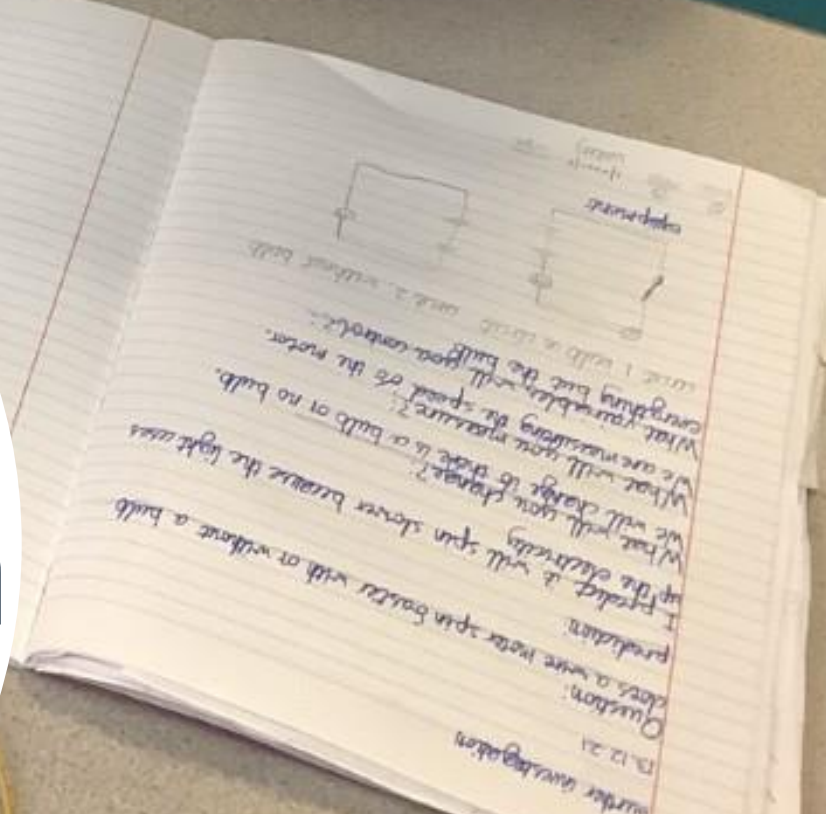


# Science Curriculum

Broughton Fields Primary School



# Intent

Science teaching at Broughton Fields aims to give all children a strong understanding of the world around them through delivering a progressive curriculum with a focus on both scientific knowledge and development of the skills needed to carry out enquiries in physics, chemistry and biology. Our science curriculum, based on the objectives outlined in the National Curriculum, aims for children leaving Broughton Fields to be inquisitive, critical thinkers who do not simply accept ideas, but have the independence of thought and self-confidence to demand evidence to support assertions. With a good foundation in scientific enquiry and processes, children will be able to pose thought-provoking questions and have the necessary skills and understanding to investigate objectively and reliably, discovering answers for themselves. This will enable them to further develop their own, thinking, reasoning and understanding. They will understand how scientific enquiry contributes to our constantly developing understanding of the world in which we live. Children will learn about the achievements, developments and limitations of science and scientists and show an understanding of the history of science and the potential for further scientific discovery in the future. They will appreciate how science impacts every area of our lives and the potential for them to have a future career in this field.



***“They will understand how scientific enquiry contributes to our constantly developing understanding of the world in which we live”***



# Leader: Penny Ellis

## Progression Keys

We track curriculum coverage of the wider National Curriculum half termly. The progression grids created by Subject Leaders are checked against planning and highlighted each half term to ensure that staff know which areas we have taught in order to continue to recap, and which objectives are new teaching.

The key to the highlights is below:

Autumn One
Autumn Two
Spring One
Spring Two
Summer One
Summer Two

The following grids show:

- 1) Yearly progression grids for science.
- 2) An example of short term planning for a science unit
- 3) An example of knowledge progression within a science strand



**Working Scientifically:**

Planning and predicting:

- suggest what might happen and ways to test ideas

Investigating and Observing:

- make observations using appropriate senses
- explore using the five senses

Recording, analysing and evaluating:

- communicate findings in simple ways
- collect evidence to try to answer a question

**Working Scientifically Vocabulary:**

observe, question, answer, observing, equipment, identify, classify, sort, group, record (diagram, chart), map, data, compare, contrast, describe, biology, chemistry, physics

Plants	Animals, Including Humans	Seasonal Changes	Materials
<ul style="list-style-type: none"> <li>• identify and name a variety of common wild and garden plants, including deciduous and evergreen trees</li> <li>• identify and describe the basic structure of a variety of common flowering plants, including trees</li> </ul>	<ul style="list-style-type: none"> <li>• identify and name a variety of common animals, including fish, amphibians, reptiles, birds and mammals</li> <li>• identify and name variety of common animals that are herbivores, carnivores and omnivores</li> <li>• describe and compare the structure of a variety of common animals (fish, amphibians, reptiles, birds, and mammals, including pets)</li> <li>• identify, name, draw and label the basic parts of the human body and say which part of the body is associated with each sense.</li> </ul>	<ul style="list-style-type: none"> <li>• observe changes across the four seasons</li> <li>• observe and describe weather associated with the seasons and how day length varies</li> </ul>	<ul style="list-style-type: none"> <li>• distinguish between an object and the material from which it is made</li> <li>• identify and name a variety of everyday materials, including wood, plastic, glass, metal, water and rock</li> <li>• describe the simple physical properties of everyday materials</li> <li>• compare and group together a variety of everyday materials on the basis of their physical properties</li> </ul>

**Vocabulary:**

Deciduous, Evergreen trees, Leaves, Flowers (blossom), Petals, Fruit, Roots, Bulb, Seed, Trunk, Branches, Stem	Fish, Reptiles, Mammals, Birds, Amphibians (+ examples of each) Herbivore, Omnivore, Carnivore, Leg, Arm, Elbow, Head, Ear, Nose, Back, Wings, Beak	Summer, Spring, Autumn, Winter, Sun, Day, Moon, Night, Light, Dark	Wood, Plastic, Glass, Paper, Water, Metal, Rock, Hard, Soft, Bendy, Rough, Smooth
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**Working Scientifically:**

Planning and predicting:

- with help, suggest some ideas and questions
- think about how to collect evidence
- suggest what might happen
- think about and discuss whether comparisons and test are fair or unfair

Investigating and Observing:

- make observations and comparisons using simple equipment, following simple instructions
- use first-hand experience and, with help, simple information sources to answer questions

Recording, analysing and evaluating:

- record findings in simple ways, including tables and graphs
- say whether what happened was what was expected and draw simple conclusions.

**Working Scientifically Vocabulary:**

observe, question, answer, observing, equipment, identify, classify, sort, group, record (diagram, chart), map, data, compare, contrast, describe, biology, chemistry, physics

Plants	Animals, Including Humans	Living Things and their Habitats	Materials
<ul style="list-style-type: none"> <li>• observe and describe how seeds and bulbs grow into mature plants</li> <li>• find out and describe how plants need water, light and a suitable temperature to grow and stay healthy</li> </ul>	<ul style="list-style-type: none"> <li>• notice that animals, including humans, have offspring which grow into adults</li> <li>• find out about and describe the basic needs of animals, including humans, for survival (water, food, air)</li> <li>• describe the importance for humans of exercise, eating the right amounts of different exercise, eating the right amounts of different types of food, and hygiene</li> </ul>	<ul style="list-style-type: none"> <li>• explore and compare the difference between things that are living, dead and things that have never been alive.</li> <li>• identify that most living things live in habitats to which they are suited and describe how different habitats provide the basic needs of different kinds of animals and plants, and how they depend on each other</li> <li>• identify and name a variety of plants and animals in their habitats, including micro-habitats</li> </ul>	<ul style="list-style-type: none"> <li>• identify and compare the suitability of a variety of everyday materials, including wood, metal, plastic, glass, brick, rock, paper and cardboard for particular uses</li> <li>• find out how the shapes of solid objects can be changed by squashing, bending, twisting and stretching</li> </ul>

**Vocabulary:**

Seeds, Bulbs, Water, Light, Temperature, Growth	Survival, Water, Air, Food, Adult, Baby, Offspring, Kitten, Calf, Puppy, Exercise, Hygiene	Living, Dead, Habitat, Energy, Food chain, Predator, Prey, Woodland, Pond, Desert	Hard, Soft, Stretchy, Stiff, Shiny, Dull, Rough, Smooth, Bendy, Waterproof, Absorbent, Opaque, Transparent Brick, Paper, Fabrics, Squashing, Bending, Twisting, Stretching Elastic, Foil
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**Working Scientifically:**

Planning and predicting:

- Respond to suggestions and, with help, put forward ideas about testing
- Make predictions
- With help, consider what constitutes a fair test
- With help, plan and carry out a fair test

Investigating and Observing:

- Make observations and comparisons
- Measure length, volume of liquid and time in standard measures using simple measuring equipment
- Use first-hand experience and simple information sources to answer questions

Recording, analysing and evaluating:

- Communicate findings in a variety of ways
- Say whether what happened was what was expected and draw simple conclusions
- With help, identify simple patterns and suggest explanations.

