

Scientific Enquiry Knowledge and Skills Progression

'As Scientists, we question how the world around us works so we can make predictions, experiment and explain our understanding.'

question, predict, experiment, observe, analyse, classify

Asking questions and recognising that they can be answered in different ways

Y 1 and 2	Y 3 and 4	Y 5 and 6
<p>Asking simple questions and recognising that they can be answered in different ways</p> <ul style="list-style-type: none"> • While exploring the world, the children develop their ability to ask questions (such as what something is, how things are similar and different, the ways things work, which alternative is better, how things change and how they happen). Where appropriate, they answer these questions. • The children answer questions developed with the teacher often through a scenario. • The children are involved in planning how to use resources provided to answer the questions using different types of enquiry, helping them to recognise that there are different ways in which questions can be answered. 	<p>Asking relevant questions and using different types of scientific enquiries to answer them</p> <ul style="list-style-type: none"> • The children consider their prior knowledge when asking questions. They independently use a range of question stems. Where appropriate, they answer these questions. • The children answer questions posed by the teacher. • Given a range of resources, the children decide for themselves how to gather evidence to answer the question. They recognise when secondary sources can be used to answer questions that cannot be answered through practical work. They identify the type of enquiry that they have chosen to answer their question. 	<p>Planning different types of scientific enquiries to answer questions, including recognising and controlling variables where necessary</p> <ul style="list-style-type: none"> • Children independently ask scientific questions. This may be stimulated by a scientific experience or involve asking further questions based on their developed understanding following an enquiry. • Given a wide range of resources the children decide for themselves how to gather evidence to answer a scientific question. They choose a type of enquiry to carry out and justify their choice. They recognise how secondary sources can be used to answer questions that cannot be answered through practical work.

Making observations and taking measurements

<p>Observing closely, using simple equipment</p> <ul style="list-style-type: none"> • Children explore the world around them. They make careful observations to support identification, comparison and noticing change. 	<p>Making systematic and careful observations and, where appropriate, taking accurate measurements using standard units, using a range of equipment, including thermometers and data loggers</p>	<p>Taking measurements, using a range of scientific equipment, with increasing accuracy and precision, taking repeat readings when appropriate</p>
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<p>They use appropriate senses, aided by equipment such as magnifying glasses or digital microscopes, to make their observations.</p> <ul style="list-style-type: none"> • They begin to take measurements, initially by comparisons, then using non-standard units. 	<ul style="list-style-type: none"> • The children make systematic and careful observations. • They use a range of equipment for measuring length, time, temperature and capacity. They use standard units for their measurements. 	<ul style="list-style-type: none"> • The children select measuring equipment to give the most precise results e.g. ruler, tape measure or trundle wheel, force meter with a suitable scale. • During an enquiry, they make decisions e.g. whether they need to: take repeat readings (fair testing); increase the sample size (pattern seeking); adjust the observation period and frequency (observing over time); or check further secondary sources (researching); in order to get accurate data (closer to the true value).
<p>Engaging in practical enquiry to answer questions</p>		
<p>Performing simple tests</p> <ul style="list-style-type: none"> • The children use practical resources provided to gather evidence to answer questions generated by themselves or the teacher. They carry out: tests to classify; comparative tests; pattern seeking enquiries; and make observations over time. <p>Identifying and classifying</p> <ul style="list-style-type: none"> • Children use their observations and testing to compare objects, materials and living things. They sort and group these things, identifying their own criteria for sorting. • They use simple secondary sources (such as identification sheets) to name living things. They describe the characteristics they used to identify a living thing. 	<p>Setting up simple practical enquiries, comparative and fair tests</p> <ul style="list-style-type: none"> • The children select from a range of practical resources to gather evidence to answer questions generated by themselves or the teacher. • They follow their plan to carry out: observations and tests to classify; comparative* and simple fair* tests; observations over time; and pattern seeking. <div data-bbox="763 1114 1442 1362"> <p>Note</p> <p>A comparative test is performed by changing a variable that is qualitative e.g. the type of material, shape of the parachute. This leads to a ranked outcome.</p> <p>A fair test is performed by changing a variable that is quantitative e.g. the thickness of the material or the area of the canopy. This leads to establishing a causative relationship.</p> </div>	<p>Planning different types of scientific enquiries to answer questions, including recognising and controlling variables where necessary</p> <ul style="list-style-type: none"> • The children select from a range of practical resources to gather evidence to answer their questions. They carry out fair* tests, recognising and controlling variables. They decide what observations or measurements to make over time and for how long. They look for patterns and relationships using a suitable sample.

