Working Scientifically

There are seven science skills we expect children to develop throughout their time at Dunham-on-Trent C of E Primary School. As teachers, we refer to these as working scientifically skills. The skills are as follows: -

- Asking question – asking questions that can be answered using a scientific enquiry.
- Making predictions – *using prior knowledge to suggest what will happen in the enquiry.*
- Setting up tests – *deciding on the method and equipment to use to carry out an enquiry.*
- Observing and measuring – *using senses and measuring equipment to make observations about the enquiry.*
- Recording data – *using tables, drawings and other means to note observations and measurements.*
- Interpreting and communicating results – u*sing information from the data to say what you found out.*
- Evaluating – *reflecting on the success of the enquiry approach and identifying further questions for enquiry.*

Enquiry approaches – over the course of the academic year, pupils should carry out several investigations which allow children to build upon their working scientifically skills (see above). The different types of enquiries that should be incorporated into Science lessons are as follows: -

- Research – *using secondary resources of information to answer scientific questions.*
- Comparative/fair testing – *changing one variable to see its effect on another, whilst keeping all others the same.*
- Pattern seeking – *identifying patterns and looking for relationships in enquiries where variables are difficult to control.*
- Observation over time – *observing changes that occur over a period of time ranging from minutes to months.*
- Identifying, grouping and classifying – *making observations to name, sort and organise items.*
- Problem solving – *applying scientific knowledge to find answers to problems.*

This document highlights the different enquiry approaches that can be explored in each programme of study. They are identified using the symbols shown in the grid. There is no expectation that all approaches highlighted are covered for each unit of work, however there needs to be at least one investigation per unit and planning over the year needs to show a variety of approaches have been covered. The problem solving approach should be incorporated into all other approaches and is not a stand-alone approach. Suggested specific investigation questions relating to each approach and each year group can be found on a separate document. These are only a guide and teachers can devise own questions to investigate or follow the children's interests.

NB: Only KS2 focus on fair testing however EYFS/KS1 do need to look at comparative testing.

Research	
Pattern Seeking	
Observation over time	
Comparative/Fair testing	
Identifying, grouping and classifying	
Problem solving	

Scientists across the curriculum

Research has shown that, while learning science can be interesting and enjoyable, many children find that what they learn at school is abstract and they cannot see how it relates to their own lives. Consequently, they see science as something that is not for them. Studies have shown that these perceptions can start early in a child's primary school career. Children who think or feel this way have low science capital. One way of increasing children's science capital is for them to learn about scientists that they can identify with.

The suggested scientist section is intended to help the school and teachers include scientists in the curriculum who:
- are relevant to the topics
- illustrate how scientific knowledge has developed over time
- children can identify with and whose work they can relate to.

The scientists meet three different criteria:
* historical figures who illustrate the development of scientific knowledge over time
* scientists from under-represented groups
*modern scientists whose work is relevant to children and who reflect their world and backgrounds.

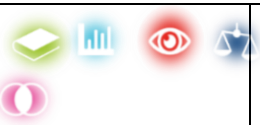
To help identify which criteria each scientist was included for, they have been colour-coded, as shown below.

Type	Colour code
Historical figures	
Under represented groups	
Modern scientists	

Chemistry						
	EYFS	**Year 1** Everyday Matters	**Year 2** Uses of Everyday Matters	**Year 3** Rocks	**Year 4** State of Matters	**Year 5** Properties and Changes of Materials
Substantive Knowledge (To know…)	• Objects are things that you can touch or see. • Objects are made from different materials. • Materials feel and look different to one another. • Some differences between materials such as wood and fabric.	• Objects are things that you can touch or see. • Objects are made from different materials • Objects feel and look different based on the material they are made from. • Some materials that objects are made from are: glass, wood, paper, metal, water, rock and plastic. • Some words to describe materials (properties)	• Materials can be changed by physical force. • Suitability means having the properties which are right for a specific purpose, e.g. metal, wood and plastic are all suitable materials for spoons.	• Igneous rock is rock that has been formed from magma or lava. • Sedimentary rock is rock that has been formed by layers of sediment being pressed down hard and sticking together, you can see the layers of sediment in the rock. • Metamorphic rock is rock that started out as igneous or sedimentary rock but changed due to being exposed to extreme heat or pressure. • Fossils are layers of rock covering • A fossil is formed when an animal/plant dies and it gets covered in a variety of substances. • The soft part of the creature/plant rots away and the skeleton remains. • Over time layers of sediment cover the remains,	• Solids, liquids and gases are described by observable properties. • Particles in a solid are close together and cannot move and they can only vibrate. • Particles in a liquid are close together but can move around each other easily. • Particles in a gas are spread out and can move around very quickly in all directions. • Heating causes solids to melt into liquids and liquids evaporate into gases. • Cooling causes gases to condense into liquids and liquids to freeze into solids. • When water and other liquids reach a certain temperature, they change state into a solid or a gas.	• Different materials are used for particular jobs based on their properties: electrical conductivity, flexibility, hardness, insulators, magnetism, solubility, thermal conductivity and transparency • A solution is made when solid particles are mixed with liquid particles. • Materials that dissolve are known as soluble. • Materials that won't dissolve are known as insoluble. • A suspension is when the particles don't dissolve. • Reversible changes, such as mixing and dissolving solids and liquids together, can be reversed by sieving, filtering and evaporating. • Sieving means smaller materials are able to fall through the holes in the sieve, separating them from larger particles. • Filtering is when the solid particles get caught in the filter