**Working Scientifically Vocabulary:**

**research** (relevant questions, scientific enquiry), comparative and fair test, systematic, careful observation, accurate measurement, **equipment** (thermometer, data logger), **data** (gather, record, classify, present), **record** (drawings, labelled diagrams, keys, bar charts, tables), oral and written explanations, conclusions, predictions, differences, similarities, changes, evidence, improve, secondary sources, guides, keys, construct, interpret

Plants	Animals, Including Humans	Rocks	Light	Forces and Magnets
<ul style="list-style-type: none"> <li>• Identify and describe the functions of different parts of flowering plants; roots, stem/trunk, leaves and flowers</li> <li>• 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</li> <li>• Investigate the way in which water is transported within plants</li> <li>• Explore the part that flowers play in the life cycle of</li> </ul>	<ul style="list-style-type: none"> <li>• 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</li> <li>• identify that humans and some animals have skeletons and muscles for support,</li> </ul>	<ul style="list-style-type: none"> <li>• Compare and group together different kinds of rocks on the basis of their appearance and simple physical properties</li> <li>• Describe in simple terms how fossils are formed when things that have lived are trapped within rock</li> <li>• Recognise that soils are made from rocks and organic matter</li> </ul>	<ul style="list-style-type: none"> <li>• Recognise that they need light in order to see and that dark is the absence of light</li> <li>• Notice that light is reflected from surfaces</li> <li>• Recognise that light from the sun can be dangerous and that there are ways to protect their eyes</li> <li>• Recognise that shadows are formed when the light from a</li> </ul>	<ul style="list-style-type: none"> <li>• Compare how things move on different surfaces</li> <li>• Notice that some forces need contact between two objects, but magnetic forces can act at a distance</li> <li>• Observe how magnets attract or repel each other and attract some materials and not others</li> <li>• 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</li> <li>• Describe magnets as having two poles</li> </ul>

**Working Scientifically:**

Planning and predicting:

- Recognise why it is important to collect data to answer questions
- Suggest questions that can be tested
- Put forward ideas about testing and make predictions
- With help, consider what constitutes a fair test

Investigating and Observing:

- Make relevant observations and comparisons
- Make measurements of temperature, time and force, as well as measurements of length
- Begin to think about why measurements of length should be repeated
- With help, carry out a fair test, recognising and explaining why it is fair

Recording, analysing and evaluating:

- Explain what the evidence shows, in a scientific way and whether it supports predictions
- Suggest improvements in their work and raise further questions

**Working Scientifically Vocabulary:**

**research** (relevant questions, scientific enquiry), comparative and fair test, systematic, careful observation, accurate measurement, **equipment** (thermometer, data logger), **data** (gather, record, classify, present), **record** (drawings, labelled diagrams, keys, bar charts, tables), oral and written explanations, conclusions, predictions, differences, similarities, changes, evidence, improve, secondary sources, guides, keys, construct, interpret

Living things and their habitats	Animals, Including Humans	States of Matter	Sound	Electricity
<ul style="list-style-type: none"> <li>• Recognise that living things can be grouped in a variety of ways</li> <li>• Explore and use classification keys to help group, identify and name a variety of living things in their local and wider environment</li> <li>• Recognise that environments can change and that this can sometimes pose dangers to living things</li> </ul>	<ul style="list-style-type: none"> <li>• Describe the simple functions of the basic parts of the digestive system in humans</li> <li>• Identify the different types of teeth in humans and their simple functions</li> <li>• Construct and interpret a wide variety of food chains, producers, predators and prey</li> </ul>	<ul style="list-style-type: none"> <li>• Compare and group materials together, according to whether they are solids, liquids or gases</li> <li>• 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.</li> <li>• Identify the part played by evaporation and condensation in the water cycle and associate the rate of evaporation with temperature</li> </ul>	<ul style="list-style-type: none"> <li>• Identify how sound are made, associating some of them with something vibrating</li> <li>• Recognise that vibrations from sound travel through a medium to the ear</li> <li>• Find patterns between the pitch of a sound and features of the object that produced it</li> <li>• Find patterns between the volume of a sound and the strength of the vibrations that produced it</li> <li>• Recognise that sound get fainter as the distance from the source increases</li> </ul>	<ul style="list-style-type: none"> <li>• Identify common appliances that run on electricity</li> <li>• Construct a simple series electrical circuit, identifying and naming its basic parts, including cells, wires, bulbs, switches and buzzers</li> <li>• 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</li> <li>• Recognise that a switch opens and closes a circuit and associate this with whether or not a lamp lights in a simple series circuit</li> <li>• recognise some common conductors and insulators, and associate metals with being good conductors</li> </ul>

**Vocabulary:**

Vertebrates, Fish, Amphibians, Reptiles, Birds, Mammals, Invertebrates, Snails, Slugs, Worms, Spiders, Insects, Environment, Habitats	Mouth, Tongue, Teeth, Oesophagus, Stomach, Small Intestine, Large Intestine, Herbivore, Carnivore, Canine, Incisor, Molar	Fossils, Soils, Sandstone, Granite, Marble, Pumice, Crystals, Absorbent	Volume, Vibration, Wave, Pitch, Tone, Speaker	Cells, Wires, Bulbs, Switches, Buzzers, Battery, Circuit, Series, Conductors, Insulators
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**Working Scientifically:**

Planning and predicting:

- recognise that scientific ideas are based on evidence and creative thinking
- make predictions based on scientific knowledge
- suggests methods of testing including a fair test
- suggest how to collect evidence
- select suitable equipment

Investigating and Observing:

- carry out a fair test explaining why it is fair
- understand why observations and measurements need to be repeated
- select information from provided sources

Recording, analysing and evaluating:

- identify simple trends and patterns and offer explanations for these
- communicate findings in tables, bar charts and line graphs, making appropriate use of ICT
- draw conclusions and communicate them in appropriate scientific language
- suggest improvements in their work and further questions, giving reasons

**Working Scientifically Vocabulary:**

Plan, variables, measurements, accuracy, precision, repeat readings

**Record data** – scientific diagrams, classification keys, labels, scatter graphs, bar graph, line graph

**Report and Present** – conclusions, causal relationships. Explanations, degree of trust, oral and written

Display and presentation

Living things and their habitats	Animals, Including Humans	Properties and Changes of Materials	Forces	Earth and Space
<ul style="list-style-type: none"> <li>• describe the differences in the life cycles of a mammal, an amphibian, an insect and a bird</li> <li>• describe the life processes of reproduction in some plants and animals</li> </ul>	<ul style="list-style-type: none"> <li>• describe changes as humans develop to old age</li> </ul>	<ul style="list-style-type: none"> <li>• compare and group together everyday materials on the basis of their properties, including their hardness, solubility, transparency, conductivity (electrical and thermal), and response to magnets</li> <li>• know that some materials will dissolve in liquid to form a solution, and describe how to recover a substance from a solution</li> <li>• use knowledge of solids, liquids and gases to describe how mixtures might be separated, including filtering, sieving and evaporating</li> <li>• give reasons, based on evidence from comparative and fair tests, for the particular uses of everyday materials, including metals, wood and plastic</li> <li>• demonstrate that dissolving, mixing and changes of state are reversible changes</li> <li>• explain that some changes result in the formation of new materials, and that this change is not usually reversible, including changes associated with burning and the action of bicarbonate of soda</li> </ul>	<ul style="list-style-type: none"> <li>• explain that unsupported objects fall towards the Earth because of the force of gravity acting between the Earth and the falling object</li> <li>• identify the effects of air resistance, water resistance and friction, that act between moving surfaces</li> <li>• recognise that some mechanisms, including levers, pulleys and gears, allow a smaller force to have a greater effect</li> </ul>	<ul style="list-style-type: none"> <li>• describe the movement of the Earth, and other planets, relative to the sun</li> <li>• describe the movement of the Moon relative to the Earth</li> <li>• use the idea of the Earth's rotation to explain day and night and the apparent movement of the sun across the sky</li> </ul>



## Vocabulary:

Vertebrates, Fish, Amphibians, Reptiles, Birds, Mammals, Invertebrates, Snails, Slugs, Worms, Spiders, Insects, Environment, Habitats	Mouth, Tongue, Teeth, Oesophagus, Stomach, Small Intestine, Large Intestine, Herbivore, Carnivore, Canine, Incisor, Molar	Fossils, Soils, Sandstone, Granite, Marble, Pumice, Crystals, Absorbent	Volume, Vibration, Wave, Pitch, Tone, Speaker	Cells, Wires, Bulbs, Switches, Buzzers, Battery, Circuit, Series, Conductors, Insulators
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**Working Scientifically:**

