Stonehouse Park Federation

Science Curriculum

Essential Knowledge

National Curriculum: Purpose of Study

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, and all pupils should be taught essential aspects of the knowledge, methods, processes and uses of science. Through building up a body of key foundational knowledge and concepts, pupils should be encouraged to recognise the power of rational explanation and develop a sense of excitement and curiosity about natural phenomena. They should be encouraged to understand how science can be used to explain what is occurring, predict how things will behave, and analyse causes.

National Curriculum Aims

The national curriculum for science aims to ensure that 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

Scientific knowledge and conceptual understanding

The programmes of study describe a sequence of knowledge and concepts. While it is important that pupils make progress, it is also vitally important that they develop secure understanding of each key block of knowledge and concepts in order to progress to the next stage. Insecure, superficial understanding will not allow genuine progression: pupils may struggle at key points of transition (such as between primary and secondary school), build up serious misconceptions, and/or have significant difficulties in understanding higher-order content.

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Pupils should be able to describe associated processes and key characteristics in common language, but they should also be familiar with, and use, technical terminology accurately and precisely. They should build up an extended specialist vocabulary. They should also apply their mathematical knowledge to their understanding of science, including collecting, presenting and analysing data. The social and economic implications of science are important but, generally, they are taught most appropriately within the wider school curriculum: teachers will wish to use different contexts to maximise their pupils' engagement with and motivation to study science.

The nature, processes and methods of science

'Working scientifically' specifies the understanding of the nature, processes and methods of science for each year group. It should not be taught as a separate strand. The notes and guidance give examples of how 'working scientifically' might be embedded within the content of biology, chemistry and physics, focusing on the key features of scientific enquiry, so that pupils learn to use a variety of approaches to answer relevant scientific questions. These types of scientific enquiry should include: observing over time; pattern seeking; identifying, classifying and grouping; comparative and fair testing (controlled investigations); and researching using secondary sources. Pupils should seek answers to questions through collecting, analysing and presenting data. 'Working scientifically' will be developed further at key stages 3 and 4, once pupils have built up sufficient understanding of science to engage meaningfully in more sophisticated discussion of experimental design and control.

Spoken language

The national curriculum for science reflects the importance of spoken language in pupils' development across the whole curriculum – cognitively, socially and linguistically. The quality and variety of language that pupils hear and speak are key factors in developing their scientific vocabulary and articulating scientific concepts clearly and precisely. They must be assisted in making their thinking clear, both to themselves and others, and teachers should ensure that pupils build secure foundations by using discussion to probe and remedy their misconceptions.

National Curriculum

Key stage 1

The principal focus of science teaching in key stage 1 is to enable pupils to experience and observe phenomena, looking more closely at the natural and humanly constructed world around them. They should be encouraged to be curious and ask questions about what they notice. They should be helped to develop their understanding of scientific ideas by using different types of scientific enquiry to answer their own questions, including observing changes over a period of time, noticing patterns, grouping and classifying things, carrying out simple comparative tests, and finding things out using secondary sources of information. They should begin to use simple scientific language to talk about what they have found out and communicate their ideas to a range of audiences in a variety of ways. Most of the learning about science should be done through the use of first-hand practical experiences, but there should also be some use of appropriate secondary sources, such as books, photographs and videos.

'Working scientifically' is described separately in the programme of study, but must always be taught through and clearly related to the teaching of substantive science content in the programme of study. Throughout the notes and guidance, examples show how scientific methods and skills might be linked to specific elements of the content.

Pupils should read and spell scientific vocabulary at a level consistent with their increasing word-reading and spelling knowledge at key stage 1.

Working scientifically

During years 1 and 2, pupils should be taught to use the following practical scientific methods, processes and skills through the teaching of the programme of study content:

- asking simple questions and recognising that they can be answered in different ways
- observing closely, using simple equipment
- performing simple tests
- identifying and classifying
- using their observations and ideas to suggest answers to questions
- gathering and recording data to help in answering questions

Lower key stage 2 programme of study

Working scientifically

During years 3 and 4, pupils should be taught to use the following practical scientific methods, processes and skills through the teaching of the programme of study content:

- asking relevant questions and using different types of scientific enquiries to answer them
- setting up simple practical enquiries, comparative and fair tests
- making systematic and careful observations and, where appropriate, taking accurate measurements using standard units, using a range of equipment, including thermometers and data loggers
- gathering, recording, classifying and presenting data in a variety of ways to help in answering questions
- recording findings using simple scientific language, drawings, labelled diagrams, keys, bar charts, and tables
- reporting on findings from enquiries, including oral and written explanations, displays or presentations of results and conclusions
- using results to draw simple conclusions, make predictions for new values, suggest improvements and raise further questions
- identifying differences, similarities or changes related to simple scientific ideas and processes
- using straightforward scientific evidence to answer questions or to support their findings.

