Poppleton Ousebank
PRIMARY SCHOOL

Contents

Science

INTENT

A high-quality science education provides the foundations for understanding the world through the specific disciplines of biology, chemistry and physics. Science has changed our lives and is vital to the world's future prosperity. For this reason, all pupils are taught essential aspects of knowledge, skills, processes and uses of science. Through building up a body of key foundational knowledge and concepts, pupils are encouraged to recognise the power of explanation and develop a sense of excitement and curiosity about natural phenomena. They develop an understanding of how science can be used to explain what is occurring, predict how things will behave, and analyse causes.

The national curriculum for science aims to ensure all pupils:

- develop **scientific knowledge and conceptual understanding** through the specific disciplines of biology, chemistry and physics
- develop understanding of the **nature, processes and methods of science** through different types of science enquiries that help them to answer scientific questions about the world around them
- are equipped with the scientific knowledge required to understand the **uses and implications** of science, today and for the future.

IMPLEMENTATION

In our school, pupils study an aspect of science each term (physics, chemistry or biology,) To get a depth of study and a real opportunity to explore science, each year group teaches one of the aspects as a main theme of study for a term, enabling children to make cross-curricular links to geography, and history and therefore developing a wider schema of understanding.

Children's scientific knowledge is then applied through the Working Scientifically skills:

- Ask questions and recognise that they can be answered in different ways
- Make observations and take measurements
- Engage in practical enquiry to answer questions
- Record and present evidence
- Answer questions and conclude
- Evaluate and raise further questions and predictions
- Communicate their findings.

Long Term

	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6
Physics	**Seasons**– seasons; night and day; sun. **Forces** – push and pull	**Light and dark**- Sources of; sun; dan- gers; shadows.	**Forces** – magnets;	**Electricity**- Electrical circuits; conductors and insulators. **Sound and hearing** sources; ears; sound travels.	**Earth and space** - sun; solar system; earth; moon. **Light** - light travels; shadows **Forces**- gravity; friction.	**Electricity -** circuits; voltage; components.
Chemistry	**Everyday Materials—** name and identify.	**Uses of everyday materials**- identify; suitability.	**Materials** – rocks and soils; for- mation; physical properties.	**States of Matter**- solids, liquids, gases; water cycle; evaporation; condensation	**Properties of Materials** - dissolving; mixing; changes of state are reversible changes	**Materials -** solubility, conductivity **Changes -** formation; burning; oxidisation
Biology	**Animals** - carnivores, herbivores and omnivores.	**Animals (including humans)** living; dead; survival; body; exercise; diet; food groups.	**Animals (including humans)** nutrition; skeletons and muscles	**Animals (including humans)** digestion; teeth	**Animals (including humans)** life cycles; classification; reproduction.	**Life Processes Reproduction** diet; lifestyle; human circulatory system; heart.

	Living things and their Habitats— Habitats; micro-habitats; food chains.	**Plants**—common; evergreen; decidu- ous; plant parts; growth.	**Plants** - function; germina-tion; seed dispersal.	**Living things and their Habitats** micro-organisms and preservation	**Living things and their Habitats- f**ood chains; chang-es in environment and impact	**Evolution and inher-itance -** offspring; adaptation; evolution.

Year 1 Medium Term

	Year 1	
Physics	**Seasons**	• observe the apparent movement of the Sun during the day. • observe changes
	Forces – push and pull	• describe how things move at different speeds, speed up and slow down, using simple comparisons, comparative vocabulary and superlative vocabulary **Toys topic link.**
Chemistry	**Everyday Materials**	• distinguish between an object and the material from which it is made. • describe the simple physical properties of a variety of everyday materials. • identify and name a variety of everyday materials, including wood, plastic, glass, metal, water, and rock. • compare and group together a variety of everyday materials on the basis of their simple physical properties. **Toys topic link.**
	Animals (including humans)	• observe and describe weather associated with the seasons and how day length varies (link to animal • identify and name a variety of common animals that are birds, fish, amphibians, reptiles, mammals and invertebrates • identify and name a variety of common animals that are carnivores, herbivores and omnivores • describe and compare the structure of a variety of common animals (birds, fish, amphibians, reptiles, mammals and invertebrates, and including pets) • notice that animals, including humans, have offspring which grow into adults.
	All living things Habitats	• explore and compare the differences between things that are living, dead, and things that have never been alive. • identify that most living things live in habitats to which they are suited and describe how different habitats provide for the basic needs of different kinds of animals and plants, and how they depend on each other. • identify and name a variety of plants and animals in their habitats, including micro-habitats. • describe how animals obtain their food from plants and other animals, using the idea of a simple food chain, and identify and name different sources of food.

Year 2 Medium Term

	Year 2	
	Light and Dark	• observe and name a variety of sources of light, including electric lights, flames and the Sun, explaining that we see things because light travels from them to our eyes. • notice that light is reflected from surfaces. • recognise that they need light in order to see things and that dark is the absence of light. • recognise that light from the sun can be dangerous and that there are ways to protect their eyes. • recognise that shadows are formed when the light from a light source is blocked by a solid object. • find patterns in the way that the size of shadows change. .
Chemistry	**Uses of everyday Materials**-	• identify and compare the uses of a variety of everyday materials, including wood, metal, plastic, glass, brick/rock, and paper/cardboard. • find out how the shapes of solid objects made from some materials can be changed by squashing, bending, twisting and stretching.
	Animals (including humans) **Plants**	• identify, name, draw and label the basic parts of the human body and say which part of the body is associated with each sense • find out about and describe the basic needs of animals, including humans, for survival (water, food and air). • describe the importance for humans of exercise, eating the right amounts of different types of food, and hygiene. • identify and name a variety of common plants, including garden plants, wild plants and trees, and those classified as deciduous and evergreen. • identify and describe the basic structure of a variety of common flowering plants, including roots, stem/trunk, leaves and flowers. • find out and describe how plants need water, light and a suitable temperature to grow and stay healthy. • observe and describe how seeds and bulbs grow into mature plants.

Year 3 Medium Term

	Year 3	
Physics	**Forces** – magnets	• compare how things move on different surfaces. • notice that some forces need contact between two objects, but magnetic forces can act at a distance. • observe how magnets attract or repel each other and attract some materials and not others. • compare and group together a variety of everyday materials on the basis of whether they are attracted to a magnet, and identify some magnetic materials. • describe magnets as having two poles. • predict whether two magnets will attract or repel each other, depending on which poles are facing.
Chemistry	**Materials** – rocks and soils	• relate the simple physical properties of some rocks to their formation (igneous or sedimentary). • describe in simple terms how fossils are formed when things that have lived are trapped within rock. • compare and group together different kinds of rocks on the basis of their simple physical properties. • recognise that soils are made from rocks and organic matter.
	Animals (including humans) **Plants**	• identify and describe the functions of different parts of flowering plants: roots, stem, leaves and flowers. • explore the requirements of plants for life and growth (air, light, water, nutrients from soil, and room to grow) and how they vary from plant to plant. Look at germination and conditions. • investigate the way in which water is transported within plants. • explore the role of flowers in the life cycle of flowering plants, including pollination, seed formation and seed dispersal. • identify that animals, including humans, need the right types and amount of nutrition, and that they cannot make their own food; they get nutrition from what they eat. • identify that humans and some animals have skeletons and muscles for support, protection and movement.

Year 4 Medium Term

	Year 4	
	Electricity	• identify common appliances that run on electricity • construct a simple series electrical circuit, 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. • identify whether or not a lamp will light in a simple series circuit, based on whether or not the lamp is part of a complete loop with a battery. • recognise that a switch opens and closes a circuit and associate this with whether or not a lamp lights in a simple series circuit. • recognise some common conductors and insulators, and associate metals with being good conductors.
	Sound and Hearing	• observe and name a variety of sources of sound, noticing that we hear with our ears. • recognise that vibrations from sounds travel through a medium to the ear. • identify how sounds are made, associating some of them with something vibrating. • recognise that sounds get fainter as the distance from the sound source increases. • find patterns between the pitch of a sound and features of the object that produced it. • find patterns between the volume of a sound and the strength of the vibrations that produced it.
Chemistry	**States of Matter** -	• 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 evapo- ration with temperature.
	Animals (including humans)	• identify and name a variety of living things (plants and animals) in the local and wider environment, using classification keys to assign them to groups. • recognise that environments are constantly changing and that this can sometimes pose dangers to specific habitats. • give reasons for classifying **plants** and animals based on specific characteristics.
	Living things and their Habitats	• describe the simple functions of the basic parts of the digestive system in humans. • identify the different types of teeth in humans and their simple functions.

