds sing. **Visits/trips**: A theatre or music venue where pupils can learn about acoustics. A local science centre. **Visitors:** A sound engineer or musician (amateur or professional). See STEM Ambassadors, https://www.stem.org.uk/stem-ambassadors **Scientists:** Aristotle (Sound Waves) Gailileo Galilei (Frequency and Pitch of Sound Waves) Alexander Graham Bell (Invented the Telephone) **Enrichment experiences:** • Learn about machines that can travel faster than the speed of sound like jetfighters and the Bloodhound Car. • Learn about anechoic chambers and how they work. • Pupils could learn about stethoscopes and have a go at using one.
Subject Links	**English** • Pupils could create their own versions of The Sound Collector by Roger McGough. Related texts • Until I Met Dudley (Roger McGough) • Oscar and the Bird: A Book about Electricity (Geoff Waring) • Electrical Wizard: How Nikola Tesla Lit Up the World (Elizabeth Rusch) • Moses Goes to a Concert (Isaac Millman) • The Deaf Musicians (Pete Seeger) • The Sound of Silence (Katrina Goldsaito) **Maths** • Investigations into how sounds change depending on proximity and how noise levels change over the course of a day provide opportunities for children to present and interpret data in line graphs. • Set pupils the challenge of working out how fast sound travels. See the British Science Week, Message Makers activity pack, https://www.stem.org.uk/resources/elibrary/resource/34391/message-makers for guidance on how to do this. **DT** • Pupils make their own ear defenders. See Comparative and Fair Testing above. **History** • Learn about significant loud sounds from the past. See The Ogden Trust for resources to support this, https://www.ogdentrust.com/resources/scientific-ideas-over-time-loudest-sounds-till-roll-timeline **Music** • Explore how different instruments make sound. Explore how the pitch changes in different instruments.

	Art • Learn about artists who were inspired by music like Kandinsky. • Pupils could make their own artworks inspired by music/different sounds.

Unit and Vocabulary	Intent - statutory and non-statutory *(in italics)* content – Substantive (knowledge)	Intent –statutory and relevant non-statutory *(in italics)* content-Disciplinary (skills)
Electricity Electricity, simple circuit, light bulb, cell, wire, buzzer, switch, motor, battery, series circuit, conductor, insulator	**Pupils should be taught to:** • identify common appliances that run on electricity. • construct a simple series electrical circuit, identifying and naming its basic parts, including cells, wires, bulbs, switches and buzzers. • identify whether or not a lamp will light in a simple series circuit, based on whether or not the lamp is part of a complete loop with a battery. • recognise that a switch opens and closes a circuit and associate this with whether or not a lamp lights in a simple series circuit. • recognise some common conductors and insulators, and associate metals with being good conductors. • *Pupils should construct simple series circuits, trying different components, for example, bulbs, buzzers and motors, and including switches, and use their circuits to create simple devices.* • *Pupils should draw the circuit as a pictorial representation, not necessarily using conventional circuit symbols at this stage; these will be introduced in year 6.* • *Note: Pupils might use the terms current and voltage, but these should not be introduced or defined formally at this stage.* • ***Pupils should be taught about precautions for working safely with electricity.***	**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, taking 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.

Implementation-activity examples and cultural capital opportunities	**Observing over time** • Measure how the electrical current in a circuit changes over time. Key question • **How does the electrical current in a circuit change over time.** **Pattern Seeking** • Ask pupils to identify a simple pattern in materials that conduct/insulate electricity (see Comparative Test below). Pupils are likely to suggest that 'metals conduct, non-metals don't conduct'. You could then provide them with playdoh to make circuits with (roll it into 'sausages' to make the wires) or a pencil sharpened at both ends to expose the graphite (you will need a 9 volt battery for this investigation) and get them to test whether they conduct electricity. For more information about using playdoh in circuits see the 'Lights on… Lights off…' resource from CLEAPSS, http://primary.cleapss.org.uk/Resource/P073-Lights-on-lights-off.aspx Key questions • **Can you identify a pattern in which materials are electrical conductors and which materials are electrical insulators? Does this pattern always work?** **Identifying and Classifying** • Group materials based on whether they conduct electricity or not (see Comparative Test below). • Go on a learning walk around the school/school grounds and identify electrical devices. Record where they get electricity from. • Visit a nearby street and identify things which are powered by electricity. Record where they get electricity from. Key questions • **Can you group these materials in conductors and insulators?** • **How would you group these electrical devices based on where the electricity comes from?** **Comparative and Fair Testing** • Carry out a comparative test to identify which materials are electrical conductors and which are electrical insulators. Construct a simple circuit and then place different types of material into it – does the bulb light or buzzer buzz? • Using a material that is a conductor carry out a comparative test to see if increasing its thickness affects the amount of electricity that can pass through it. Pupils could measure this by observing if the brightness of the bulb or volume of the buzzer changes. They could measure this with a datalogger or light meter app that has been downloaded onto a tablet. Key questions • **How does the thickness of a conducting material affect how bright the lamp is?** • **Which metal is the best conductor of electricity?** **Researching using secondary sources** • Research how electricity has changed the way we live. • Research how the language of electricity has developed. See this Ted Education talk for more information, https://www.youtube.com/watch?v=MBRTR2dlwvA