Upper key stage 2 programme of study

Working scientifically

During years 5 and 6, pupils should be taught to use the following practical scientific methods, processes and skills through the teaching of the programme of study content:

- planning different types of scientific enquiries to answer questions, including recognising and controlling variables where necessary
- taking measurements, using a range of scientific equipment, with increasing accuracy and precision, taking repeat readings when appropriate
- recording data and results of increasing complexity using scientific diagrams and labels, classification keys, tables, scatter graphs, bar and line graphs
- using test results to make predictions to set up further comparative and fair tests
- reporting and presenting findings from enquiries, including conclusions, causal relationships and explanations of and a degree of trust in results, in oral and written forms such as displays and other presentations
- identifying scientific evidence that has been used to support or refute ideas or arguments

Working Scientifically						
	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6
Questions	**Ask questions and know some can be answered using scientific enquiry.**		**Identify scientific questions. ie can be investigated through scientific enquiry.**		**Raise scientific questions and hypothesise**	
Observe: Qualitative and Simple Quantitative	**Observe change over time.** Use Senses/equipment.	**Measure change over time e.g. plant growth.** Select equipment	**Systematic/ careful observations.** Use bar charts, pictograms, tables.	**Accurate measurements.** Use time graphs and other graphs.	**Accurate/ precise measurements,** Use diagrams, tables, bar and line graphs.	**Take repeat readings when appropriate.** Use Scatter graphs.
Classify and find patterns	**Identify and Classify**		**Classify and Find Patterns**		**Classify and Find Patterns**	
	E.g. familiar plants, animals, materials Compare and contrast	**E.g. living/ dead/ never alive; materials** Compare differences	**Classify animals/ materials.** Link two variables e.g. *the closer the magnet the bigger the force.*	**Use simple classification keys.** Link two variables e.g. *the more cells in a circuit, the brighter the bulb.*	**Use complex classification keys.** Identify causal relationships.	**Develop classification keys.** Identify evidence that supports/ refutes causal relationship.
Control investigations: comparative and fair testing	**Simple comparative tests**		**Comparative and fair tests**		**Design own comparative and fair tests**	
	E.g. *What is the best material for an umbrella?*	**E.g. *What if plants do not get light and water?***	**Predict. Fair tests e.g. *How does distance***	**Predict. Language of independent and control**	**Identify when and how to use tests.**	**E.g. *What is the best material***

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			affect magnet strength?	**variable.**	Recognise and control variables. **Make predictions based on previous test results.**	***for an umbrella?***
Research	Find information using specific given sources. e.g. *animals.*	**Select information from a range of given sources.**	**Research using given sources. e.g. *research different food groups and how they keep us healthy***	**Select information to support findings. e.g. *research animals***	**Explore relevant information by using a wide range of secondary sources.**	
					Explore how scientific ideas have developed over time.	**Identify evidence that has been used to support or refute ideas.**
Model	**Concrete / context** Draw diagrams e.g. *parts of plants/ the body.*	**Explore and create** Drawings and physical models e.g. *habitats.*	**Abstract contexts e.g. processes and phenomena such as forces/ light.** Use labelled diagrams and drawings and physical models.	**Abstract contexts e.g. processes and phenomena such as sound/ electricity.** Create labelled diagrams and drawings and physical models.	**Abstract contexts.** Evaluate diagrams/ models e.g. states of matter; solar system.	**Abstract contexts.** Create own versions of models. e.g. circulatory system; light.
Conclude	**Describe what has happened or been observed.**	**Explain why a simple observation occurred.** Evaluate the effectiveness of observations.	**Explain an observation or an event in scientific terms.** Distinguish between what has been observed and why it happened. **Begin to link evidence from secondary sources as well as primary.** Suggest improvements.		**Evaluate original hypothesis against observed** Evidence and reach appropriate conclusions. **Identify causal relationships. Begin to identify how reliable the data is.**	
Biology						
	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6
Living things and their 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		**Recognise that living things can be grouped in a variety of ways Explore and use (pre made) classification keys to help group, identify and name a variety of living**	**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.	**Describe how living things are classified into broad groups according to common observable characteristics and based on similarities and differences, including**