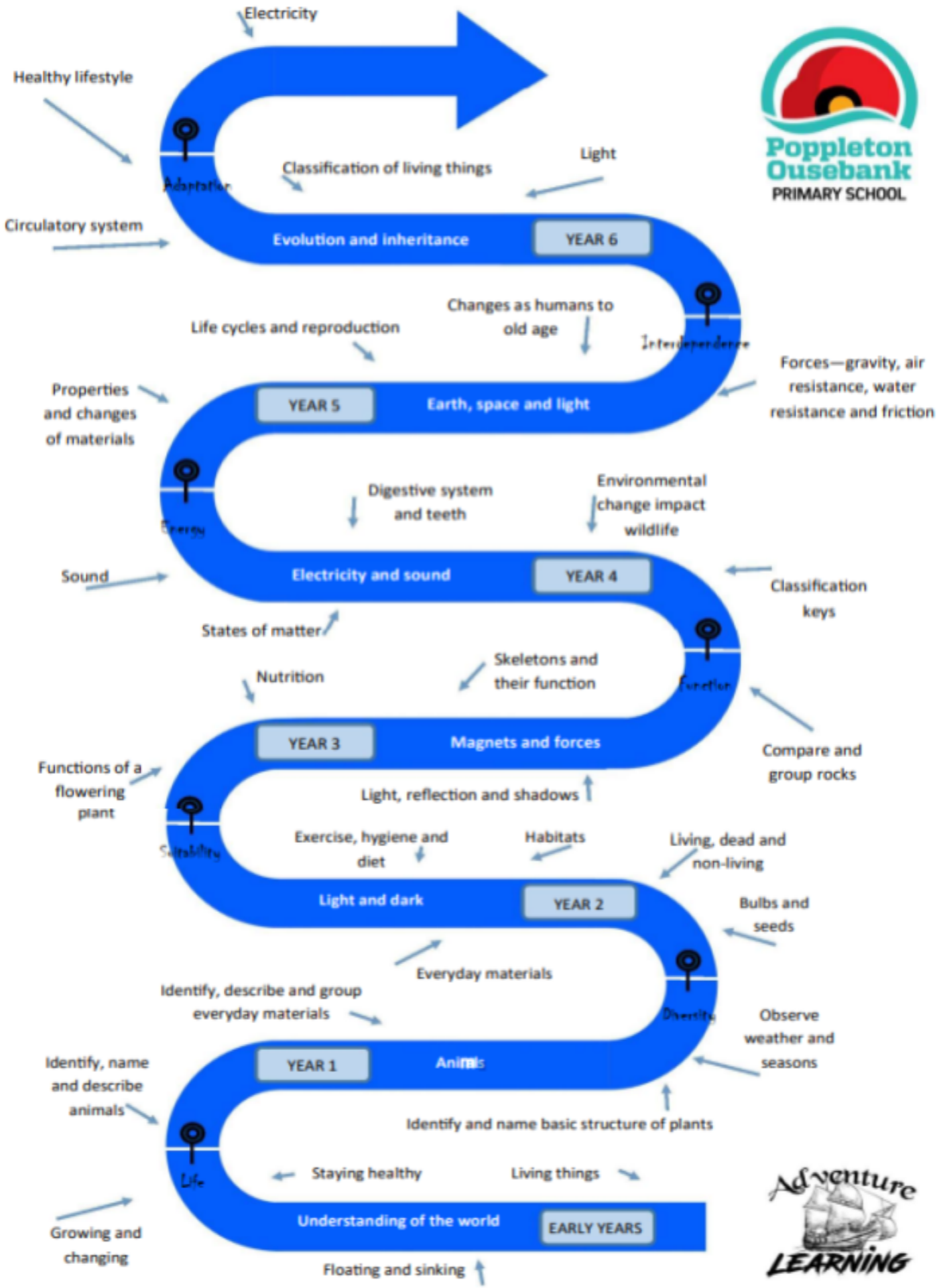
Year 5 Medium Term

	Year 5	
	Earth and Space	• describe the movement of the Earth relative to the Sun in the solar system. • use the idea of the Earth's rotation to explain day and night and the apparent movement of the sun across the sky. • describe the Sun, Earth and Moon as approximately spherical bodies. • describe the movement of the Moon relative to the Earth.
	Forces	• explain that unsupported objects fall towards the Earth because of the force of gravity acting between the Earth and the falling object. • identify the effects of air resistance, water resistance and friction, that act between moving surfaces. • recognise that some mechanisms, including levers, pulleys and gears, allow a smaller force to have a greater effect.
	Light	• understand that light appears to travel in straight lines. • 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. • use the idea that light travels in straight lines to explain why shadows have the same shape as the objects that cast them, and to predict the size of shadows when the position of the light source changes.
Chemistry	**Properties of Materials** -	• 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.
	Animals (including humans)	• describe the differences in the life cycles of a mammal, an amphibian, an insect and a bird. • describe the life process of reproduction in some plants and animals. **Link to rainforest topic.**
	Living things and their Habitats-	• identify how plants and animals, including humans, resemble their parents in many features. • construct and interpret a variety of food chains, identifying producers, predators and prey. • describe the life cycles common to a variety of animals, including humans (birth, growth, development, reproduction, death), **and to a variety of plants (growth, reproduction and death).** **Link to rainforest topic.**

Year 6 Medium Term

	Year 6	
Physics	**Electricity**	• identify and name the basic parts of a simple electrical circuit, including cells, wires, bulbs, switches and buzzers; use their common symbols to draw circuit diagrams • associate the brightness of a lamp or the volume of a buzzer with the number and voltage of cells used in the circuit. • compare and give reasons for variations in how components function, including the brightness of bulbs, the loudness of buzzers and the on/off position of switches. **Could link to DT.**
Chemistry	**Materials** **Changes**	• compare and group together everyday materials based on evidence from comparative and fair tests, including their hardness, solubility, 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. • 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, oxidisation, and the action of acid on bicarbonate of soda.
	Animals (including humans) **Evolution and Inheritance**	• recognise the impact of diet, exercise, drugs and lifestyle on the way their bodies function. • identify and name the main parts of the human circulatory system, and describe the functions of the heart, blood vessels and blood. • recognise the impact of diet, exercise, drugs and lifestyle on the way their bodies function. • 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. • give reasons for classifying plants and animals based on specific characteristics. • recognise that living things produce offspring of the same kind, but normally offspring vary and are not identical to their parents. • recognise that living things have changed over time and that fossils provide information about living things that inhabited the Earth millions of years ago.identify how animals and plants are adapted to suit their environment in different ways and that adaptation may lead to evolution. • describe how adaptation leads to evolution. • describe the changes as humans develop from birth to old age. • describe the life process of reproduction in some animals.

OUR ADVENTURE IN SCIENCE



Teaching science

Like all other subjects in school, science lessons are taught through the L.E.A.E. structure, developing knowledge, skills and an ability to communicate as a specialist. In science, children should have experiences or make observations to generate discussion and questions. As the expert, the teacher carefully plans and sequences the lessons, modelling and explaining the new knowledge and skills for that particular unit, before allowing the children to practice and apply this new learning.

When planning learning, teachers should sequence the lessons to ensure that the children are applying their knowledge to the scientific enquiry, rather than acquiring the knowledge through it. This has a two-fold benefit. Firstly, it reduces the cognitive load of learning a new skill and the knowledge, and also ensures the children remember the experience *and* the learning.

There are five different types of enquiry and they are a statutory requirement of the national Curriculum. They are:

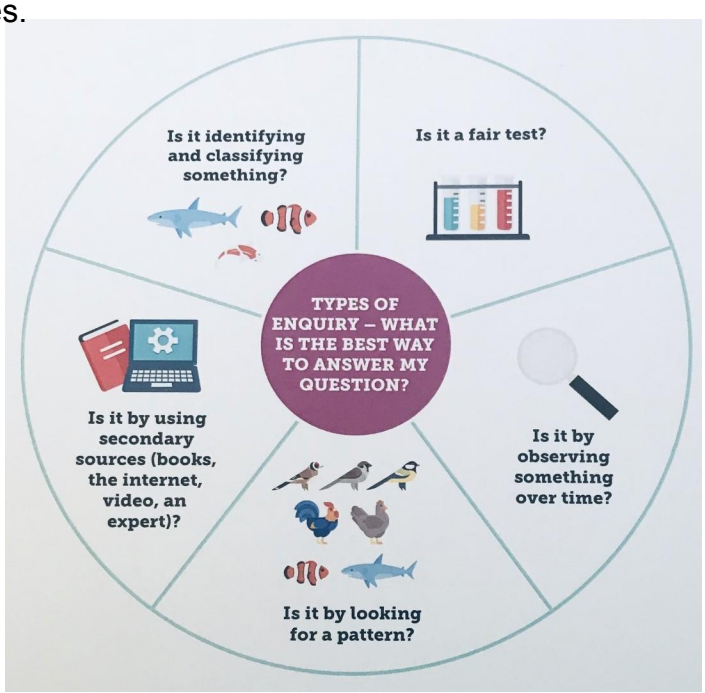
- **Fair and Comparative Testing** – changing **one** variable to observe its effect whilst controlling all of the other variables, e.g: Which kitchen roll is most absorbent?
- **Research from Secondary Sources** – using books, the internet, pictures, visitors and experts as sources of evidence to answer questions.
- **Observing** – observing and measuring how something changes over time.
- **Identifying, classifying and grouping** – arranging and sorting objects, materials and living things into particular sets according to certain characteristics. These can be characteristics and groups designed by the children or recognised groups such as carnivores, omnivores and herbivores.
- **Looking for patterns** – observing and recording patterns in nature or carrying out a survey where all of the variables cannot be controlled, e.g: where do daisies grow? Do children with the longest arms have the longest legs.