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Recording and presenting evidence		
Gathering and recording data to help in answering questions <ul style="list-style-type: none"> • The children record their observations e.g. using photographs, videos, drawings, labelled diagrams or in writing. • They record their measurements e.g. using prepared tables, pictograms, tally charts and block graphs. • They classify using simple prepared tables and sorting rings. 	Gathering, recording, classifying and presenting data in a variety of ways to help in answering questions <p>Recording findings using simple scientific language, drawings, labelled diagrams, keys, bar charts, and tables</p> <ul style="list-style-type: none"> • The children sometimes decide how to record and present evidence. They record their observation e.g. using photographs, videos, pictures, labelled diagrams or writing. They record their measurements e.g. using tables, tally charts and bar charts (given templates, if required, to which they can add headings). They record classifications e.g. using tables, Venn diagrams, Carroll diagrams. • Children are supported to present the same data in different ways in order to help with answering the question. 	Recording data and results of increasing complexity using scientific diagrams and labels, classification keys, tables, scatter graphs, bar and line graphs <ul style="list-style-type: none"> • The children decide how to record and present evidence. They record observations e.g. using annotated photographs, videos, labelled diagrams, observational drawings, labelled scientific diagrams or writing. They record measurements e.g. using tables, tally charts, bar charts, line graphs and scatter graphs. They record classifications e.g. using tables, Venn diagrams, Carroll diagrams and classification keys. • Children present the same data in different ways in order to help with answering the question.
Answering questions and concluding		
Using their observations and ideas to suggest answers to questions <ul style="list-style-type: none"> • Children use their experiences of the world around them to suggest appropriate answers to questions. They are supported to relate these to their evidence e.g. observations they have made, 	Using straightforward scientific evidence to answer questions or to support their findings. <ul style="list-style-type: none"> • Children answer their own and others' questions based on observations they have made, measurements they have taken or information they have gained from secondary sources. The answers are consistent with the evidence. 	Identifying scientific evidence that has been used to support or refute ideas or arguments <ul style="list-style-type: none"> • Children answer their own and others' questions based on observations they have made, measurements they have taken or information they have gained from secondary sources. When doing this, they discuss whether other evidence

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measurements they have taken or information they have gained from secondary sources.		<p>e.g. from other groups, secondary sources and their scientific understanding, supports or refutes their answer.</p> <ul style="list-style-type: none"> • They talk about how their scientific ideas change due to new evidence that they have gathered. • They talk about how new discoveries change scientific understanding.
<p><i>Using their observations and ideas to suggest answers to questions</i></p> <ul style="list-style-type: none"> • The children recognise 'biggest and smallest', 'best and worst' etc. from their data. 	<p>Identifying differences, similarities or changes related to simple scientific ideas and processes</p> <ul style="list-style-type: none"> • Children interpret their data to generate simple comparative statements based on their evidence. They begin to identify naturally occurring patterns and causal relationships. <p><i>Using results to draw simple conclusions, make predictions for new values, suggest improvements and raise further questions</i></p> <ul style="list-style-type: none"> • They draw conclusions based on their evidence and current subject knowledge. 	<p><i>Reporting and presenting findings from enquiries, including conclusions, causal relationships and explanations of and degree of trust in results, in oral and written forms such as displays and other presentations</i></p> <ul style="list-style-type: none"> • In their conclusions, children: identify causal relationships and patterns in the natural world from their evidence; identify results that do not fit the overall pattern; and explain their findings using their subject knowledge.
Evaluating and raising further questions and predictions		
	<p><i>Using results to draw simple conclusions, make predictions for new values, suggest improvements and raise further questions</i></p> <ul style="list-style-type: none"> • They identify ways in which they adapted their method as they progressed or how they would do it differently if they repeated the enquiry. 	<p><i>Reporting and presenting findings from enquiries, including conclusions, causal relationships and explanations of and degree of trust in results, in oral and written forms such as displays and other presentations</i></p>

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					<ul style="list-style-type: none">• They evaluate, for example, the choice of method used, the control of variables, the precision and accuracy of measurements and the credibility of secondary sources used.• They identify any limitations that reduce the trust they have in that data.
Vocabulary					
Year 1	Year 2	Year 3	Year 4	Year 5	Year 6
question answer observe equipment test	Year 1 words plus: identify classify gather record	All previous words plus: enquiry practical compare fair accurate standard units thermometer data-logger present predict	All previous words plus: explanation conclusion similarities differences processes evidence	All previous vocabulary plus: variables precision refute	All previous vocabulary plus: classification keys causal relationships

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Types of Enquiry - Coverage in each Year Group