Key questions

- **How has electricity changed the way we live?**
- **How does a light bulb work?**

Exploring and Problem Solving

- Explore the flow of electricity around a circuit using drama or by using 'energy balls' which can be purchased from educational suppliers.
- Challenge pupils to make a 'steady hand game'. See CLEAPSS for more information, http://primary.cleapss.org.uk/Resource/P023-Steady-hand-game.aspx
- Explore which materials can be used instead of wires to make a circuit.
- Challenge pupils to get a bulb to light with as few components as they can or to make a bulb light using only one wire.
- Explore how to connect a range of different switches and investigate how they function in different ways.
- Choose switches to add to circuits to solve particular problems, such as a pressure switch for a burglar alarm.
- Apply their knowledge of conductors and insulators to design and make different types of switch.
- Get your class thinking how they can close a circuit to get a lighthouse working again. See the Explorify 'To the wire' activity for more information, https://explorify.uk/en/activities/problem-solvers/to-the-wire
- Explore the question, 'What if everything conducted electricity?' See Explorify for more information, https://explorify.uk/en/activities/what-if/everything-conducted-electricity

Key question

- See above.

Cultural capital opportunities:

Sustainable Development Goals: Number 13 Climate Action, Number 7 Affordable and Clean Energy.
Climate change links: Pupils could learn about ways that they can reduce the amount of electricity that they use in order to reduce greenhouse gas emissions.
Visits/trips: A local power station, onshore windfarm, or solar farm.
Visitors: An electrician or electrical engineer. An outreach officer from an electricity provider. A representative of a renewable energy company. See STEM Ambassadors, https://www.stem.org.uk/stem-ambassadors
Scientists: Joseph Swan (Incandescent Light Bulb)
Enrichment experiences:

- Pupils could make batteries using coins or fruit. See The Ogden Trust for resources to support this, https://www.ogdentrust.com/resources/phizzi-practicals-coin-battery & https://www.ogdentrust.com/resources/phizzi-practical-fruity-batteries
- Pupils could make an electroscope, https://www.ogdentrust.com/resources/phizzi-practicals-electroscope

Subject Links	
	English • Write a short science fiction story about what would happen if we had a power cut that lasted for several days. Related texts • Until I Met Dudley (Roger McGough) • Oscar and the Bird: A Book about Electricity (Geoff Waring) • Electrical Wizard: How Nikola Tesla Lit Up theWorld (Elizabeth Rusch) **Maths** • Investigating how the current changes in a circuit over a period of time provides opportunities for children to present data in line graphs. **DT** • Make a steady hand game. See exploring and problem solving above. **PSHE** • Learn about the dangers of electricity and how to stay safe. **Geography** • Learn about how electricity is generated in different ways around the world. **History** • Learn about how the ideas/experiments of scientists/thinkers from the past has advanced our knowledge of electricity. See The Ogden Trust for resources to support this, https://www.ogdentrust.com/resources/research-cards-electricity **Music** • Learn about how electric guitars work. • Learn about how speakers work. **PE** • During a PE warm-up pupils could be electrons flowing around a circuit.

Criteria to assess readiness for next year groups	**Working at the expected standard** **Working scientifically** The pupil can, using appropriate scientific language from the national curriculum: • asking relevant questions and using different types of scientific enquiries to answer them • setting up simple practical enquiries, comparative and fair tests • making systematic and careful observations and, where appropriate, taking accurate measurements using standard units, using a range of equipment, including thermometers and data loggers • 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 • reporting on findings from enquiries, including oral and written explanations, displays or presentations of results and conclusions • using results to draw simple conclusions, make predictions for new values, suggest improvements and raise further questions • identifying differences, similarities or changes related to simple scientific ideas and processes • using straightforward scientific evidence to answer questions or to support their findings **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] • name and describe the functions of the main parts of the digestive system [year 4],