		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 microhabitats.** Describe how animals obtain their food from plants and other animals, using the idea of a simple food chain (3-4 stage with producer first and carnivore at the end), and identify and name different sources of food		**things in their local and wider environment** Recognise that environments can change (through flooding, fire earthquakes or through human action) and that this can sometimes pose dangers to living things **<u>Maths links</u>** Statistics interpret and present data using bar charts, pictograms and tables (year 3 retrieval) interpret and present discrete and continuous data using appropriate graphical methods, including bar charts and time graphs. □ solve comparison, sum and difference problems using information presented in bar charts, pictograms, tables and other graphs (year 4 recap)		**microorganisms, plants and animals give reasons for classifying plants and animals based on specific characteristics.**
Animals including plants	**Identify and name a variety of common animals including**	**Notice that animals, including humans,**	**Identify that animals, including humans, need the**	**Describe the simple functions of the basic parts of the digestive**	**Describe the changes as humans develop**	**Identify and name the main parts of the human circulatory**

Evolution & Inheritance (Y6 only)	**fish, amphibians, reptiles, birds and mammals.** 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 (fish, amphibians, reptiles, birds and mammals, including pets).** Identify, name, draw and label the basic parts of the human body and say which part of the body is associated with each sense.	**have offspring which grow into adults.** Find out about and describe the basic needs of animals, including humans, for survival (water, food, shelter and air). **Describe the importance for humans of exercise, eating the right amounts of different types of food, and hygiene (PSHE LINK).**	**right types and amount of nutrition, and that they cannot make their own food; they get nutrition from what they eat** Identify that humans and some other animals have skeletons and muscles for support, protection and movement. **Maths links** **Statistics** interpret and construct simple pictograms, tally charts, block diagrams and simple tables (year 2 retrieval) interpret and present data using bar charts, pictograms and tables solve one-step and two-step questions [for example, 'How many more?' and 'How many fewer?'] using information	**system in humans (teeth/tongue/stomach/small intestine/large intestine/anus)** Identify the different types of teeth in humans and their simple functions(incisor/canine/pre-molar/molar) construct and interpret a variety of food chains, identifying producers, predators and prey. **Maths links** **Statistics** interpret and present data using bar charts, pictograms and tables solve one-step and two-step questions [for example, 'How many more?' and 'How many fewer?'] using information presented in scaled bar charts and pictograms and tables. (year 3 retrieve)	**to old age.** **Maths links** **Statistics** solve comparison, sum and difference problems using information presented in a line graph complete, read and interpret information in tables, including timetables. (Year 5 reinforce)	**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 the ways in which nutrients and water are transported within animals, including humans.** **Maths link** **Place value** read, write, order and compare numbers up to 10 000 000 and determine the value of each digit

			presented in scaled bar charts and pictograms and tables. (year 3 recap)			round any whole number to a required degree of accuracy (year 6 recap)
	Identify and name a variety of common wild and garden plants, including deciduous (trees that have leaves that drop off seasonally) and evergreen trees. Identify and describe the basic structure of a variety of common flowering plants (root, stem leaves petals), including trees.	**Observe and describe how seeds and bulbs grow into mature plants through germination.** Find out and describe how plants need water, light and a suitable temperature to grow and stay healthy.	**Identify and describe the functions of different parts of flowering plants: roots, stem/trunk, leaves and flowers** Explore the requirements of plants for life and growth (air, light, water, nutrients from soil, and room to grow) and how they vary from plant to plant **Investigate the way in which water is transported within plants** **Explore the part that flowers play in the life cycle of flowering plants, including pollination, seed formation and seed dispersal (wind/water animal/bird**			

			transportation/bursting).			
						Recognise that living things have changed over time and that fossils provide information about living things that inhabited the Earth millions of years ago Recognise that living things produce offspring of the same kind, but normally offspring vary and are not identical to their parents **Identify how animals and plants are adapted to suit their environment in different ways and that adaptation may lead to evolution.**
Physics						
Materials	**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**	**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		**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	**Compare and group together everyday materials on the basis of their properties, including their hardness, solubility (how easy it is for a material to dissolve into a liquid), transparency (how well light can pass through an object), conductivity**	

	everyday materials (hard/soft/bendy/ see-through…) compare and group together a variety of everyday materials on the basis of their simple physical properties.	be changed by squashing, bending, twisting and stretching.		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.**	**(how well electricity/heat can flow through an object) (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 (the more soluble the material, the easier it will dissolve into a solution) **Use knowledge of solids, liquids and gases to decide how mixtures might be separated, including through filtering (smaller particles, e.g sand that are partially soluble should be filtered from a solution), sieving (non-soluble particles that are large can be sieved from a solution) and evaporating (if a soluble solid has been dissolved into a solution, the liquid will need to be evaporated)**	