Year 1	Animals including humans - T1	Plants - T1	Seasonal Change -T123	Everyday materials - T3
Research	<p>What does each sense do?</p> <p>How are the animals in Australia different to the ones that we find in Britain?</p> <p>Do all animals have a similar skeleton structure?</p>	<p>What are the most common local plants and where can we find them?</p>	<p>Look at postcards showing different seasons in order to make own.</p>	<p>Which materials can be recycled?</p> <p>How to make a 'Bug City'.</p> <p>How is bread packaged?</p>
Pattern Seeking		<p>Do trees with bigger leaves lose their leaves first in the Autumn?</p> <p>Is there a pattern in where we find moss growing in the school grounds?</p>		<p>Is there a pattern in the types of materials that are used to make objects in a school?</p> <p>Look for plastics – which things are made from plastic.</p>
Observing over time	<p>How does my height change over the year?</p>	<p>Grow and observe a runner bean plant.</p>	<p>Over the year, which things change and which stay the same.</p> <p>Start to notice gradual changes – days getting warmer. Lighter when we go home.</p>	
Identifying and classifying	<p>What are the names for all the parts of our bodies?</p> <p>Label Percy Parkkeeper cut out.</p> <p>How can we sort animals? Zoo animals / pets.</p> <p>Herbivore / carnivore / omnivore</p> <p>Start to introduce classification – fish, insect, reptile etc</p>	<p>How can we sort the leaves that we collected on our walk?</p> <p>Deciduous / evergreen</p>	<p>How would you group these things based on which season you are most likely to see them in?</p>	<p>We need to choose a material to make an umbrella. Which materials are waterproof?</p> <p>Which materials will float and which will sink?</p> <p>Group classroom / school objects based on the material.</p>

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Comparative tests		What type of compost grows the tallest bean? Which tree has the biggest leaves? What does a plant need to grow?	In which season does it rain the most?	Which materials are the most suitable for <i>our</i> park ranger? Indian park ranger? Which materials are the most/least absorbent? Which materials are most suitable for a bag?
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Year 2	Uses of everyday materials - T123	Animals, inc humans - T123	Living things & habitats T23	Plants T3
Research	How have materials changed over time? How are plastics made?	How do we need to look after a pet dog/cat/lizard and keep it healthy? What food do we need in a healthy diet and why?	How does the habitat of the Arctic compare with the habitat of the rainforest?	How does a cactus survive in the desert with no water?
Pattern Seeking		Which age group of children wash their hands the most in a day?	What conditions do woodlice prefer to live in? Which habitat do worms prefer - where can we find the most worms?	Do bigger seeds grow into bigger plants?
Observing over time	How long do bubble bath bubbles last for? What will happen to our snowman? Would a paper boat float forever?	How does a tadpole change over time? How much food and drink do I have over a week?		What happens to my bean after I have planted it? Observe and take measurements
Identifying and classifying	Which materials are shiny and which are dull? Sort materials in different ways and for different purposes.	Which offspring belongs to which animal?	How would you group these plants and animals based on what habitat you would find them in? How would you group things to show which are living, dead, or have never been alive?	How can we identify the trees that we observed on our tree hunt?

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Comparative tests	Which shapes make the strongest paper bridge?	Do amphibians have more in common with reptiles or fish?		Do cress seeds grow quicker inside or outside?
	Which material would be best for the roof of the little pig's house?	Do bananas make us run faster?		Is there the same level of light in the evergreen wood compared with the deciduous wood?
	Which material makes the best sculpture?			

Year 3	Rocks and soils - T1	Light - T1	Animals, inc humans - T2	Plants - T2	Forces and Magnets - T23
Research	Who was Mary Anning and what did she discover?	What is a light source?	Why do different types of vitamins keep us healthy and which foods can we find them in?	What are all the different ways that seeds disperse?	What are forces and magnets used for?
Pattern Seeking	Do all volcanic rocks contain crystals?		Do male humans have larger skulls than female humans?	What colour flowers do pollinating insects prefer?	Does the size and shape of a magnet affect how strong it is?
Observing over time		When is our classroom darkest? What happens to the Sun during the day?		What happens to celery when it is left in a glass of coloured water? How do flowers in a vase change over time?	
Identifying and classifying	Can you use the identification key to find out the name of each of the rocks in your collection?	How would you organise these light sources into natural and artificial sources?	How do the teeth of different animals compare? How can we group the food that we eat?		What materials are magnetic?

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Fair tests		How does the number of layers of transparent plastic affect how much light can pass through? How does the distance between the shadow puppet and the screen affect the size of the shadow?	How does the angle that your elbow/knee is bent affect the circumference of your upper arm/thigh?	How does the length of a celery stem affect how long it takes for the food colouring to dye the petals?	How does the mass of an object affect how much force is needed to make it move?
Comparative tests	Which soil absorbs the most water?	Which pair of sunglasses will be best at protecting our eyes?	How does the skull circumference of a girl compare with that of a boy?	Which conditions help seeds germinate faster?	