In the science National Curriculum, there is now greater emphasis on children asking their own questions and making decisions in enquiries.

All the activities should be designed to given children responsibility and might involve chil- dren choosing:

- What they will measure
- What equipment they will use.
- The parameters of their control variable e.g: how much water to use.
- How they will record their results.

By giving this responsibility to children, and providing support and guidance where necessary, important working scientifically skills are developed.



Working Scientifically

EYFS
Show curiosity about objects, events and people. Playing and Exploring . Questions why things happen. Speaking: 30-50 months.
Engage in open-ended activity. Playing and Exploring.
Take a risk, engage in new experiences and learn by trial and error. Playing and Exploring.
Find ways to solve problems / find new ways to do things / test their ideas. Creating and Thinking Critically
Develop ideas of grouping, sequences, cause and effect. Creating and Thinking Critically. Know about similarities and differences in relation to places, objects, materials and living things. ELG: The World
Comments and asks questions about aspects of their familiar world such as the place where they live or the natural world. The World: 30—50 months.
Closely observes what animals, people and vehicles do. The World 8-20 months. Use senses to explore the world around them Playing and Exploring.
Make links and notice patterns in their experience. Creating and Thinking Critically
Choose the resources they need for their chosen activities. ELG: Self Confidence and Awareness. Handle equipment and tools effectively. ELG: Moving and Handling.
Create simple representations of events, people and objects. Being Imaginative: 40-60+ months
Answer how and why questions about their experiences. ELG Understanding. Make observations of animals and plants and explain why some things occur, and talk about changes. ELG: The World.
Develop their own narratives and explanations by connecting ideas or events. ELG: Speaking. Builds up vocabulary that reflects the breadth of their experience. Understanding:30—50 months.

Progression - Working Scientifically Skills

NB - The National Curriculum statements in italics in these tables indicate that they feature more than once.

Year 1 & 2	Year 3 & 4	Year 5 & 6
Asking questions and recognising that they can be answered in different ways		
Asking simple questions and recognising that they can be answered in different ways • 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.	Asking relevant questions and using different types of scientific enquiries to answer them • 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.	*Planning different types of scientific enquiries to answer questions, including recognising and controlling variables where necessary* • 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.

Progression - Working Scientifically Skills

Making observations and taking measurements		
Observing closely, using simple equipment • Children explore the world around them. They make careful observations to support identification, comparison and noticing change. They use appropriate senses, aided by equipment such as magnifying glasses or digital microscopes, to make their observations. • They begin to take measurements, initially by comparisons, then using non-standard units.	**Making systematic and careful observations and, where appropriate, taking accurate measurements using standard units, using a range of equipment, including thermometers and data loggers** • 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.	**Taking measurements, using a range of scientific equipment, with increasing accuracy and precision, taking repeat readings when appropriate** • 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).

Engaging in practical enquiry to answer questions		
Performing simple tests • 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. **Identifying and classifying** • Children use their observations and testing to compare objects, materials and living	**Setting up simple practical enquiries, comparative and fair tests** • 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.	***Planning different types of scientific enquiries to answer questions, including recognising and controlling variables where necessary*** • 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.

Progression - Working Scientifically Skills

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.	**Explanatory note** 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. 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.	

Recording and presenting evidence		
Gathering and recording data to help in answering questions • 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** **Recording findings using simple scientific language, drawings, labelled diagrams, keys, bar charts, and tables** • 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	**Recording data and results of increasing complexity using scientific diagrams and labels, classification keys, tables, scatter graphs, bar and line graphs** • 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.

Progression - Working Scientifically Skills

	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.	• 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 • 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, measurements they have taken or information they have gained from secondary sources.	**Using straightforward scientific evidence to answer questions or to support their findings.** • 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** • 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 e.g. from other groups, secondary sources and their scientific understanding, supports or refutes their answer. • 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.
Using their observations and ideas to suggest answers to questions • The children recognise 'biggest and smallest', 'best and worst' etc. from their data.	**Identifying differences, similarities or changes related to simple scientific ideas and processes** • Children interpret their data to generate simple comparative statements based on their evidence. They begin to identify naturally occurring patterns and causal relationships.	*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* • In their conclusions, children: identify causal relationships and patterns in the natural world from their evidence; identify

Progression - Working Scientifically

	Using results to draw simple conclusions, make predictions for new values, suggest improvements and raise further questions • They draw conclusions based on their evidence and current subject knowledge.	results that do not fit the overall pattern; and explain their findings using their subject knowledge.

Evaluating and raising further questions and predictions		
	Using results to draw simple conclusions, make predictions for new values, suggest improvements and raise further questions • They identify ways in which they adapted their method as they progressed or how they would do it differently if they repeated the enquiry.	*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* • 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 their data.

Progression - Working Scientifically Skills

	Using results to draw simple conclusions, make predictions for new values, suggest improvements and raise further questions • Children use their evidence to suggest values for different items tested using the same method e.g. the distance travelled by a car on an additional surface. • Following a scientific experience, the children ask further questions which can be answered by extending the same enquiry.	Using test results to make predictions to set up further comparative and fair tests • Children use the scientific knowledge gained from enquiry work to make predictions they can investigate using comparative and fair tests.
Communicating their findings		
	Reporting on findings from enquiries, including oral and written explanations, displays or presentations of results and conclusions • They communicate their findings to an audience both orally and in writing, using appropriate scientific vocabulary.	*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* • They communicate their findings to an audience using relevant scientific language and illustrations.

Coverage

When planning, teachers should ensure that all skills are covered in enough depth over the range of topics.

Think what type of enquiry skills would fit best in each unit of work.

Planning Advise

Many enquiry activities take more than one lesson.

Consider splitting the enquiry cycle (L.E.A.E.) so that:

Exploration, wondering and planning are covered in one lesson.

The hands on investigating and review- ing carried out in other lessons.

Opportunities to retrieve what they have learned and time between activities pro- vides sufficient distance to reflect without bias.

Variety and complexity

Look at the Learning2Learn skills and the assessment framework to ensure challenge and variety of enquiry to develop well rounded scientists..

Planning

Generating questions

When given the right stimulus, children find it relatively easy to think of variables they could change in an investigation.

- Children need to choose **one** variable to change and formulate the investigation question.
- The **other variables** then become the things they need to control (**control variables).**
- Formulating the question is an area which children often find challenging. Initially children may benefit from having this modelled for them.
- When planning a fair or comparative enquiry children may also benefit from using a planning board.

Here is an example...

Size of parachute.

Height of drop.

Material the parachute is made from

Mass of the parachute

How does the **size of the parachute** affect the **time take to hit the ground?**

How does the **?** affect the **?**

Planning

Using a Planning Board

- Introduce an activity, that involves children planning an investigation to answer a broad question.
- Introduce children to the first post-it planning poster designed to help them plan a fair test/ comparison.
- On a ‘Post-it’ note, write the broad question for the investigation, e.g. “What will affect the brightness of a bulb?”
- List the things that you could change. Now ask the children to identify what factors could be changed to find out the answer to the question. (e.g. type of material for the wires, length of wire, thickness of wire, number of batteries, number of bulbs). Write each factor on a ‘Post- it’ note and add each one to the poster (there may be more than six factors, this is OK just squash them on).
- List the things that you could measure or observe Here, we want to elicit the ‘dependent variable’. Say to the children “If we change one of these things” (the factors already identified). “What can we measure or observe to see if it’s made a difference?”
- Here the children should identify the dependent factors. These should be written on ‘Post-it’ notes (a different colour) and stuck on the appropriate place on the planning poster.
- Choose one thing to change and one to measure or observe. Choose a factor to investigate, and what you will measure/observe, and place these post-its in the appropriate places on the planning poster.
- Ask the children “What do we need to keep the same to make it a fair test or comparison?” They are likely to identify each of the factors on the left hand side of the poster in turn. Move the appropriate ‘Post-its’ down into the next section of the poster as the children list them.
- The ‘Post-its’ can be easily replaced in their original positions, and you can exemplify the fair test/comparison stage again, by deciding on a different factor to test. This helps more of the children to realise that one factor only is changed, and the rest kept constant.