Planning and predicting:

- make predictions based on scientific knowledge and understanding
- suggest methods of testing, including a fair test and how to collect evidence, ensuring it is sufficient and appropriate

Investigating and Observing:

- carry out a fair test identifying key factors to be considered
- make a variety of relevant observations and measurements, using simple apparatus correctly
- decide when observations and measurements need to be checked, by repeating, to give more reliable data
- select information from a range of sources

Recording, analysing and evaluating:

- communicate findings in tables, bar charts and line graphs, making appropriate use of ICT
- identify trends and patterns and results that do not appear to fit the pattern
- provide explanations for differences in observations and measurements
- draw conclusion and communicate them in scientific language
- make practical suggestions for improving methods in their work and raise further questions

**Working Scientifically Vocabulary:**

Plan, variables, measurements, accuracy, precision, repeat readings

**Record data** – scientific diagrams, classification keys, labels, scatter graphs, bar graph, line graph

**Report and Present** – conclusions, causal relationships. Explanations, degree of trust, oral and written

Display and presentation

**Evidence** – support, refute ideas or arguments

Identify, classify, describe

Living things and their habitats	Animals, Including Humans	Evolution and Inheritance	Light	Electricity
<ul style="list-style-type: none"> <li>• describe how living things are classified into broad groups according to common observable characteristics and based on similarities and differences, including micro-organisms, plants and animals</li> <li>• give reasons for classifying plants and animals based on specific characteristics</li> </ul>	<ul style="list-style-type: none"> <li>• identify and name the main parts of the human circulatory system, and describe the functions of the heart, blood vessels and blood</li> <li>• recognise the impact of diet, exercise, drugs and lifestyle on the way their bodies function</li> <li>• describe the ways in which nutrients and water are transported within humans, including animals</li> </ul>	<ul style="list-style-type: none"> <li>• recognise that living things have changed over time and that fossils provide information about living things that inhabited the Earth millions of years ago</li> <li>• recognise that living things produce offspring of the same kind, but normally offspring vary and are not identical to their parents</li> <li>• identify how animals and plants are adapted to suit their environment in different ways and that adaptation may led to evolution</li> </ul>	<ul style="list-style-type: none"> <li>• Recognise that light appears to travel in straight lines</li> <li>• Use the idea that light travels in straight lines to explain that objects are seen because they give out or reflect light into the eye</li> <li>• Explain that we see things because light travels from light sources to our eyes or from light sources to objects and then to our eyes</li> <li>• Use the idea that light travels in straight lines to explain why shadows have the same shape as the objects that cast them</li> </ul>	<ul style="list-style-type: none"> <li>• Associate the brightness of a lamp or the volume of a buzzer with the number and voltage of cells being used in the circuit</li> <li>• Compare and give reasons for variations in how components function, including the brightness of bulbs, the loudness of switches and the on/off position of switches</li> <li>• Use recognised symbols when representing a simple circuit</li> </ul>
<b>Vocabulary:</b>				
Classification, Vertebrates, Invertebrates, Micro-organisms, Amphibians, Reptiles, Mammals, Insects	Circulatory, Heart, Blood Vessels, Veins, Arteries, Oxygenated, Deoxygenated, Valve, Exercise, Respiration	Fossils, Adaptation, Evolution, Characteristics, Reproduction, Genetics	Refraction, Reflection, Light, Spectrum, Rainbow, Colour,	Cells, Wires, Bulbs, Switches, Buzzers, Battery, Circuit, Series, Conductors, Insulators, Amps, Volts, Cell

## Year 2 Science Planning: Working Scientifically

Term: Spring 1 2022 Decades

### Prior Learning:

- In Year 1:
- \* Distinguish between an object and the material from which it is made
  - \* Identify and name a variety of everyday materials, including wood, plastic, glass, metal, water, and rock
  - \* Describe the simple physical properties of a variety of everyday materials
  - \* Compare and group together a variety of everyday materials on the basis of their simple physical properties
- In Year 2: (this will also be covered through this current topic)
- To identify and compare the suitability of a variety of everyday materials for particular uses.
  - To identify and classify the uses of everyday materials.
  - To find out how the shapes of solid objects made from some materials can be changed by squashing, bending, twisting and stretching.

Main focus will be:

### Working Scientifically:

- To ask scientific questions.
- To plan an enquiry
- To observe closely
- To take measurements
- To gather / record results
- To present results
- To interpret results

	Learning Objectives	Lesson Input, Modelling & Activities.	Outcomes	Vocabulary	Resources
Week 2 - Floating and Sinking (objects) - Classification N.B. This lesson may need 1 ½ hours.	<p><b>Knowledge:</b> To compare and group together a variety of everyday materials based on their physical properties. To know the difference between floating and sinking. To know objects that float and objects that sink.</p> <p><b>Working Scientifically:</b> To gather / record and interpret results</p> <p><b>Scientific Enquiry Type:</b> Classification</p>	<p><b>Engaging Input / Retrieval Practice:</b> Quick fire quiz questions – answers on whiteboards Rapid recall on types of materials and their properties: <a href="https://www.educationquizzes.com/ks1/science/materials-common-materials/">https://www.educationquizzes.com/ks1/science/materials-common-materials/</a> and <a href="https://www.educationquizzes.com/ks1/science/materials-properties-describing/">https://www.educationquizzes.com/ks1/science/materials-properties-describing/</a></p> <p><b>Main Input:</b> Floating and sinking investigation in groups. Ask the children how could we find out which materials float? Discuss. (<b>Greater Depth children to work separately with an adult –children to lead discussion with less input.</b>) Provide children with a large container filled with water and discuss ideas for answering the question, 'Which materials will float?' Children to have objects (identify the material they are made from), describe their properties, then think about and predict whether they will float or sink. Key questions:  <ul style="list-style-type: none"> <li>• Which object do you think will float?</li> <li>• Which object do you think will sink?</li> <li>• How will we test whether an object floats or sinks?</li> <li>• How will we know if the object floats or sinks?</li> </ul> </p> <p><b>Plenary:</b> Discuss as a class:</p> <p>*What have you found out? *Which materials would you group together? *What do you notice about each group? *What do these materials have in common? *Challenge: <b>Why do some objects float and others sink?</b> Watch: <a href="https://www.youtube.com/watch?v=y8DqVmM-92k">https://www.youtube.com/watch?v=y8DqVmM-92k</a> Start at 5.11 mins.</p>	<p><b>Scaffolded:</b> Adult demonstrates floating and sinking examples. With support, they can say which objects float or sink during the test and complete a prepared table to sort materials.</p> <p><b>Expected:</b> Children carry out a simple test and describe what they find out. Can the children use test results to group materials into those which float or those that sink? Can the children create their own simple table / Venn diagram to record data?</p> <p><b>Greater Depth:</b> Adult to observe. Children consider how the test will be carried out &amp; choose their own objects to investigate (taking note of the materials they are made from). Children show a systematic approach to carrying out an investigation and record their findings independently.</p> <p><b>Further Challenge</b> – Can you change one of the objects/materials to try and make it float/sink?</p>	float sink object material group / sort wood plastic glass metal rock brick water paper fabric elastic foil card/cardboard rubber wool clay  hard, soft, stretchy, stiff, bendy, floppy, waterproof, absorbent, breaks / tears, rough, smooth, shiny, dull, see- though, not see- through  opaque, transparent, translucent, reflective, non- reflective, rigid, suitability.	Water tanks / bowls / containers Measuring beakers Water  Variety of materials / objects – e.g. lolly stick, straw, rubber, plastic bottle, stone, paper clip, apple, sponge, marble.  Paper towels Prepared table – scaffolded