				• Fossils are only found in sedimentary rocks. • Water seeps into the rock and dissolves the bone, then minerals from the water deposit into the mould. • Changes in sea level take place over a long period of time. • When erosion and weathering take place eventually a fossil becomes exposed. • Soil is the upmost layer of the Earth. • Soil is a mixture of different things, minerals, air, water and organic matter.	• The temperatures that changes happen at are called the boiling, melting or freezing point. • Condensation and evaporation occur within the water cycle. • Water from lakes, puddles, rivers and seas is evaporated by the sun's heat, turning it into water vapour. • Water vapour rises, then cools down to form water droplets in clouds (condensation). • When the droplets get too heavy,they fall back to the earth as rain, sleet, hail or snow (precipitation).	paper but the liquid gets through • Evaporating is when the liquid changes into a gas, leaving the solid particles behind. • Some changes can be reversed, and some cannot. • Irreversible changes often result in a new product being made from the old materials (reactants). *E.g. burning wood produces ash. Mixing vinegar and milk produces casein plastic.*
Key Vocabulary	Object, materials, *Names of different materials and their properties*	Properties. *Names of different materials and adjectives for properties*	Absorbent, transparent, opaque, reflective, translucent, flexible, rigid, bending, squashing, twisting, stretching.	Fossils, bone, soils, layers, sandstone, slate, grain, granite, marble, chalk, pumice, minerals, crystals, texture.	Solid, Liquid, Gas, evaporation, condensation, particles, temperature, freezing, heating, cooling, state change, melting, boiling, water cycle, vapour.	Hardness, solubility, transparency, conductivity, magnetic, filter, product, dissolving, mixing, thermal, insulator, conductor, mixture, dissolve, solution, soluble, insoluble, reversible, irreversible change.
Links to Progression of Knowledge map	Explore the natural world around them. Describe what they see, hear and feel whilst outside	To describe the simple physical properties of a variety of everyday materials.	To find out how the shapes of solid objects made from some materials can be changed by	To compare and group together different kinds of rocks on the basis of their	To compare and group materials together, according to whether they are solids, liquids	To know that some materials will dissolve in liquid to form a solution, and describe how to recover a substance

	ELG Understand some important processes and changes in the natural world around them, including the seasons and **changing states of matter.**	To compare and group together a variety of everyday materials on the basis of their simple physical properties. distinguish between an object and the material from which it is made; To identify and name a variety of everyday materials, including wood, plastic, glass, metal, water, and rock.	squashing, bending, twisting and stretching. To identify and compare the suitability of a variety of everyday materials, including wood, metal, plastic, glass, brick, rock, paper and cardboard for particular uses;	appearance and simple physical properties. To describe in simple terms how fossils are formed when things that have lived are trapped within rock. To recognise that soils are made from rocks and organic matter.	or gases. To 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). To identify the part played by evaporation and condensation in the water cycle and associate the rate of evaporation with temperature.	from a solution. To use knowledge of solids, liquids and gases to decide how mixtures might be separated, including through filtering, sieving and evaporating. To demonstrate that dissolving, mixing and changes of state are reversible changes. To 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. To compare and group together everyday materials on the basis of their properties, including their hardness, solubility, transparency, conductivity (electrical and thermal), and response to magnets. To give reasons, based on evidence from comparative and fair tests, for the particular uses of everyday materials, including metals, wood and plastic.

Suggested working scientifically enquiries						
Suggested Scientists		Chester Greenwood Becky Shroeder	John Dunlop Charles Macintosh John McAdam Victoria Callaghan Dr Pearl Agyakwa	William Smith James Hutton Florence Bascom Anjana Khatwa Brianna Green	Joseph Priestley Carl Wilhelm Scheele Daniel Fahrenheit Anders Celsius John Boyd Dunlop	Spencer Silver & Arthur Fry Ruth Benerito