Note

Try the activity on your own first to make sure the investigation suits using the posters.

The wording of the questions you ask children is crucial.

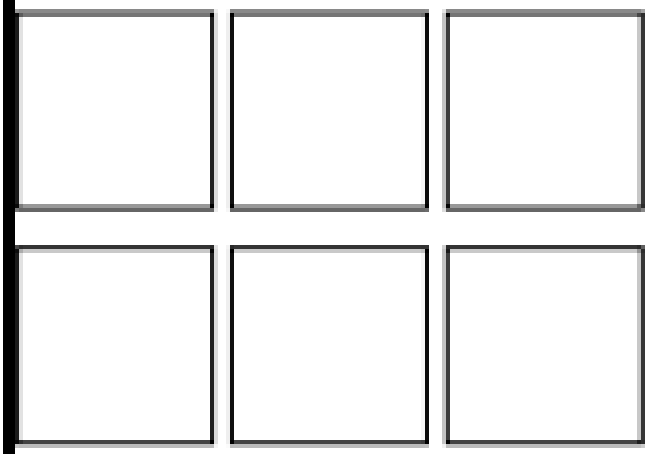
Two versions of the posters for Obtaining Evidence and for Considering and Evaluating Evidence are provided below These are differentiated to allow different levels of complexity in the investigations you wish children to pursue.

Planning

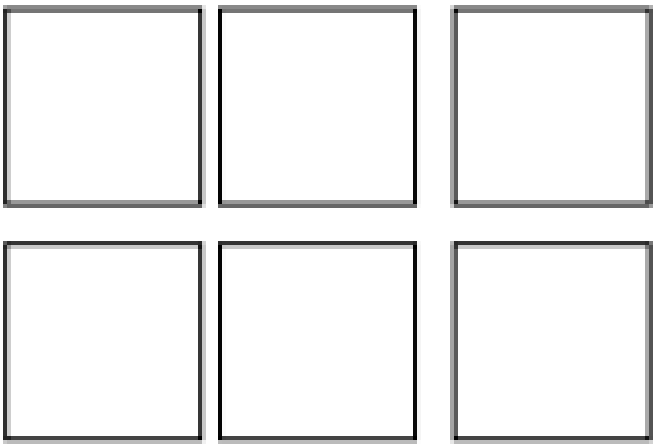
Class/Group planning Board

Our question is…

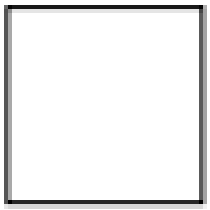
We could change



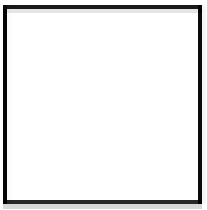
We could measure/observe



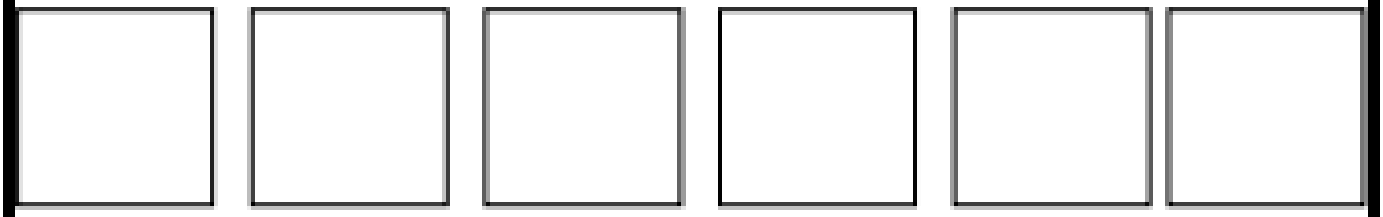
We will change



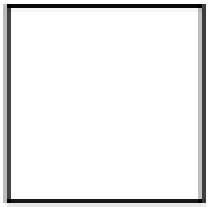
We will measure/observe



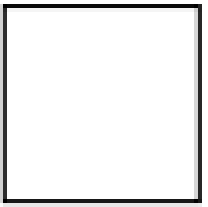
We will keep these the same…



When I change:



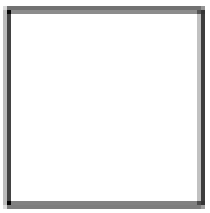
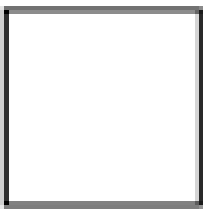
What will happen to:



Why?

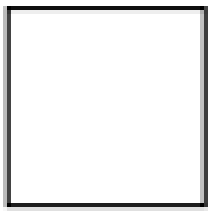
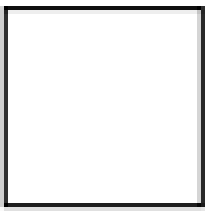
Obtaining evidence

Group Recording table

Change	Measure
	

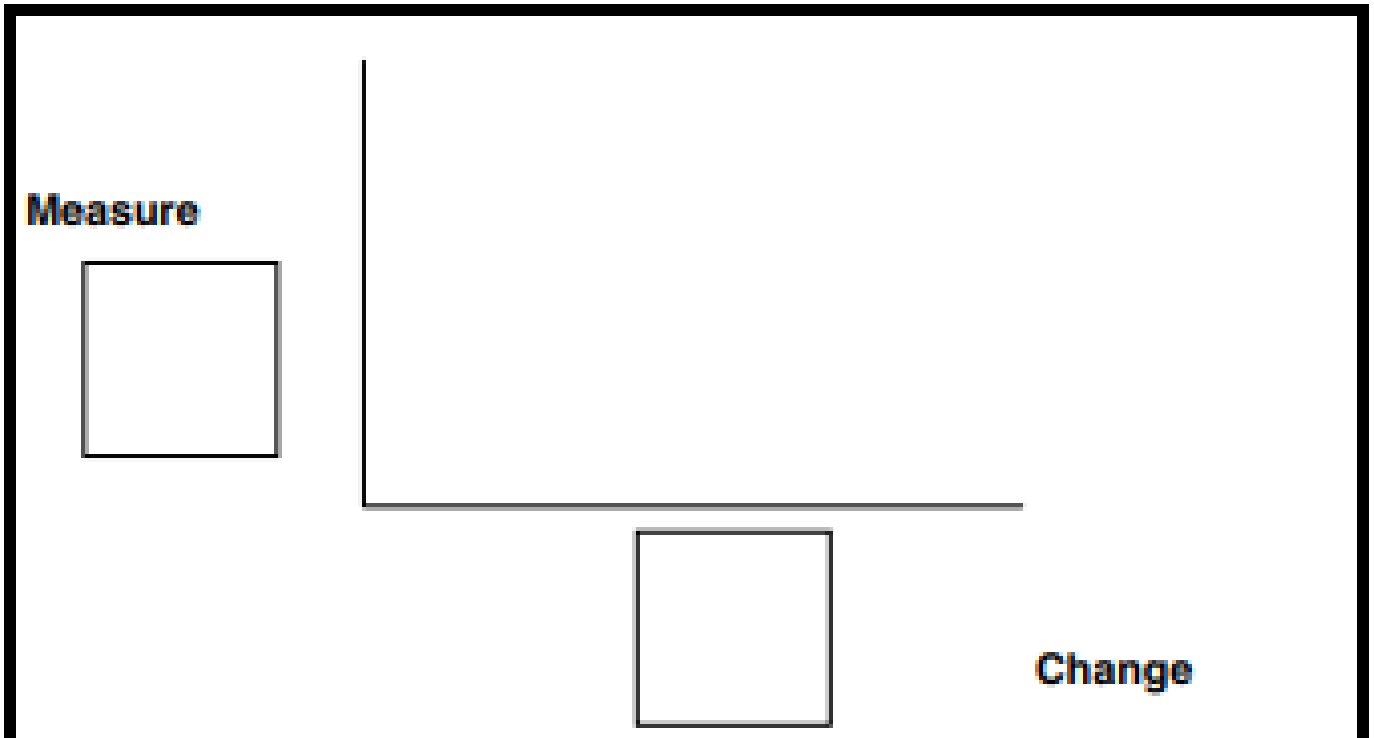
Obtaining evidence

Group Recording Table

Change	Measure			
				
				Average

Considering and evaluating evidence

Class/group
Reviewing board



When we Changed

What happened to?