<p style="writing-mode: vertical-rl; transform: rotate(180deg);">Week 3 – Plan an enquiry to investigate boat materials</p>	<p><b>Knowledge:</b> To identify and compare the suitability of a variety of everyday materials for particular uses.</p> <p><b>Working Scientifically:</b> To ask scientific questions To plan an enquiry</p> <p><b>Scientific Enquiry Type:</b> Comparative / fair test</p>	<p><b>Engaging Input / Retrieval Practice:</b> Recap on findings from last lesson and then watch: <a href="https://www.bbc.co.uk/cbeebies/watch/messy-goes-to-okido-why-do-things-sink-and-float">https://www.bbc.co.uk/cbeebies/watch/messy-goes-to-okido-why-do-things-sink-and-float</a></p> <p>This links into today's lesson:</p> <p><b>Main Input:</b> What does the word 'marine' / 'engineer' / 'architect' mean? <a href="https://www.youtube.com/watch?v=445nfaA6gdI">https://www.youtube.com/watch?v=445nfaA6gdI</a> <b>School Value 'Aspiration'</b> – what does it mean to be a marine engineer and naval architect?</p> <p><b>PowerPoint</b> - Look at a variety of pictures of different boats and ships and discuss the materials that they are made from. <b>What is important about the materials and the designs? How do the boats stay afloat?</b></p> <p>Today we will be marine / nautical engineers and naval architects! Discuss context/problem – we need a boat to carry Peter Rabbit across the river to Mrs Tiggywinkle. (Show the Peter Rabbit small fluffy toy.) Ask the children to <b>identify the question to investigate from the scenario.</b> <b>What would be the most suitable material for a boat to carry Peter Rabbit across the river in to see Mrs Tiggywinkle?</b></p> <p>Children to discuss in ability table groups their ideas. <b>What properties will the materials of the boats need to have? What other considerations are there to think about?</b> They should think about the materials, design and equipment to use, e.g. paper, card, foil, fabric, plastic bag etc.</p> <p>Decide what to do / what to observe in order to answer the question. Fair testing – design / size of boats, weight in each boat, amount of time on water.</p> <p>Model recording of plan as described for 'expected' task.</p>	<p><b>Scaffolded:</b> With support, draw and label 3 pictures, which show the steps of the investigation. Key words on pictures. E.g. name of materials, water, tank, object in boat, time on water. Adult to put key word bank on whiteboard according to what they choose to use. Limit to 3 different materials.</p> <p><b>Expected:</b> Record the steps of their investigation in a story board format with a key sentence and diagram: e.g. 1. Make the same sized boats out of ... 2. Fill a tank with water. 3. Test each boat containing... on the water for ... minutes. Use sentence stems as necessary.</p> <p><b>Greater Depth:</b> Work independently as a group (adult to observe, prompt with key questions as necessary). Choose design, materials for boat. Consider fair testing. <b>Challenge: to make the boat which carries the most weight or lasts the longest in water. Use counters/marbles/weights etc to measure load.</b></p> <p>Record plan as a set of instructions. Record verbally if writing more challenging for certain pupils.</p>	<p>marine engineer architect nautical question plan fair test suitability</p> <p>Words as above in lesson 1.</p>	<p>Ppt - Pictures of a range of different boats and ships</p> <p>Small Peter Rabbit toy</p> <p>Story board style sheet for recording steps.</p>
<p style="writing-mode: vertical-rl; transform: rotate(180deg);">Week 4 – Cross-curricular link DT</p>	<p><b>Design and technology – Design</b> Design purposeful and functional boats based on design criteria.</p> <p>Generate, develop, model and communicate ideas through talking.</p> <p><b>Make</b> Select from and use a range of tools and equipment to perform practical tasks. Select from and use a wide range of materials and components, according to their characteristics.</p>	<p><b>Engaging Input:</b> Discuss which boat is the odd one out. <a href="https://explorify.uk/en/activities/odd-one-out/fun-floating">https://explorify.uk/en/activities/odd-one-out/fun-floating</a></p> <p><b>Teacher notes:</b> These three boats are all efficient water-crossing vessels, but are powered in different ways. The rowing boat requires a person to propel the boat through the water using the oars. The second boat has sails, which capture the wind to drive the boat forward. The container ship has a huge engine that makes the boat move. It needs much more power than the other two because it has lots of heavy cargo to move, and often much further to travel.</p> <p><b>Retrieval Practice:</b> Recall from last lesson the purpose, function and design of different boats using the <b>Ppt</b> of pictures as necessary.</p>	<p>Children make the boats needed for their investigation in their ability table groups.</p> <p><b>Scaffolded:</b> Adult support. Instructions and templates as required: <a href="https://www.instructables.com/Make-a-Floating-Boat-out-of-Paper/">https://www.instructables.com/Make-a-Floating-Boat-out-of-Paper/</a> Or instructions on Ppt for making a boat.</p> <p><b>Expected:</b> Children use a variety of materials and joining materials to make their boats in the way they</p>	<p>Words as above in lesson 1.</p> <p>Function Purpose Design Properties</p>	<p>Variety of materials for building boats – card, foil, plastic bags, paper etc. Scissors Joining materials (Glue, tape, pins etc.)</p> <p>Ppt - Pictures of a range of different boats and ships Ppt – Teaching Slides Building Boats</p> <p>Instruction sheet as needed for making a boat</p>

		<p><b>Main Input:</b>  <b>Ppt – Teaching Slides for lesson – Building Boats – slide 2</b>  <i>What are the properties of a boat?</i>  Ask the children to look back at their enquiry plan. Discuss the boats that will be made and the materials chosen.</p> <p>Model making a boat-using template / instructions.</p>	<p>wish. Ensure they are the same size. Adult support as required.</p> <p><b>Greater Depth:</b> Children use a variety of materials and joining materials to make their own boat designs independently. Ensure they are the same size.</p> <p>Throughout the lesson, targeted questioning to scaffold children to explain their designs based on their scientific knowledge of materials and floating and sinking. Photographs of finished designs to be taken and uploaded to Seesaw with voice note of their reasoning.</p>		
Week 5 – gathering results	<p><b>Knowledge:</b> To identify and compare the suitability of a variety of everyday materials for particular uses.</p> <p><b>Working Scientifically:</b> To gather results. To observe closely.</p> <p><b>Scientific Enquiry Type:</b> Comparative / Fair Test</p>	<p><b>Engaging Input: Compassionate Science</b>  Take a moment to reflect on what is happening to our oceans:  A Plastic Ocean  <a href="https://www.youtube.com/watch?v=ApfKysJf2tQ">https://www.youtube.com/watch?v=ApfKysJf2tQ</a>  <i>How does this video make you feel?</i>  <i>Which pieces of litter sink / float?</i>  <i>Is there hope for the future?</i>  <i>What can we all do to help?</i></p> <p><b>Retrieval Practice: Investigation question:</b>  <b>What would be the most suitable material for a boat to carry Peter Rabbit across the river to see Mrs Tiggywinkle?</b>  Recall in ability table groups how they will test each boat to see which is the most suitable material. Refer to their enquiry plan in their books.</p> <p><b>Main Input:</b>  Discuss in their groups what they think will happen to each boat as it goes into the water. Share their ideas.</p> <p>Explain to the children that when carrying out this enquiry, they will gather their data and record observations by taking photos of each stage on the <i>App - Shadow Puppet Edu</i> (children will be familiar with this from Computing).</p>	<p><b>Expected &amp; Greater Depth:</b>  Children work in their ability groups to carry out their investigation. GD children working more independently.  Photos taken of each stage and observation on I-Pads.</p> <p><b>Scaffolded:</b> Adult support to set up and carry out the investigation.</p>	<p>Words as above in lesson 1.</p> <p>Fair test</p>	<p><b>Book I-Pads - Shadow Puppet Edu App</b></p> <p>Previous enquiry plans in children's books.</p>
Week 6 – presenting and interpreting results	<p><b>Knowledge:</b> To identify and compare the suitability of a variety of everyday materials for particular uses.</p> <p><b>Working Scientifically:</b> To present and interpret results.</p> <p><b>Scientific Enquiry Type:</b> Comparative / Fair test</p>	<p><b>Engaging Input: Compassionate Science:</b> Plastic in the Ocean  <i>A Whale's Tale</i>  <a href="https://www.youtube.com/watch?v=xFPoIU5iiYQ">https://www.youtube.com/watch?v=xFPoIU5iiYQ</a>  <i>What is the message and importance of this story?</i>  <i>How do you think the whale felt at different points of the story?</i>  <i>What affect does the story have on us?</i></p> <p><b>Main Input:</b>  <b>Investigation question:</b>  <b>What would be the most suitable material for a boat to carry Peter Rabbit across the river to see Mrs Tiggywinkle?</b></p>	<p>Children present what they have learnt verbally using the photos and the App.  Get children to practise what they want to say with each photo first.</p> <p><b>Scaffolded:</b> Questions and sentence stems given to support verbally presenting results. Can the children say whether a particular material was more suitable?</p>	<p>Words as above in lesson 1.</p> <p>Because  Properties  Floated  Sank  Most suitable  Recommend</p>	<p><b>Book I-Pads - Shadow Puppet Edu App – photos taken from previous lesson.</b></p> <p>Questions and sentence stems to help present results verbally.</p>

