Chemistry

Strand: Materials

Working Scientifically Drives All of the Knowledge & Understanding

Year 1			
NC Objectives	**Key Scientific Knowledge**	**Key Vocabulary**	**Working Scientifically**
To distinguish between an object and the material from which it is made	To be able to name an object and then state the material it is made of/ from e.g. cup= plastic, bottle= glass	Material, object, 'made of/ from'	Teacher **asks questions**: What are these objects made of? What different materials are there? Teacher asks more complex question: How do you KNOW that the cup is made from plastic? Chn to explain their knowledge based on physical properties/ 'evidence' e.g. 'I know it's plastic, cause it feels like it/ looks like it,'
To identify and name a variety of everyday materials, including wood, plastic, glass, metal, water, and rock	To name and identify wood, plastic glass, metal, water, rock e.g. in everyday surroundings/ from given objects	Material, wood, plastic glass, metal, water	Ask simple questions: What different materials are there? How can we sort these materials? Support **chn in asking questions** of each other when **identifying & classify materials**. **Make explicit that they are being scientists by naming, observing and sorting ('we call this 'classifying' based on features).** Chn sort materials into groups (extend to include brick/ stone/ chalk/ paper/ fabric/ foil/ coin/ elastic/ rubber).
To describe the simple physical properties of a variety of everyday materials	To name the physical properties of materials e.g. hard/soft; stretchy/stiff; shiny/dull; rough/smooth; bendy/not bendy; waterproof/not waterproof;	Describe, 'How is this material different from that one?'	**Observations/ simple test:** can I bend this material? **Support chn in raising simple questions e.g. 'If I …' (what could I 'do' to this object?)**

	absorbent/not absorbent; opaque/transparent	hard/soft; stretchy/stiff; shiny/dull; rough/smooth; bendy/not bendy; waterproof/not waterproof; absorbent/not absorbent; opaque/transparent; soak in/	If I pour water on this material, what happens? Where does the water go? What happens to the material if I …. (pull/ twist/ rub/bend)…?' **Predictions:** which material do you think might be bendy/ waterproof ? How did you decide this?
To compare and group together a variety of everyday materials on the basis of their simple physical properties.	To be able to identify the physical property of materials and group them with others.	As above, group, sort	**Teacher asks** how we could group everyday objects based on their properties. **Chn perform simple tests:** what is the best material for building a house/ making a waterproof coat? To be able to relate the properties to the job it performs. **Chn identify & classify**: e.g. Put the writing objects in one group (e.g. pens/ pencils/ felt tips/ crayons- all made from different materials. Why have I put these in one group? How else could I sort this group e.g. by material/ colour (some may go on to identify man-made vs natural). Which other objects could go in the 'bendy' / 'bendy and hard' group. **Gather and record data:** chn create tally/ similar to record which materials sort into which groups following exploration/ testing. **Chn present findings verbally to share conclusions** e.g. 'We put these 5 objects in the metal group because they were all shiny/ hard/ cold to the touch.'

Year 2			
<u>Uses of Everyday Materials:</u> 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	*To be be able to identify a range of everyday materials (Yr 1 revision).* To be able to compare the suitability of materials for particular uses e.g. a rock/ brick is suitable for building a house because it is strong and waterproof. To be able to explain that some materials are used for many different things because of their properties e.g. metal (strong, waterproof, not bendy)- coin, car, can, plane. To be able to identify that some items can be made from different materials e.g. bottle = glass, metal, plastic; spoon= metal, plastic, wood, (recyclable/ compostable materials) but generally not glass (too easily breakable) To consider recycling of materials and its importance.	Compare, name, use, wood, metal, plastic, glass, brick, rock, paper and cardboard, Every-day, creative Recycle, recycling, environment, reuse	Support chn in **raising questions** about the world around them/ materials used and why. **Explore & compare** the uses of everyday materials found in school, with materials found in other locations e.g. journey to school/ at home/ in stories/ rhyme e.g. Three Little Pigs' houses; Hansel & Gretel witch's house. Consider creative/ unusual uses for everyday materials e.g. How else could you use glass/ wood/ plastic? (And to consider disadvantages of using these). **Research**: to find out about people who have developed useful new materials e.g. John Dunlop, Charles Macintosh or John McAdam **Perform simple tests:** Test 5 different materials for the following: waterproofing, absorbency, elasticity and insulation.
To find out how the shapes of solid objects made from some materials can be changed by squashing, bending, twisting and stretching.	To be able to describe that some materials keep their shape, some change their shape briefly and some materials are changed in shape through the application of force (this leads on to the children's understanding of what solid are/ properties of shapes/ Yr 4)	Shape, bend, twist, squash, stretch, solid, change	**Observation & testing**; what happens when we squash/ bend/ twist/ stretch this material? **Predicting** which material will behave in a particular way **Gather and record data**