Describe the pattern

Explain the pattern

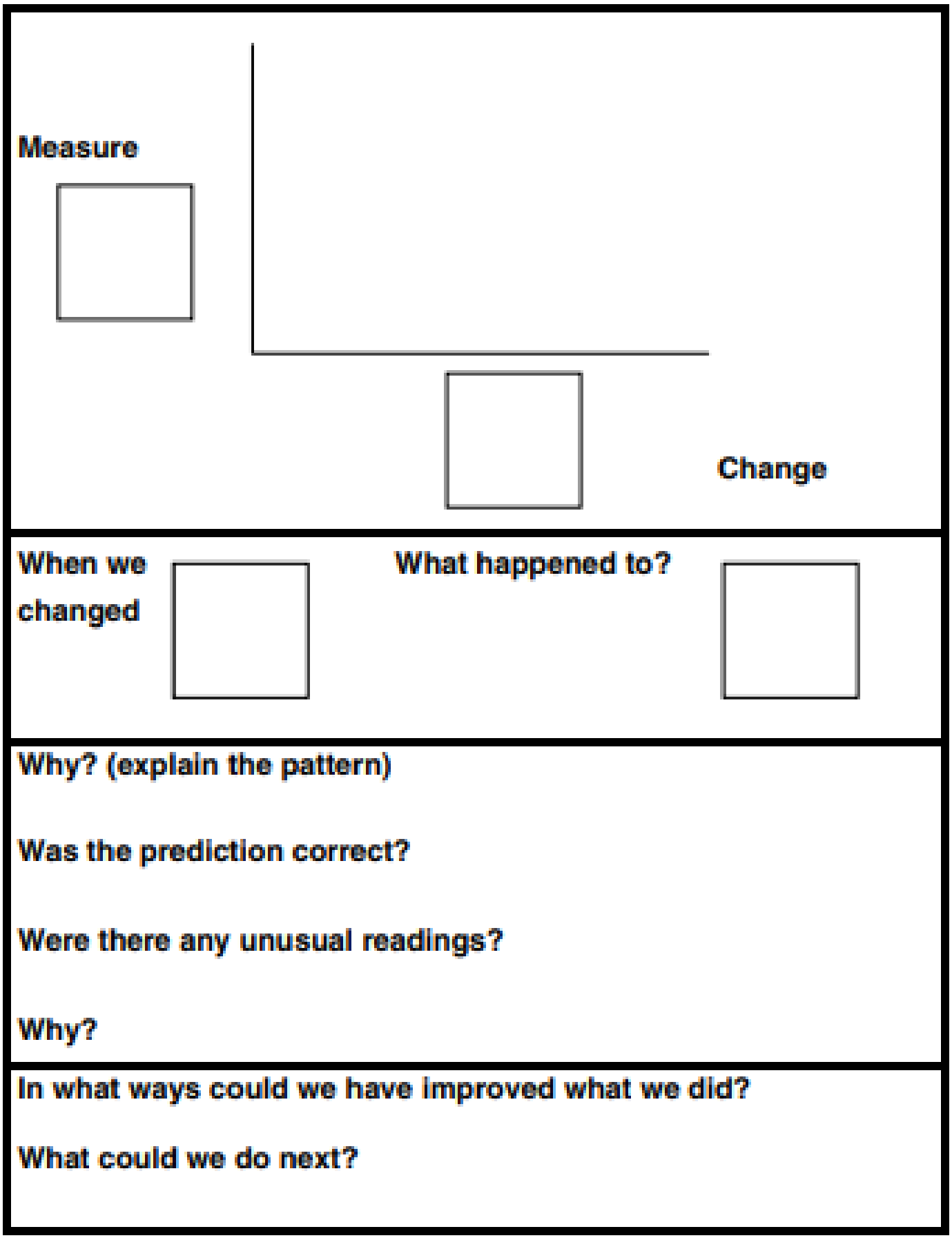
Was the prediction correct?

In what ways could we have improved what we did?

What could we do next?

Considering and evaluating evidence

Class/group
Reviewing board



When we changed

What happened to?

Why? (explain the pattern)

Was the prediction correct?

Were there any unusual readings?

Why?

In what ways could we have improved what we did?

What could we do next?

Communicating in

From a very young age, children will communicate their observations and ideas through talk. They will ask questions and make statements that demonstrate their thinking, as well as make suggestions about what they could do and how they could do it. For young children, this type of conversation will be captured by the adult and used to plan next lessons and record their efforts alongside the EYFS. As children become older, although the conversations and discussions will continue, their ability to record their work in science becomes increasingly possible as they develop pencil control and the ability to write.

Communication in science includes:

- Speaking and listening—discussing, debating
- Drawing—showing thinking, organisation, groupings, equipment and plans
- Sketching—recording of observations
- Jotting—quick notes
- Recording data and tabulation/ diagrams/graphs
- Writing—labelling, explaining ideas, plans, hypothesise, findings/results, conclusions.
- Extended writing—to demonstrate depth of understanding and their ability to apply what they have learned to new situations or to link ideas and concepts.

The essential element of all these methods of communication is the use of language and scientific terminology. Adults should use and expect pupils to use **scientific vocabulary** at all times. Their ability to talk as an expert will be determined by their use of correct language and their depth of knowledge. This will also be reflected in their writing.

Within the enquiry skills section of this document, there are expectations regarding recording and presenting data using tables, graphs and other diagrams.

Where possible, teachers and children should make use of photographs of pupils and their activities to contribute to their science work.

Using the Learning2Learn approaches will engage pupils further in thought and discussion. Staff should use these to plan enquiry and follow up work.

Think about:

Focus of communication

Method of communication

Vocabulary choices

Sketching in

Draw what you **see**…

(not the picture in your head)

Scientific sketching is…

A ACCURATE

B BIG

C Colorful

D Detailed

E Explained

Exercise #1: Sketch a Leaf

Following are several steps to help you sketch a leaf.

Remember, you're trying to convey as much information as possible so someone could pick your leaf out of a pile.

Step 1: Place leaf on paper and make little dots at the edge of each needle. This will give you the overall shape of the leaf

Step 2: Draw the centerline and connect the points to the center. You don't have to complete them all to get a