		<p>Ensure all children have the photos taken on the App – Shadow Puppet Edu – in front of them.</p> <p>Discuss in groups the findings of the enquiry using the photos for support.</p> <p>Questions to consider:</p> <ul style="list-style-type: none"> <li>• Which materials did you use for your boats?</li> <li>• What did you find out about the materials?</li> <li>• What kind of material/design worked the best? How did you know?</li> <li>• Why do you think that material worked best?</li> <li>• Which material would not be good for the boat?</li> <li>• What materials would you recommend to Peter Rabbit? Why?</li> <li>• Are there any materials that you think are good and bad? Explain why.</li> </ul> <p>Using the App – <i>Shadow Puppet Edu</i> - Model to children how they can choose the appropriate photos of their enquiry to add a voice over to, explaining the results of their investigation. Use examples given for expected / greater depth learners.</p>	<p><b>Expected:</b> Can the children use their results to explain why some materials would be better than others for making a boat, in terms of their properties e.g. the foil was good because it was waterproof and strong, paper is bad because it rips when it gets wet, the plastic bag floated for a long time.</p> <p><b>Greater Depth:</b> Can the children use their results to support explanations (e.g. how many marbles each boat held)? Can the children consider how some materials are good in certain circumstances? For example, the card is good for a little while but it will get soggy later, the foil makes a good boat shape but the hole in the corner made it sink, when we blew up the bag it was really good but the marbles just rolled off so it needs some edges.</p> <p><b>Children to save the presentation and interpretation of their results in SeeSaw.</b></p>		
<p style="writing-mode: vertical-rl; transform: rotate(180deg);">Week 7: Assessment</p>	<p><b>Working Scientifically:</b> To ask scientific questions. To gather results To present results To interpret results</p> <p><b>Scientific Enquiry Type:</b> Comparative / Fair test</p>	<p><b>Main Input:</b> Key Scientific Enquiry Skills to be assessed through a simple floating investigation:</p> <p>Concept Cartoon Use slide 2 as the basis of the lesson: Read slide 2 together – ensure all vocabulary is understood (deep water / shallow) Get the children to discuss their thoughts. Show the class the equipment they will have – water, water tank / bowl, plastic tub (boat).</p> <p>Can the children identify the question to investigate from the scenario? (Do boats float better in deeper water or do they sink?) Can the children plan how they will test this? How will it be fair?</p> <p>Can the children present and interpret their results?</p>	<p><b>Expected:</b> Children will take a photo of the investigation and record a Seesaw video / voice over explaining:</p> <ul style="list-style-type: none"> <li>- the investigation question</li> <li>- how they carried the investigation out</li> <li>- what the result was and what they have found out.</li> </ul> <p><i>The deep water makes no difference to how the boat floats. Boats are made well to float in shallow and deep water.</i></p> <p><b>Scaffolded:</b> Children follow how they will carry out the investigation using slides 3 and 4 of the Ppt. Sentence stems given to support verbal explanations.</p> <p><b>Greater Depth:</b> As above for expected. <i>Can you think of other things that might affect the way a boat floats? Think of possible investigation questions. E.g. Would a boat float better on salty water, like the sea?</i></p>	<p>Words as above in lesson 1.</p> <p>Shallow Deep</p>	<p>Ppt Year 2 Concept Cartoon Teaching slides</p> <p><b>Book I-Pads – Seesaw</b></p> <p>Water Measuring jugs / beakers Tanks / bowls to hold water Empty plastic tubs / containers</p> <p>Sentence stems</p>

		<p><b>Get the children to share their results and their interpretation of them with the class at the end.</b></p> <p><b>This Engaging Plenary could be used to conclude the topic:</b></p> <p>Explorify – Liquid Densities Year 1 and 2 Materials - challenge GD</p> <p>Spark a conversation with this video showing two liquids of different densities. This activity is great for describing observations and applying ideas in unfamiliar contexts. Further information and questions when you go to the link: <a href="https://explorify.uk/en/activities/whats-going-on/liquid-densities">https://explorify.uk/en/activities/whats-going-on/liquid-densities</a></p>	<p>Ensure all assessment photos and videos are saved in the Science Folder on Seesaw.</p>		<p>Oil Water Beaker</p>
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## Year 1 – Everyday Materials

### National Curriculum Objectives:

- \* Distinguish between an object and the material from which it is made
- \* Identify and name a variety of everyday materials, including wood, plastic, glass, metal, water, and rock
- \* Describe the simple physical properties of a variety of everyday materials
- \* Compare and group together a variety of everyday materials on the basis of their simple physical properties.

Prior Learning:	Working Scientifically (NC) Links:	Ideas for Science Enquiry:	Story Opportunities:	Maths Opportunities:	Vocabulary:
<p><b>In EYFS:</b></p> <p>* Understands some important processes and changes in the natural world around them, including the seasons and changing states of matter.</p>	<p>* Perform simple tests to explore questions, for example: ‘What is the best material for an umbrella? ...for lining a dog basket? ...for curtains? ...for a bookshelf? ...for a gymnast’s leotard?’</p>	<p>* How can we sort these items?</p> <p>* Which material would make the best umbrella?</p> <p>* Which material would make the best chair?</p> <p>* Which materials are flexible / rigid / smooth / shiny etc...?</p> <p>* Which materials can be recycled?</p>	<p>The Three Little Pigs</p> <p>Cinderella – link to shoes</p> <p>The Great Paper Caper (Oliver Jeffers)</p> <p>Who Sank the Boat (Pamela Allen)</p>	<p>Sorting hoops</p>	<p>object, material, wood, plastic, glass, metal, rock, brick, water, paper, fabric, elastic, foil, card/cardboard, rubber, wool, clay, hard, soft, stretchy, stiff, bendy, floppy, waterproof, absorbent, breaks / tears, rough, smooth, shiny, dull, see-through, not see-through</p>
<p><b>In Year 2:</b></p> <ul style="list-style-type: none"> <li>* Identify and compare the suitability of a variety of everyday materials, including wood, metal, plastic, glass, brick, rock, paper and cardboard for particular uses</li> <li>* Find out how the shapes of solid objects made from some materials can be changed by squashing, bending, twisting and stretching.</li> </ul>					

**Types of scientific Enquiry:**  
 Fair & Comparative testing  
 Research using secondary sources  
 Identifying, classifying & grouping  
 Observing over time



**WHAT PUPILS NEED TO KNOW OR DO TO BE SECURE**

**Show understanding of a concept using scientific vocabulary correctly**

Key learning	Possible evidence
<p>All objects are made of one or more materials. Some objects can be made from different materials e.g. plastic, metal or wooden spoons.</p> <p>Materials can be described by their properties e.g. shiny, stretchy, rough etc. Some materials e.g. plastic can be in different forms with very different properties.</p>	<ul style="list-style-type: none"> <li>• Can label a picture or diagram of an object made from different materials</li> <li>• Can describe the properties of different materials</li> </ul>
Key vocabulary	
<p>Object, material, wood, plastic, glass, metal, water, rock, brick, paper, fabric, elastic, foil, card/cardboard, rubber, wool, clay, hard, soft, stretchy, stiff, bendy, floppy, waterproof, absorbent, breaks/tears, rough, smooth, shiny, dull, see-through, not see-through</p>	

**Common misconceptions**

Some children may think:

- only fabrics are materials
- only building materials are materials
- only writing materials are materials
- the word 'rock' describes an object rather than a material
- 'solid' is another word for hard.

**Apply knowledge in familiar related contexts, including a range of enquiries**

Activities	Possible evidence
<ul style="list-style-type: none"> <li>• Classify objects made of one material in different ways e.g. a group of object made of metal.</li> <li>• Classify in different ways one type of object made from a range of materials e.g. a collection of spoons made of different materials.</li> <li>• Classify materials based on their properties.</li> <li>• Test the properties of objects e.g. absorbency of cloths, strength of party hats made of different papers, stiffness of paper plates, waterproofness of shelters.</li> </ul>	<ul style="list-style-type: none"> <li>• Can sort objects and materials using a range of properties</li> <li>• Can choose an appropriate method for testing an object for a particular property</li> <li>• Can use their test evidence to answer the questions about properties e.g. "Which cloth is the most absorbent?"</li> </ul>

## Year 2- Uses of Everyday Materials

### National Curriculum Objectives:

- \* Identify and compare the suitability of a variety of everyday materials, including wood, metal, plastic, glass, brick, rock, paper and cardboard for particular uses
- \* Find out how the shapes of solid objects made from some materials can be changed by squashing, bending, twisting and stretching.