Year 4	Animals, inc humans - T1	Living things and their habitats - T1	Electricity - T2	Sound - T2	States of matter - T3
Research	What are the different types of teeth for?		How has electricity changed the way we live? How do we make a bulb light up?	How does the ear work?	What is a gas? Particles in solids / liquids / gas?
Pattern Seeking			Which room has the most electrical sockets in a house? Which has the least – and why?	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? Thick / thin string – how does the thickness affect the sound?	Is there a pattern in how long it takes different sized ice cubes to melt?
Observing over time	Apple with hole in – link to tooth decay.			When is our classroom the quietest?	How does the level of water in a glass change when left on the windowsill? How does the mass of an ice-cube change over time?

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Identifying and classifying	What are the names of all the organs involved in the digestive system? How can we organise animals into groups based on teeth?	Can we use the classification keys to identify the animals on the Chase?	How would you group these electrical devices based on where the electricity comes from? Mains, Battery or both?		Can you group these materials and objects into solids, liquids and gases?
Fair tests			Testing materials – Insulator or conductor?	How does the length of a ruler (on table) affect the pitch of the sound?	How does the mass of a block of ice affect how long it takes to melt? How does the surface area of a container of water affect how long it takes to evaporate?
Comparative tests	Do people with longer leg muscles jump further?		Which metal is the best conductor of electricity? Which material makes the best switch?	Which material is best to use for muffling sound in ear defenders?	

Year 5	Forces - T1	Earth and Space - T1	Animals including humans, living things and their habitats - T2	Properties and changes to materials - T3
Research	How do parachutes slow you down?	How have our ideas about the solar system changed over time? What do the Flat Earth Society believe?	What are the differences between the life cycle of an amphibian (Poison Dart Frog) and a mammal (human)? What is the life cycle of a Kapok tree?	What are microplastics and why are they harming the planet?
Pattern Seeking	Do all objects fall through water in the same way?	Is there a pattern between the size of a planet and the time it takes to travel around the Sun? (Data studied in Maths)	Are the oldest children in our class the tallest?	Do all stretchy materials stretch in the same way?

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Observing over time			How does a bean change as it germinates?	How does a container of salt water change over time? And / or How does a sugar cube change as it is put in a glass of water?
Identifying and classifying	Can you label and name all the forces acting on the objects in each of these situations?	Can you observe and identify all the phases in the cycle of the Moon? How could you organise objects in the solar system into groups?	Can you identify all the stages in the human life cycle?	Can you group these materials based on whether they are stretchy or not?
Fair tests	How does the surface area of a parachute affect the time it takes to fall to the ground?		How does age affect a human's reaction time?	How does the temperature of tea affect how long it takes for a sugar cube to dissolve?
Comparative tests	Which shoe is the most slippy? Which shape/ material parachute takes the longest to fall?	How does the length of daylight hours change in each season?		Which types of sugar dissolves the fastest?

Year 6	Light - T1	Animals, including humans - T1	Evolution and Inheritance - T2	Living things & their habitats - T2	Electricity
Research	Why do some people need to wear glasses to see clearly? How do we know that white light contains all the colours in the spectrum? How do we 'see'?	How does our circulatory system work? What does my heart do?	What happened when Charles Darwin visited the Galapagos islands?	What adaptation features do animals have in a mountain environment?	How has our understanding of electricity changed over time?
Pattern Seeking	How can we angle a mirror to make light change to a specific direction?	Is there a pattern between how long we exercise and our resting heart rate?	Do creatures with similar features live in the same sorts of habitat have a similar diet? Is there a pattern between the size and shape of a bird's beak and the food it will eat?		How does a circuit change if more components are added? How does the length of wire affect the brightness of a bulb?

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Observing over time	How does my shadow change over the day?	How does my heart rate change with exercise? PE link – fitness levels – Does improved performance on circuit training record affect our heart rate / return to resting pulse?		What happens to a piece of bread if you leave it on the windowsill for two weeks?	
Identifying and classifying	Can you identify all the colours of light that make white light when mixed together? What colours do you get if you mix different colours of light together?	Which organs of the body make up the circulatory system, and where are they found? Identify function of blood cells.		How would you make a classification key for Himalayan creatures? Can they sort living things into vertebrates, invertebrates and micro-organisms?	How would you group electrical components and appliances based on what electricity makes them do?
Fair Test	How does the angle that a light ray hits a plane mirror affect the angle at which it reflects off the surfaces?	How does the length of time we exercise for affect our heart rate? Can exercising regularly affect your lung capacity?		How does the temperature affect how much gas is produced by yeast?	How does the voltage of the batteries in a circuit affect the brightness of the lamp? How does the thickness of wires affect the brightness?
Comparative tests		What type of exercise has the greatest effect on our heart rate?	What is the most common eye colour in our class?		Which type of fruit makes the best fruity battery?