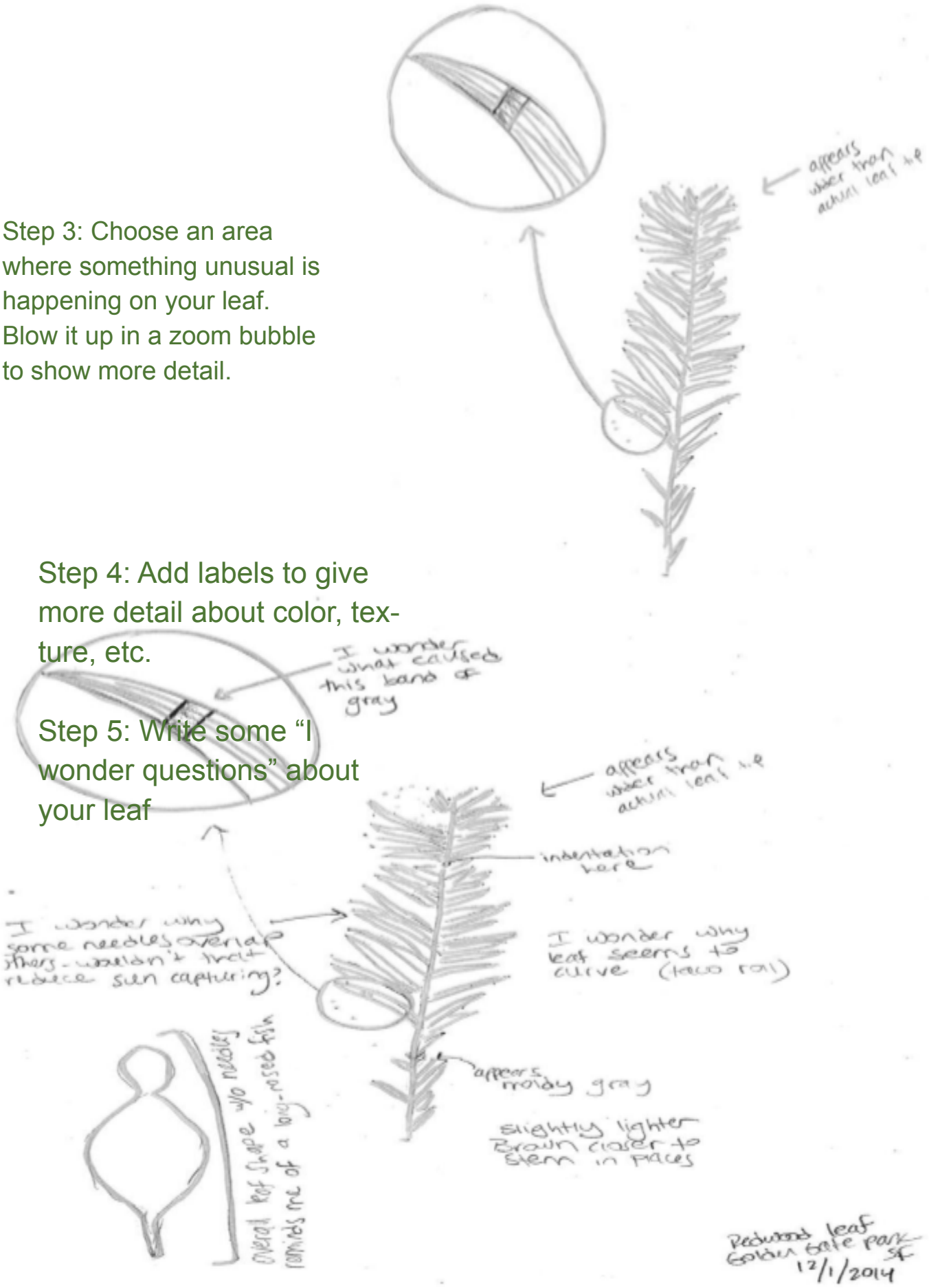
sense of the shape

Sketching in Science

Step 3: Choose an area where something unusual is happening on your leaf. Blow it up in a zoom bubble to show more detail.

Step 4: Add labels to give more detail about color, texture, etc.

Step 5: Write some “I wonder questions” about your leaf

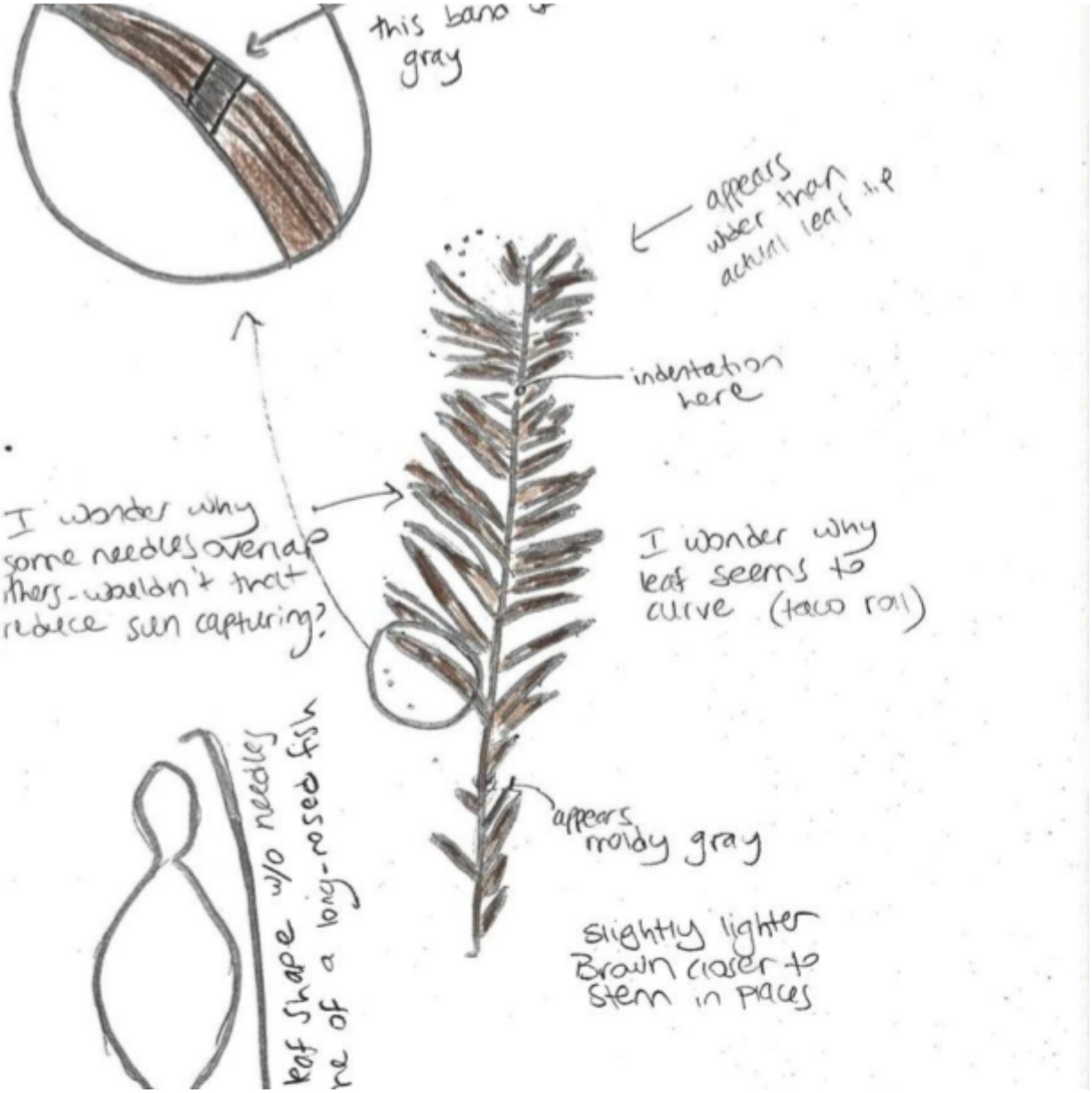


Sketching in Science

Step 6:

Add color

Remember to title and date your sketch.



Use sketching and words to record as much information about your leaf as you can.

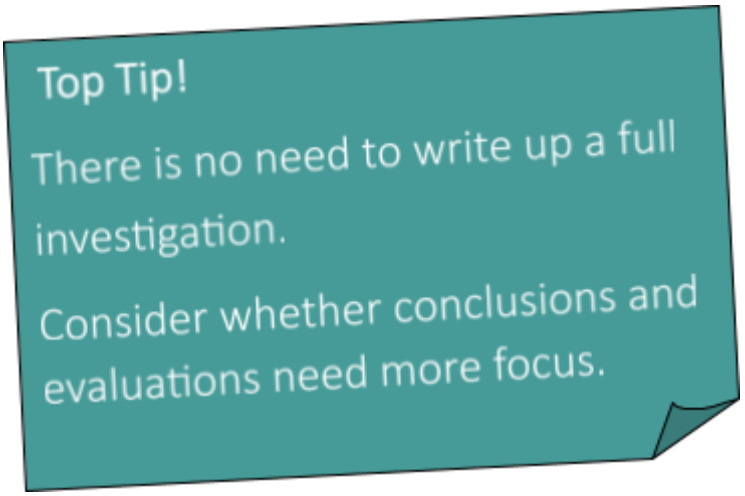
Include at least three "I wonder…" questions about your leaf

Writing in Science

Writing in science can take on many forms and purposes. They may be linked to the task or the age of pupils / abilities of pupils. e.g labelling could be task, but may also be expected of a child in Reception or an older child with SEND.

Writing in science may include—labelling, explaining ideas, plans, hypothesise, findings/results, conclusions, evaluations.

Extended writing is used to demonstrate depth of understanding and a pupil's ability to apply what they have learned to new situations or to link ideas and concepts.



Although children need to experience full enquiries, it does not mean that they need to write each section up every time. Each part of the enquiry cycle needs to be supported and developed. In the same way that teachers model the development of a story plot or a character- they should focus on each section—modelling each part and providing development opportunities to communicate each section. Some parts may be done through discussion, or observation and others through writing. A mixture of approaches is therefore required, with each part of an enquiry receiving the opportunity for pupils to write overtime.

Developing scientific writing.

Like stories, science has patterns of language that children need to learn. Some children also find that language gets in the way of the content and so teachers should look to scaffold writing when teaching children to write as a scientist. This is also particularly helpful for pupils with SEND. Teachers can use Sentence stems to model writing and support pupil discussion and thinking. Sentence stems can be used at any stage of the enquiry cycle and for any kind of skill. These stems are also useful when discussing science and many conjunctions used in English are particularly useful in science.

E.g. I observed….. I noticed… The cause of_____was_____.

The model shows_____. The benefits are_____. The limitations are_____.

Our data shows_____. Based on_____, I can conclude that_____.

I already know that_____, so_____.