					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.** **<u>MATHS LINK</u>** **Statistics** interpret and present discrete and continuous data using appropriate graphical methods,	

					including bar charts and time graphs. Solve comparison, sum and difference problems using information presented in bar charts, pictograms, tables and other graphs. (Year 4 recap) solve comparison, sum and difference problems using information presented in a line graph complete, read and interpret information in tables, including timetables. (Year 5 recap)	
Rocks			**Compare and group together different kinds of rocks(metamorphic/**			

			sedimentary/igneous) 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.**			
Light			**Recognise that they need light in order to see things and that dark is the absence of light** **Notice that light is reflected from surfaces (<u>The shinier the surface, the clearer the reflection</u>)** Recognise that light from the sun can be dangerous and that there are ways to protect their eyes (<u>sunlight (U.V rays) can burn organic material</u>) **Recognise that shadows are formed when the light from a light source is blocked by an opaque object**			**Recognise 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** 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 **Use the idea that light travels in straight lines to explain why shadows have the same shape as the**

			(opaque = not see through) Find patterns in the way that the size of shadows change. (The closer an object is to a source the larger the shadow) Maths Link **Measure** choose and use appropriate standard units to estimate and measure length/height in any direction (m/cm) (year 2 recap)			**objects that cast them.** **Maths links** **Geometry** Know angles are measured in degrees: estimate and compare acute, obtuse and reflex angles draw given angles, and measure them in degrees (o) Identify angles at a point and one whole turn (total 360o) Angles at a point on a straight line and 2 1 a turn (total 180o) other multiples of 90o (Year 5 recap) identify, describe and represent the position of a shape following a reflection or translation, using the appropriate language, and know that the shape has not changed. (Year 5 recap)
Electricity				**Identify common appliances that run on electricity**		**Associate the brightness of a lamp or the volume of a buzzer with the**

				Construct a simple series electrical circuit, Identify and name its basic parts, including cells, wires, bulbs, switches and buzzers **Identify whether or not a lamp will light in a simple series circuit, based on whether or not the lamp is part of a complete loop with a battery <u>(A circuit needs to be 'complete' for a component to work)</u>** Recognise that a switch opens and closes a circuit and associate this with whether or not a lamp lights in a simple series circuit <u>(If a switch is closed the circuit is complete, if it is open it is not)</u> **Recognise some common conductors and insulators, and associate metals with being good conductors. (conductors)**		**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 **Use recognised symbols when representing a simple circuit in a diagram.**

Sound				**Identify how sounds are made, associating some of them with something vibrating** Recognise that vibrations from sounds travel through a medium (air/solid object) to the ear **Find patterns between the pitch of a sound and features of the object that produced it** Find patterns between the volume of a sound and the strength of the vibrations that produced it **Recognise that sounds get fainter as the distance from the sound source increases.** **<u>Maths link</u>** **Measurement** measure, compare, add and subtract: lengths (m/cm/mm) (Year 4 recap)		
Earth & Space					**Describe the movement of the Earth (one lesson),**	

					and other planets (one lesson to compare), relative to the Sun in the solar system Describe the movement of the Moon (rotation and orbit) relative to the Earth **Describe the Sun, Earth and Moon as approximately spherical bodies** Use the idea of the Earth's rotation to explain day and night and the apparent movement of the sun across the sky. **<u>Maths links</u>** **Geometry** identify and describe the properties of 3-D shapes, including the number of edges, vertices and faces (year 2 recap) interpret and present discrete and continuous data using appropriate graphical methods, including bar charts	

					and time graphs.(year 4 recap) read, write, order and compare numbers to at least 1 000 000 and determine the value of each digit (year 5 reinforce)	
Forces and 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,**		**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.** **<u>Maths links</u>** **Angles** identify acute and obtuse angles and compare and order angles up to two	

			depending on which poles are facing. **<u>Maths links</u>** **Measurement** choose and use appropriate standard units to estimate and measure length/height in any direction (m/cm); (retrieval year 2) **<u>Statistics</u>** interpret and construct simple pictograms, tally charts, block diagrams and simple tables (year 2 retrieval)		right angles by size (retrieve year 4)	