Prior Learning:	Working Scientifically (NC) Links:	Ideas for Science Enquiry:	Story Opportunities:	Maths Opportunities:	Vocabulary:
<p><b>In Year 1:</b></p> <ul style="list-style-type: none"> <li>* Distinguish between an object and the material from which it is made</li> <li>* Identify and name a variety of everyday materials, including wood, plastic, glass, metal, water, and rock</li> <li>* Describe the simple physical properties of a variety of everyday materials</li> <li>* Compare and group together a variety of everyday materials on the basis of their simple physical properties.</li> </ul>	<ul style="list-style-type: none"> <li>* Compare use of everyday materials in and around school and other places (link to topic or a story).</li> <li>* Observe closely; identifying and classifying the use of materials and recording their observations.</li> </ul> <p><b>Types of scientific Enquiry:</b></p> <ul style="list-style-type: none"> <li>Fair &amp; Comparative testing</li> <li>Research using secondary sources</li> <li>Identifying, classifying &amp; grouping</li> <li>Pattern seeking</li> <li>Observing over time</li> </ul>	<ul style="list-style-type: none"> <li>* What would be the best material to build a castle from?</li> <li>* Which materials have been used to build our school?</li> <li>* How can you change the shape of these materials?</li> <li>* What materials can you bend and twist?</li> <li>* How can we group materials by the changes that can be made to them?</li> <li>* Which material would be best for; the roof of the 3 Little Pigs house, a bucket etc...?</li> <li>* How have materials we use changed over time?</li> </ul>	<ul style="list-style-type: none"> <li>* The 3 Little Pigs</li> <li>* The Billy Goats Gruff</li> <li>* Dragon Wagon</li> <li>* The Tin Forest (Helen Ward)</li> <li>* Traction Man (Mini Grey)</li> </ul> <p><b>Famous Scientists:</b></p> <ul style="list-style-type: none"> <li>* William Addis (Toothbrush inventor)</li> <li>* Charles Mackintosh (waterproof coat)</li> <li>* John Macadam (road construction)</li> </ul>	<p>Tables Measurement Venn/ Carroll Diagrams</p>	<p>As Year 1, plus: opaque, transparent, translucent, reflective, non-reflective, rigid, flexible, shape, push/pushing, pull/pulling, twist/twisting, squash/squashing, bend/bending, stretch/stretching</p>

### In Year 3:

#### Rocks and Soils:

- \* Compare and group together different kinds of rocks based on their appearance and simple physical properties.

#### Forces and Magnets:

- \* Notice that some forces need contact between 2 objects, but magnetic forces can act at a distance.

### In Year 5:

#### Properties and Changes of Materials:

- \* Compare and group together everyday materials on the basis of their properties, including their hardness, solubility, transparency, conductivity (electrical and thermal), and response to magnets.
- \* Give reasons, based on evidence from comparative and fair tests, for the particular uses of everyday materials, including metals, wood and plastic.

**WHAT PUPILS NEED TO KNOW OR DO TO BE SECURE****Show understanding of a concept using scientific vocabulary correctly**

Key learning	Possible evidence
<p>All objects are made of one or more materials that are chosen specifically because they have suitable properties for the task. For example, a water bottle is made of plastic because it is transparent allowing you to see the drink inside and waterproof so that it holds the water. When choosing what to make an object from, the properties needed are compared with the properties of the possible materials, identified through simple tests and classifying activities. A material can be suitable for different purposes and an object can be made of different materials.</p> <p>Objects made of some materials can be changed in shape by bending, stretching, squashing and twisting. For example, clay can be shaped by squashing, stretching, rolling, pressing etc. This can be a property of the material or depend on how the material has been processed e.g. thickness.</p>	<ul style="list-style-type: none"> <li>• Can name an object, say what material it is made from, identify its properties and make a link between the properties and a particular use</li> <li>• Can label a picture or diagram of an object made from different materials</li> <li>• For a given object can identify what properties a suitable material needs to have</li> </ul>

Key vocabulary	
<p>Names of materials – wood, metal, plastic, glass, brick, rock, paper, cardboard</p> <p>Properties of materials – as for Year 1 plus opaque, transparent and translucent, reflective, non-reflective, flexible, rigid</p> <p>Shape, push/pushing, pull/puling, twist/twisting, squash/squashing, bend/bending, stretch/stretching</p>	<ul style="list-style-type: none"> <li>• Whilst changing the shape of an object can describe the action used</li> <li>• Can use the words flexible and/or stretchy to describe materials that can be changed in shape and stiff and/or rigid for those that cannot</li> <li>• Can recognise that a material may come in different forms which have different properties</li> </ul>

**Common misconceptions**

<p>Some children may think:</p> <ul style="list-style-type: none"> <li>• only fabrics are materials</li> <li>• only building materials are materials</li> <li>• only writing materials are materials</li> <li>• the word rock describes an object rather than a material</li> <li>• solid is another word for hard.</li> </ul>
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**Apply knowledge in familiar related contexts, including a range of enquiries**

Activities	Possible evidence
<ul style="list-style-type: none"> <li>• Classify materials.</li> <li>• Make suggestions about alternative materials for a purpose that are both suitable and unsuitable</li> <li>• Test the properties of materials for particular uses e.g. compare the stretchiness of fabrics to select the most appropriate for Elastigirl's costume, test materials for waterproofness to select the most appropriate for a rain hat</li> </ul>	<ul style="list-style-type: none"> <li>• Can sort materials using a range of properties</li> <li>• Can explain using the key properties why a material is suitable or not suitable for a purpose</li> <li>• Can begin to choose an appropriate method for testing a material for a particular property</li> <li>• Can use their test evidence to select appropriate material for a purpose e.g. Which material is the best for a rain hat?</li> </ul>

## Year 3 – Rocks

### National Curriculum Objectives:

- \* 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.

Prior Learning:	Working Scientifically (NC) Links:	Ideas for Science Enquiry:	Story Opportunities:	Maths Opportunities:	Vocabulary:
<p><b>In Year 1 – Everyday Materials:</b></p> <ul style="list-style-type: none"> <li>* Distinguish between an object and the material from which it is made.</li> <li>* Identify and name a variety of everyday materials, including wood, plastic, glass, water, metal and rock.</li> <li>* Describe the simple physical properties Of a variety of everyday materials.</li> <li>* Compare and group together a variety of everyday materials on the basis of their simple physical properties.</li> </ul> <p><b>In Year 2:</b></p> <ul style="list-style-type: none"> <li>* Identify and compare the suitability of a variety of everyday materials, including wood, metal, plastic, glass, brick, rock, paper and cardboard for particular uses</li> </ul>	<ul style="list-style-type: none"> <li>* Compare and group together different kinds of rocks on the basis of their appearance and simple physical properties.</li> <li>* Describe in simple terms how fossils are formed when things that have lived are trapped within rock</li> <li>* Recognise that soils are made from rocks and organic matter.</li> </ul> <p><b>Types of scientific Enquiry:</b></p> <ul style="list-style-type: none"> <li>Fair &amp; Comparative testing</li> <li>Research using secondary sources</li> <li>Identifying, classifying &amp; grouping</li> <li>Pattern seeking</li> <li>Observing over time</li> </ul>	<ul style="list-style-type: none"> <li>* How can we group / classify these different rocks based on their physical properties?</li> <li>* How are rocks formed?</li> <li>How are fossils formed?</li> <li>* What is soil made from?</li> <li>* Which soil drains fastest?</li> <li>* How does adding sand to soil affect how long water takes to drain through it?</li> </ul>	<p><b>The Pebble in my Pocket</b> – Meredith Hooper</p> <p><b>Pebble – a story of belonging</b> – Susan Milord</p> <p><b>Stone Underpants</b> – Rebecca Lisle</p> <p><b>Stone Girl, Bone Girl</b> (Laurence Anholt)</p> <p><b>The Street Beneath My Feet</b> (Charlotte Guillain &amp; Yuval Zommer)</p> <hr/> <p><b>Famous Scientists</b> – Mary Anning (Discovery of Fossils)</p> <p>Inge Lehmann (Earth’s Mantle)</p>	<p>Scales – (to order hardness)</p> <p>Classification key/ venn diagrams/ tables</p> <p>Measuring the mass or volume of soil</p>	<p>rock, stone, water, soil, pebble, chalk, slate, peat. boulder, grains, sandy / chalky / clay soils, layers, hard, soft, texture, fossils, soils sandstone, granite, marble, pumice, crystals, absorb, absorbent.</p>

### In Year 6: Evolution and Inheritance:

- \* Recognise that living things have changed over time and that fossils provide information about living things that inhabited the Earth millions of years ago.

### In KS3:

- \* The composition of the Earth. \* The structure of the Earth. \* The rock cycle and the formation of igneous, sedimentary and metamorphic rock.

**WHAT PUPILS NEED TO KNOW OR DO TO BE SECURE****Show understanding of a concept using scientific vocabulary correctly**

Key learning	Possible evidence
<p>Rock is a naturally occurring material. There are different types of rock e.g. sandstone, limestone, slate etc. which have different properties. Rocks can be hard or soft. They have different sizes of grain or crystal. They may absorb water. Rocks can be different shapes and sizes (stones, pebbles, boulders). Soils are made up of pieces of ground down rock which may be mixed with plant and animal material (organic matter). The type of rock, size of rock pieces and the amount of organic matter affect the property of the soil.</p> <p>Some rocks contain fossils. Fossils were formed millions of years ago. When plants and animals died, they fell to the seabed. They became covered and squashed by other material. Over time the dissolving animal and plant matter is replaced by minerals from the water.</p>	<ul style="list-style-type: none"> <li>• Can name some types of rock and give physical features of each</li> <li>• Can explain how a fossil is formed</li> <li>• Can explain that soils are made from rocks and also contain living/dead matter</li> </ul>

**Common misconceptions**

Some children may think:

- rocks are all hard in nature
- rock-like, man-made substances such as concrete or brick are rocks
- materials which have been polished or shaped for use, such as a granite worktop, are not rocks as they are no longer 'natural'
- certain found artefacts, like old bits of pottery or coins, are fossils
- a fossil is an actual piece of the extinct animal or plant
- soil and compost are the same thing.