Consequently… As a result…

Purposes for writing

Method	Explanation	Example
Emails	Set up a fictional character for the children to email explaining a scientific concept	Send an email to a chocolate company explaining how they can prevent their chocolate melting in hot countries
Advertisements	Get children to create advertisements related to any science topic	Create an advert for a pair of ear muffs. Why are they better then your competitors?
Newspaper articles	Children can write newspaper articles regarding their "new" invention/ discovery	Children in class 4 discover secret to successful paragliding…
Cartoons	Often good to use with children who struggle with writing, get children to draw cartoons in order to help them remember scientific concepts	Comic strip about digesting a banana sandwich
Drama	Acting out concepts is a great way of including speaking and listening. Either the children or an adult can video or take photos of it to be stuck into books	What happens to the particles in ice when you heat them?
Displays	Get children involved in making the classroom display. On going as topic progresses or display is created with blanks that children can add to as their knowledge develops	Can children create a glossary of terms used? Can they write an explanation of their investigation for display?
Instructions/ explanations	Writing a set of instructions is a great way of demonstrating understanding, particularly if children are writing instructions to explain to a younger audience	Can you write a set of instructions to our head teacher about the best ways to save electricity in the school?
Leaflet	Often included in display work. Rather then a simple recount, children can create a leaflet giving their written work a purpose	Can you create a leaflet demonstrating how to make shadow puppets
Diagrams	Where the concepts covered are difficult to explain in words, allow children opportunity to draw diagrams to demonstrate understanding.	Draw a diagram to explain the forces that act upon a boat
Posters	A good way for children to display and share their knowledge and understanding. Particularly fun when there is a public health message involved	Design a poster to remind pupils of the importance of washing hands
Photographs	Not just a tool for recording for less able children. Photos of investigations can help children remember what they did	Create a photo diary of how you investigated and sorted the different rocks

Letters	In a similar vein to email, children solve a scientific problem then write a reply stating their recommendations supported by their results	Write a letter to the best manufacturer of kitchen roll explaining how you investigated the absorbency of kitchen roll and how theirs was the best.
Reports	A standard method of recording science.	Write a report onto the effect of light on the growth of plants

Purposes for writing

Labels	Children write facts they discover of conclusions on labels that can then be stuck into books or added to class display.	For each image write a label explaining how sound is made.
PowerPoint	Children create a PowerPoint about their investigation. Incorporating photos/videos taken	Create a PowerPoint to explain your investigation into the effect of exercise on your pulse rate
Tables	Really important aspect of recording in science, whether it's completing tables of constructing own	Record results onto a whiteboard as investigation is being conducted
Flow charts	Show relationship between things using flow charts. Again children can either complete or design and complete depending on ability	Flow chart to demonstrate the water cycle
Lists	Simple tool for recording information.	List the different things in your house that use electricity
Concept Cartoons	Great to begin discussions but can also get children to create their own concept cartoon including deliberate mistakes	Three children are discussing their snowman. One of them has a hat and gloves on. What three statements might these children make about how quick this snowman will melt?
Concept maps	A representative of the links between various concepts. The concepts are shown in bubbles; children make links between them using arrows and words	Can you draw a concept map about forces
Diary Entry	Particularly useful when discussing scientists in history. Allows children to imagine they were the scientist and to discuss the main ideas and concepts	Write a diary entry by Sir Isacc Newton.

Although the above are ways to engage children in both writing and science , it is important that the writing task does not take over the importance of the science. The writing task should be an alternative way for children to demonstrate their understanding in science and teachers should
expect scientific explanations and the use of correct terminology throughout. Such tasks are use- ful to assess a pupil's ability to communicate in science.

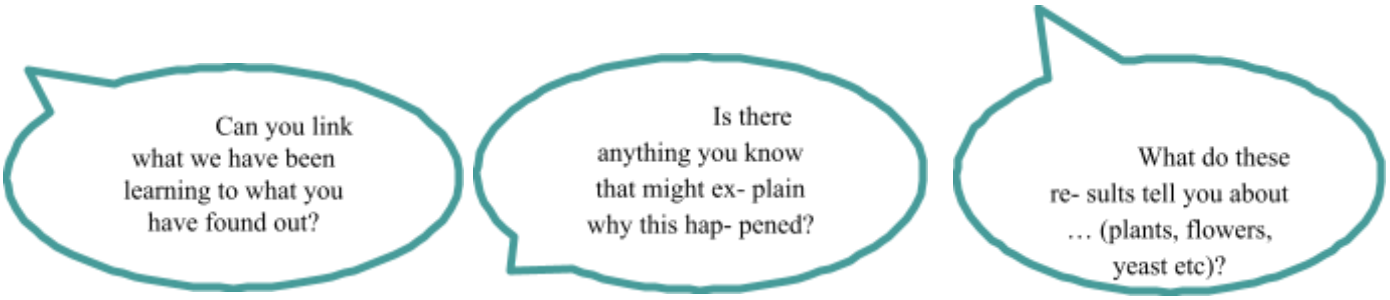
Writing in Science

Explanations

Children can explain many things in science, from the reason they have chosen equipment to their understanding of their results. Explanations are a way for children to justify their thinking and so teachers should challenge pupils to explain, rather than to just accept their ideas or decisions. Not only is it a great way to correct misconceptions and challenge pupils, but it also models to and supports other pupils who may not have an explanation or reason.

Writing explanations to support conclusions

Useful questions to encourage children to think about explanations:



Writing conclusions

A conclusion is a decision or judgement reached at the end of an enquiry, by reflecting on the data and results, and reasoning/ explaining the out- come.

It is useful to think about a ***conclusion as having up to three parts***.

The first part of a conclusion is a statement that clearly answers the original enquiry question.

In KS2, this summary sentence is often a comparative sentence eg:

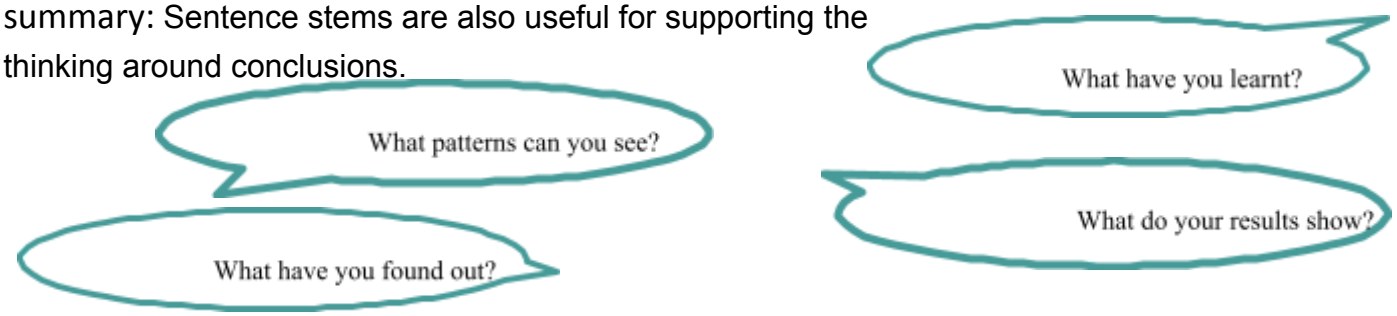
The higher the ramp the further the car travels.

The hotter the temperature the quicker the water evaporates.

The second part of forming a conclusion is for children to support their statement by say- ing ***how*** they know.

This may involve using results and observations. Children may need to be encouraged to do this. Although this skill comes in LKS2 but in KS1 asking children 'how they know' reveals more about their understanding.

Useful questions to ask children to prompt a basic summary: Sentence stems are also useful for supporting the thinking around conclusions.



The third section, will link very close- ly to section two, and is the most im- portant part— the explanation.

Top tip: The first part of drawing a conclusion is about using observations and results to answer the enquiry questions, therefore, make sure the question states specifically what the children are trying to find out.

Writing in Science

Evaluations

Once children have explained their conclusion, many children think that this is the end of their work. Good scientists reflect on their investigation to see how effective their enquiry processes were. Getting children to evaluate is perhaps harder than drawing conclusions.

When starting to evaluate an investigation children often start to comment on factors such as how well they worked together. Just like drawing conclusions the skill of evaluating needs to be explic- itly taught and modelled.

Evaluation skills are outlined on the 'working scientifically' tables earlier in this document. Evaluations will ask if children could identify ways in which they adapted their method as they progressed or how they would do it differently if they repeated the enquiry. To eventually asking older pupils to evaluate, the choice of method used, the control of variables, the precision and accuracy of measurements, the credibility of secondary sources used or identify any limitations that reduce the trust they have in their data.

Scientists do not do experiments once, they repeat them to see if the results change. Children may have time to do this for some experiments or they could pool their results (if using the same methods and variables etc) . This will bring about discussions in itself.

Writing in Science

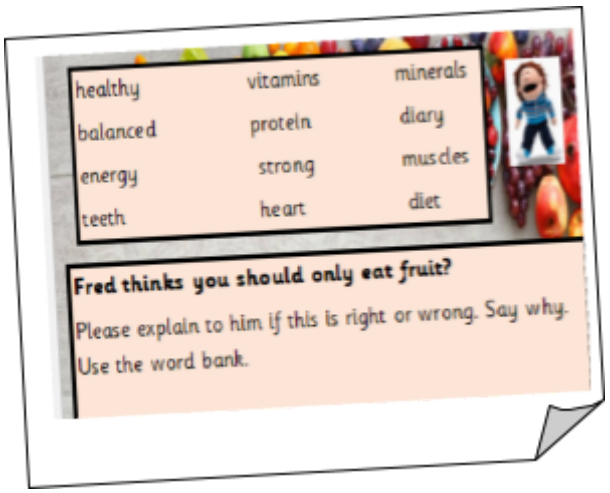
Extended writing

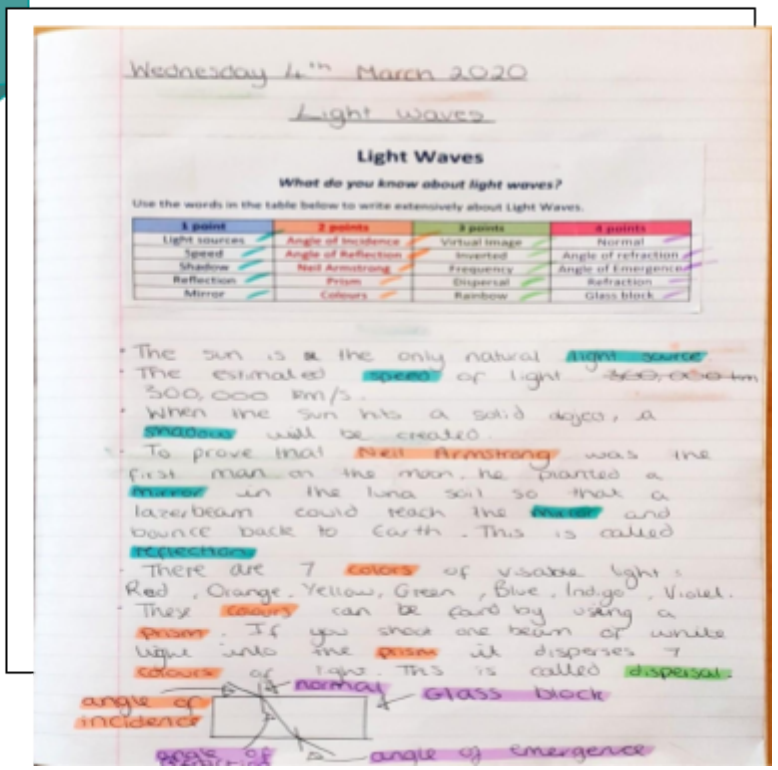
Extended writing tasks enable pupils
to show their understanding within and across science units of work. Teachers use the L2L skills and assessment grids to probe the depth of understanding and pupils' ability to manipulate and apply it.

Extended writing tasks should be planned near the end of a unit when pupils have sufficient knowledge on which to draw. This disciplinary writing provides excellent assessment information although it does not solely inform a child's abilities in science.

Like English writing, some children will require scaffolds to support independent writing and the ability to focus on the science content. Word banks and sentence stems or writing frames will be useful for some lower attaining pupils and pupils with SEND.

When picking an extended writing task think what knowledge and understanding pupils need to show you and how best they can do this. **Can they do this through proving something is right or wrong; explanation; persuasion; dis- cussion; conclusion; analysis; evalua- tion. See the LSL skills and assess- men**



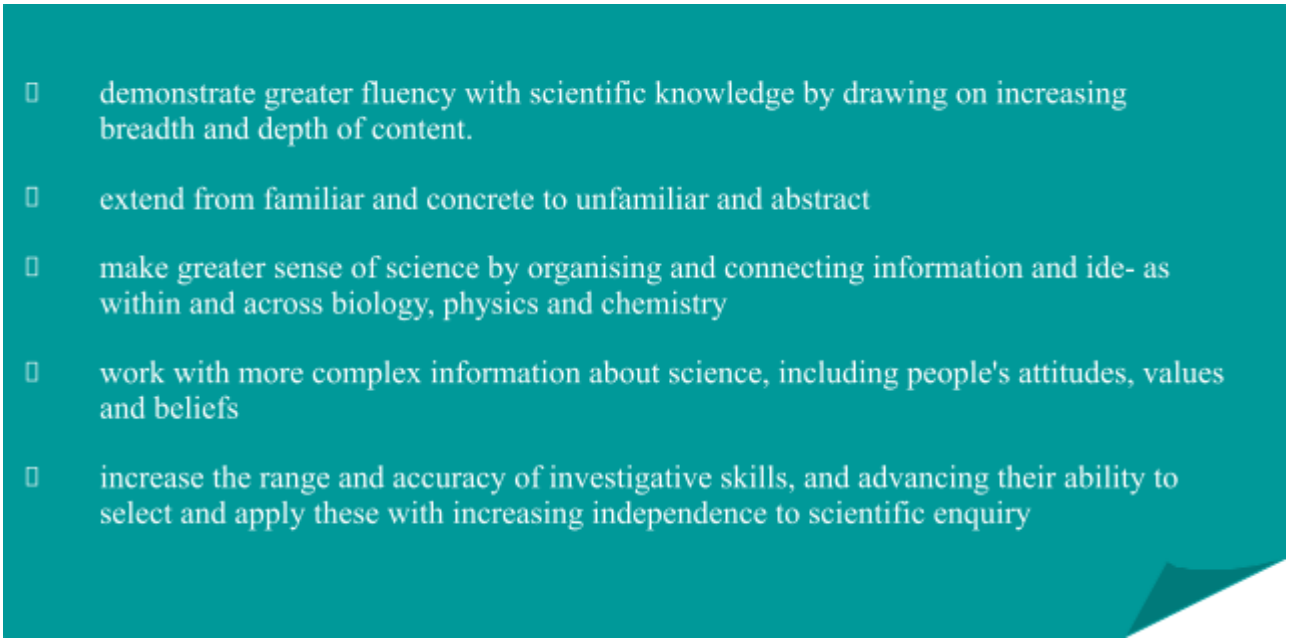


Assessment in

Assessment in Science focuses on **three areas:**

- Knowledge and understanding
- Skills
- Communication

We assess pupils against each one of these areas within each science topic.
Our assessment framework ensures that pupils develop all aspects of being a scientist, providing a clear vision of what we are trying to achieve, giving leaders a clear understanding of standards . It also provides a shared understanding and a common language. By focussing on these three strands we can challenge and support pupils to



Helping children to ‘know more, remember more and do more’.

To promote learning and progress in science, teachers plan opportunities for ‘retrieval practice’ in each lesson. The aim of these is to strengthen pupils memory by recalling information and transferring it from working memory to long term memory. This facilitates application and flexibility of the knowledge for further use. See **‘Promoting learning and progress policy’** for more details.

POP Tasks—proof of progress

POP Tasks show Proof of Progress across a unit of work. They form a collection of evidence and can include retrieval quizzes, scientific enquiries, explanations, conclusions, extended wpeices of writing and end of unit assessment tests. These pieces of work assess knowledge and understanding, skills and pupils' abilities to communicate in the subject, slowly building a picture of each child as a scientist.

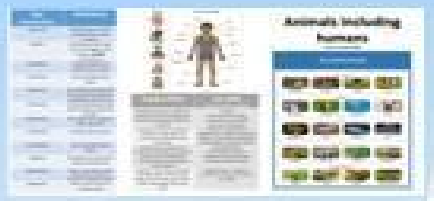
How to demonstrate the 5 Dimensions in Science

Long term and medium term plan

content/knowledge

intent

Non-negotiables



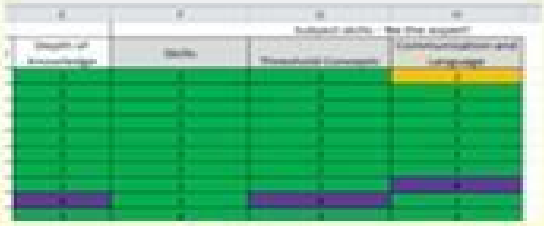
key processes

key concepts

key knowledge

POP Tasks Make Learning Stick

Impact



data

impact

scientific enquiry

conclusions

explanations

formative

big questions

sketching

extended pieces of writing

formative

retrieval quizzes

formative

end of unit POP Task

summative

implementation