**Apply knowledge in familiar related contexts, including a range of enquiries**

Activities	Possible evidence
<ul style="list-style-type: none"> <li>• Observe rocks closely.</li> <li>• Classify rocks in a range of ways, based on their appearance.</li> <li>• Devise a test to investigate the hardness of a range of rocks.</li> <li>• Devise a test to investigate how much water different rocks absorb.</li> <li>• Observe how rocks change over time e.g. gravestones or old building.</li> <li>• Research using secondary sources how fossils are formed.</li> <li>• Observe soils closely.</li> <li>• Classify soils in a range of ways based on their appearance.</li> <li>• Devise a test to investigate the water retention of soils.</li> <li>• Observe how soil can be separated through sedimentation.</li> <li>• Research the work of Mary Anning.</li> </ul>	<ul style="list-style-type: none"> <li>• Can classify rocks in a range of different ways, using appropriate vocabulary</li> <li>• Can devise tests to explore the properties of rocks and use data to rank the rocks</li> <li>• Can link rocks changing over time with their properties e.g. soft rocks get worn away more easily</li> <li>• Can present in different ways their understanding of how fossils are formed e.g. in role play, comic strip, chronological report, stop-go animation etc.</li> <li>• Can identify plant/animal matter and rocks in samples of soil</li> <li>• Can devise a test to explore the water retention of soils</li> </ul>

## Year 4 – States of Matter

### National Curriculum Objectives:

- \* 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.

Prior Learning:	Working Scientifically (NC) Links:	Ideas for Science Enquiry:	Story Opportunities:	Maths Opportunities:	Vocabulary:
<p><b>In Year 1 – Everyday Materials:</b></p> <ul style="list-style-type: none"> <li>* Distinguish between an object and the material from which it is made.</li> <li>* Identify and name a variety of everyday materials, including wood, plastic, glass, water, metal and rock.</li> <li>* Describe the simple physical properties Of a variety of everyday materials.</li> <li>* Compare and group together a variety of everyday materials on the basis of their simple physical properties.</li> </ul> <p><b>In Year 2:</b></p> <ul style="list-style-type: none"> <li>* Identify and compare the suitability of a variety of everyday materials, including wood, metal, plastic, glass, brick, rock, paper and cardboard for particular uses</li> <li>* Find out how the shapes of solid objects made from some materials can be changed by squashing, bending, twisting and stretching.</li> </ul>	<ul style="list-style-type: none"> <li>* Group and classify a variety of different materials; exploring the effect of temperature on substances such as chocolate, butter, cream (for example, to make food such as chocolate crispy cakes and ice-cream for a party).</li> <li>* Research the temperature at which materials change state, for example, when iron melts or when oxygen condenses into a liquid.</li> <li>* Observe and record evaporation over a period of time, for example, a puddle in the playground or washing on a line.</li> <li>* Investigate the effect of temperature on washing drying or snowmen melting.</li> </ul> <p><b>Types of scientific Enquiry:</b></p> <ul style="list-style-type: none"> <li>Fair &amp; Comparative testing</li> <li>Research using secondary sources</li> <li>Identifying, classifying &amp; grouping</li> <li>Pattern seeking</li> <li>Observing over time</li> </ul>	<ul style="list-style-type: none"> <li>* Can you sort these materials into solid, liquid and gases?</li> <li>* What is the boiling point of different liquids?</li> <li>* What is the melting point of different materials?</li> <li>* Where is the best place to dry washing?</li> <li>* How does temp / mass of the block affect the speed an ice cube melts?</li> <li>* Which material is best for keeping our hot chocolate warm?</li> <li>* How does ice change as it is heated to 100 degrees?</li> <li>* Is there a pattern between the surface area of a container and how fast water evaporates?</li> </ul>	<p><b>Charlie and the Chocolate Factory</b> (Roald Dahl)</p> <p><b>Once Upon a Raindrop: The Story of Water</b> (James Carter)</p> <p><b>Sticks</b> (Diane Alber)</p> <p><b>Famous Scientists</b></p> <p><b>Anders Celcius</b> (Temp scate)</p> <p><b>Daniel Fahrenheit</b> (Temp Scale &amp; Thermometer)</p>	<p>Measuring : temperatu re / time Tables &amp; Graphs – minutes it takes an ice cube to melt</p>	<p>solid, liquid, gas, state change, melting, freezing, heating, melting, boiling, melting point, boiling point, evaporation, temperature, water cycle, condensation</p>

<p><b>In Year 5:</b></p> <ul style="list-style-type: none"> <li>* Compare and group together everyday materials on the basis of their properties, including their hardness, solubility, transparency, conductivity (electrical and thermal), and response to magnets</li> <li>* Know that some materials will dissolve in liquid to form a solution, and describe how to recover a substance from a solution</li> <li>* Use knowledge of solids, liquids and gases to decide how mixtures might be separated, including through filtering, sieving and evaporating</li> <li>* Give reasons, based on evidence from comparative and fair tests, for the particular uses of everyday materials, including metals, wood and plastic</li> <li>* Demonstrate that dissolving, mixing and changes of state are reversible changes</li> <li>* Explain that some changes result in the formation of new materials, and that this kind of change is not usually reversible, including changes associated with burning and the action of acid on bicarbonate of soda.</li> </ul>
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**WHAT PUPILS NEED TO KNOW OR DO TO BE SECURE****Show understanding of a concept using scientific vocabulary correctly**

Key learning	Possible evidence
<p>A solid keeps its shape and has a fixed volume. A liquid has a fixed volume but changes in shape to fit the container. A liquid can be poured and keeps a level, horizontal surface. A gas fills all available space; it has no fixed shape or volume. Granular and powdery solids like sand can be confused with liquids because they can be poured, but when poured they form a heap and they do not keep a level surface when tipped. Each individual grain demonstrates the properties of a solid.</p> <p>Melting is a state change from solid to liquid. Freezing is a state change from liquid to solid. The freezing point of water is 0°C. Boiling is a change of state from liquid to gas that happens when a liquid is heated to a specific temperature and bubbles of the gas can be seen in the liquid. Water boils when it is heated to 100°C. Evaporation is the same state change as boiling (liquid to gas), but it happens slowly at lower temperatures and only at the surface of the liquid. Evaporation happens more quickly if the temperature is higher, the liquid is spread out or it is windy. Condensation is the change back from a gas to a liquid caused by cooling.</p> <p>Water at the surface of seas, rivers etc. evaporates into water vapour (a gas). This rises, cools and condenses back into a liquid forming clouds. When too much water has condensed, the water droplets in the cloud get too heavy and fall back down as rain, snow, sleet etc. and drain back into rivers etc. This is known as precipitation. This is the water cycle.</p>	<ul style="list-style-type: none"> <li>• Can create a concept map, including arrows linking the key vocabulary</li> <li>• Can name properties of solids, liquids and gases</li> <li>• Can give everyday examples of melting and freezing</li> <li>• Can give everyday examples of evaporation and condensation</li> <li>• Can describe the water cycle</li> </ul>
<b>Key vocabulary</b>	
Solid, liquid, gas, state change, melting, freezing, melting point, boiling point, evaporation, temperature, water cycle	

**Common misconceptions**

Some children may think:

- 'solid' is another word for hard or opaque
- solids are hard and cannot break or change shape easily and are often in one piece
- substances made of very small particles like sugar or sand cannot be solids
- particles in liquids are further apart than in solids and they take up more space
- when air is pumped into balloons, they become lighter
- water in different forms – steam, water, ice – are all different substances
- all liquids boil at the same temperature as water (100 degrees)
- melting, as a change of state, is the same as dissolving
- steam is visible water vapour (only the condensing water droplets can be seen)

- clouds are made of water vapour or steam
- the substance on windows etc. is condensation rather than water
- the changing states of water (illustrated by the water cycle) are irreversible
- evaporating or boiling water makes it vanish
- evaporation is when the Sun sucks up the water, or when water is absorbed into a surface/material.

**Apply knowledge in familiar related contexts, including a range of enquiries**

Activities	Possible evidence
<ul style="list-style-type: none"> <li>• Observe closely and classify a range of solids. Observe closely and classify a range of liquids.</li> <li>• Explore making gases visible e.g. squeezing sponges under water to see bubbles, and showing their effect e.g. using straws to blow objects, trees moving in the wind.</li> <li>• Classify materials according to whether they are solids, liquids and gases.</li> <li>• Observe a range of materials melting e.g. ice, chocolate, butter.</li> <li>• Investigate how to melt ice more quickly.</li> <li>• Observe the changes when making rocky road cakes or ice-cream.</li> <li>• Investigate the melting point of different materials e.g. ice, margarine, butter and chocolate.</li> <li>• Explore freezing different liquids e.g. tomato ketchup, oil, shampoo.</li> <li>• Use a thermometer to measure temperatures e.g. icy water (melting), tap water, hot water, boiling water (demonstration).</li> <li>• Observe water evaporating and condensing e.g. on cups of icy water and hot water.</li> <li>• Set up investigations to explore changing the rate of evaporation e.g. washing, puddles, handprints on paper towels, liquids in containers.</li> <li>• Use secondary sources to find out about the water cycle.</li> </ul>	<ul style="list-style-type: none"> <li>• Can give reasons to justify why something is a solid liquid or gas</li> <li>• Can give examples of things that melt/freeze and how their melting points vary</li> <li>• From their observations, can give the melting points of some materials</li> <li>• Using their data, can explain what affects how quickly a solid melts</li> <li>• Can measure temperatures using a thermometer</li> <li>• Can explain why there is condensation on the inside the hot water cup but on the outside of the icy water cup</li> <li>• From their data, can explain how to speed up or slow down evaporation</li> <li>• Can present their learning about the water cycle in a range of ways e.g. diagrams, explanation text, story of a water droplet</li> </ul>



## Year 5 – Properties and Changes of Materials.

### National Curriculum Objectives:

- \* Compare and group together everyday materials on the basis of their properties, including their hardness, solubility, transparency, conductivity (electrical and thermal), and response to magnets
- \* Know that some materials will dissolve in liquid to form a solution, and describe how to recover a substance from a solution
- \* Use knowledge of solids, liquids and gases to decide how mixtures might be separated, including through filtering, sieving and evaporating
- \* Give reasons, based on evidence from comparative and fair tests, for the particular uses of everyday materials, including metals, wood and plastic
- \* Demonstrate that dissolving, mixing and changes of state are reversible changes
- \* Explain that some changes result in the formation of new materials, and that this kind of change is not usually reversible, including changes associated with burning and the action of acid on bicarbonate of soda.

Prior Learning:	Working Scientifically (NC) Links:	Ideas for Science Enquiry:	Story Opportunities:	Maths Opportunities:	Vocabulary:
<p><b>In Year 2:</b></p> <ul style="list-style-type: none"> <li>* Identify and compare the suitability of a variety of everyday materials, including wood, metal, plastic, glass, brick, rock, paper and cardboard for particular uses</li> <li>* Find out how the shapes of solid objects made from some materials can be changed by squashing, bending, twisting and stretching.</li> </ul> <p><b>In Year 4:</b></p> <ul style="list-style-type: none"> <li>* Compare and group materials together, according to whether they are solids, liquids or gases</li> <li>* 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)</li> <li>* Identify the part played by evaporation and condensation in the water cycle and associate the rate of evaporation with temperature.</li> </ul>	<ul style="list-style-type: none"> <li>* Explore and compare the properties of a broad range of materials, including relating these to what they learnt about magnetism in year 3 and electricity in year 4.</li> <li>* Which materials would be the best for making a warm jacket, wrapping ice cream to stop it melting or for making blackout curtains?</li> <li>* Compare materials in to make a switch in a circuit.</li> <li>* Observe and compare changes that take place, e.g. when burning different materials or baking bread / cakes / pancakes.</li> <li>* Research and compare how chemical changes affect our lives, e.g. when cooking</li> <li>* Discuss use of new materials, e.g. polymers, super-sticky and super-thin materials.</li> </ul> <p><b>Types of scientific Enquiry:</b></p> <ul style="list-style-type: none"> <li>Fair &amp; Comparative testing</li> <li>Research using secondary sources</li> <li>Identifying, classifying &amp; grouping</li> <li>Pattern seeking</li> <li>Observing over time</li> </ul>	<ul style="list-style-type: none"> <li>* Which material is the best thermal insulator?</li> <li>* How can we separate these materials?</li> <li>* Which material is the most soluble?</li> <li>* How can we make sugar dissolve faster?</li> <li>* Which material would make the best flask?</li> <li>* How can we make the water clean?</li> <li>How sweet can you make your tea?</li> <li>* Which material will make the best coat?</li> <li>* Which of these experiments can be reversed?</li> <li>How can you get the salt back from water?</li> <li>What amount of vinegar / bicarb of soda best inflates the balloon?</li> </ul>	<p><b>Itch</b> – Simon Mayo</p> <p><b>Kensuke’s Kingdom</b> – Michael Morpurgo</p> <p><b>The BFG</b> – Roald Dahl</p> <p><b>Famous Scientists</b> – Spencer Silver, Arthur Fry and Alan Amron (Post-it notes)</p> <p><b>Ruth Benerito</b> (Wrinkle-Free Cotton)</p>	<ul style="list-style-type: none"> <li>* Measurement and reading scales – thermometers</li> <li>* interpreting scales</li> <li>* Data logging</li> <li>* Drawing / interpreting line graphs</li> <li>* Looking for trends/ patterns</li> </ul>	<p>thermal / electrical insulator / conductor, change of state, mixture, dissolve, solution, soluble, insoluble, filter, sieve, reversible / non-reversible change, burning, rusting, new materials, hardness, solubility, transparency, magnetic, evaporate</p>
<p><b>In KS3:</b> * Chemical reactions as the re-arrangement of atoms. * Representing chemical reactions using formulae and equations. * Combustion, thermal decomposition, oxidation and displacement reactions. * Defining acids and alkalis in terms of neutralisation reactions. * The pH scale for measuring acidity / alkalinity and indicators.</p>					

**WHAT PUPILS NEED TO KNOW OR DO TO BE SECURE**

**Show understanding of a concept using scientific vocabulary correctly**

Key learning	Possible evidence
<p>Materials have different uses depending on their properties and state (liquid, solid, gas). Properties include hardness, transparency, electrical and thermal conductivity and attraction to magnets. Some materials will dissolve in a liquid and form a solution while others are insoluble and form sediment.</p> <p>Mixtures can be separated by filtering, sieving and evaporation.</p> <p>Some changes to materials such as dissolving, mixing and changes of state are reversible, but some changes such as burning wood, rusting and mixing vinegar with bicarbonate of soda result in the formation of new materials and these are not reversible.</p>	<ul style="list-style-type: none"> <li>• Can use understanding of properties to explain everyday uses of materials, for example, how bricks, wood, glass and metals are used in buildings</li> <li>• Can explain what dissolving means, giving examples</li> <li>• Can name equipment used for filtering and sieving</li> <li>• Can use knowledge of liquids, gases and solids to suggest how materials can be recovered from solutions or mixtures by evaporation, filtering or sieving</li> <li>• Can describe some simple reversible and non-reversible changes to materials, giving examples</li> </ul>
Key vocabulary	
<p>Thermal/electrical insulator/conductor, change of state, mixture, dissolve, solution, soluble, insoluble, filter, sieve, reversible/non-reversible change, burning, rusting, new material</p>	
Common misconceptions	
<p>Lots of misconceptions exist around reversible and irreversible changes, including around the permanence or impermanence of the change. There is confusion between physical/chemical changes and reversible and irreversible changes. They do not correlate simply. Chemical changes result in a new material being formed. These are mostly irreversible. Physical changes are often reversible but may be permanent. These do not result in new materials e.g. cutting a loaf of bread. It is still bread, but it is no longer a loaf. The shape, but not the material, has been changed.</p> <p>Some children may think:</p> <ul style="list-style-type: none"> <li>• thermal insulators keep cold in or out</li> <li>• thermal insulators warm things up</li> <li>• solids dissolved in liquids have vanished and so you cannot get them back</li> <li>• lit candles only melt, which is a reversible change.</li> </ul>	
Apply knowledge in familiar related contexts, including a range of enquiries	
Activities	Possible evidence
<ul style="list-style-type: none"> <li>• Investigate the properties of different materials in order to recommend materials for particular functions depending on these properties e.g. test waterproofness and thermal insulation to identify a suitable fabric for a coat.</li> <li>• Explore adding a range of solids to water and other liquids e.g. cooking oil, as appropriate.</li> <li>• Investigate rates of dissolving by carrying out comparative and fair test.</li> </ul>	<ul style="list-style-type: none"> <li>• Can create a chart or table grouping/comparing everyday materials by different properties</li> <li>• Can use test evidence gathered about different properties to suggest an appropriate material for a particular purpose</li> </ul>