			Using observations to suggest answers to questions ; write a simple conclusion
Year 3			
<u>Rocks:</u> To compare and group together different kinds of rocks on the basis of their appearance and simple physical properties	*Revise Yr 1/2 vocabulary and content.* To describe the physical appearance of different rocks e.g. colour; texture (visible); features; crystal, fossil, grains To identify the physical properties of different rocks (e.g. flaky, strong, can't scratch it; sandy/ grainy). NB: Chn do not need to be able to name different rock types e.g. sedimentary/ igneous/ metamorphic, but this could be useful in discussion/ developing further understanding e.g. in relation to fossils	Colour, texture, grain, fossil, crystal, scratch, flake, sandy, absorb, water, permeable, impermeable, property, physical	Compare the appearance and physical properties of different rocks **Perform tests** and explore the properties of rocks e.g. absorbs water/ permeable, What happens when we rub these rocks together? **Support chn in raising questions:** Does the structure of the rock affect its ability to take in water? E.g. Are all hard (not flaky/ can't scratch) rocks impermeable?/ Pattern seeking: Is there a link between rock structure and water absorbency? **Gather and record data** e.g. table **Present findings in different ways e.g. oral presentation; writing a simple conclusion**
To describe in simple terms how fossils are formed when things that have lived are trapped within rock	To be able to describe how fossils are formed in sedimentary rock: millions of years ago, organism dies; covered in layers of sediment soon after death; over millions of yrs, sediment is compressed making new layers of rock; fossil is discovered	Fossil, organism, sedimentary, sediment, compressed	**Teacher asks question:** what are fossils? How are they formed? How could we find out about them? (**Chn should be supported in understanding that there are different ways we can answer questions in Science. Research is one way we use** e.g. using secondary sources) **First draw** flow **diagrams** to show process using key terminology; then write an **explanation of how fossils are formed using diagrams/**

			captions (in English lesson with stem sentences & key vocabulary)
To recognise that soils are made from rocks and organic matter.	To explain in simple terms how soil is formed. To understand that soil is formed (over a long period of time) when rocks weather due to rock disintegration/ erosion through rain, forming smaller and smaller pieces and then grains; organic matter decays and forms part of soil, along with air and water.	Soil, organic matter, weathering, decay, erosion, wearing away	Can chn answer questions: What is soil? Where does it come from? What is in soil? What different soils are there? Create/ view **diagrams** of the make-up of soil.
Year 4			
To compare and group materials together, according to whether they are solids, liquids or gases	*Revise Yr 1,2,3 content & vocab.* *What materials can we name? What properties do they have? How are fossils formed?* To understand what a solid, liquid, gas is. To identify common examples of solids e.g. table, pen, cup; liquids: water, urine, petrol, coke; gas: air, helium, carbon dioxide, oxygen To be able to describe simple properties of states of matter e.g. solids hold their shape (link back to Yr 2) liquids pour and form a pool not pile, gases escape from unsealed containers	Solid, liquid, gas, states of matter, carbon dioxide, oxygen, air, helium, property, particle, pour, escape	**Compare and group** materials based on their state of matter. Answer questions: do all materials fit neatly into three states of matter? Some chn know about non-newtonian fluids; is toothpaste a solid or liquid? Can you pour sand/ rice? Does that make it a liquid? What state of matter is lava? What happens when it is cooled? **Chn group materials** based on s/l/g. This raises further questions about more tricky materials (e.g. non Newtonian fluids). **Chn create particle arrangement drawings** **Use straight forward scientific evidence to answer questions;** using what you know about

	To understand in simple terms/ diagrams the particle arrangement of solids, liquids and gases.		the particle arrangement of gases, why can I smell a gas quickly e.g. petrol, when I'm not standing near it? Because gas molecules have lots of energy and try 'to escape' and move freely and quickly.
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 describe what happens to some materials e.g. wax candle, chocolate, water, jelly cubes, when heated / cooled. To understand that 'boiling' is the rapid evaporation of liquid to gas/ vapour To be able to describe this change as a change of state. To be able to use a thermometer to measure temperature accurately. To be able to explain that melting (heating) and freezing (cooling) are opposing process; to be able to explain that evaporation (heating) and condensation (cooling) are opposing processes To understand that the gas produced following evaporation is called vapour.	Boiling point, temperature, change of state, degrees Celsius, thermometer, solid, liquid, boil, vapour, evaporation, condensation, condense,	**Skill: accurate & precise reading of thermometers using a range of scales (chn must observe therm'r at eye level).** Teacher asks question: if we want to know when a liquid boils, what equipment might help? **Make systematic & careful observations; measure on thermometers** liquids evaporating and then beginning to boil. **Observe** liquids returning to solid form e.g. candle wax **Gather and record data** relating to testing changes of state **Use thermometers** for measuring temperatures of boiling/ beginning to evaporate/ first bubble. **Support chn in raising questions:** Show pics/ have discussions about their experiences of changes of state / look at data ie what temperature e.g. water evaporates, jelly sets, chocolate hardens back to solid. What questions does this raise? *'Do all solids freeze at the same*

			temp? Why? Why not?' 'Which liquids evaporate at lower temperatures than water? Why?' **Support chn in raising further questions:** do all liquids have the same boiling point? What affects the boiling point of a liquid? Is a higher/ lower boiling point useful? Do all liquids freeze at the same temperature?
To identify the part played by evaporation and condensation in the water cycle and associate the rate of evaporation with temperature.	To be able to explain the processes of evaporation and condensation, applying knowledge about changing states. To describe and explain the water cycle. To understand that an increase in temperature can speed up evaporation rate	Process, evaporation, evaporate, condensation, condense, water cycle, rate, speed, temperature, state, heat, cool, variable	What factors affect the rate of evaporation? Teacher asks how they might find out the answer (**supporting them in understanding the range of ways scientists answer questions e.g. testing).** **Chn plan/ design** experiments to test evaporation rates **based on one variable**. **Gather and record data** e.g. weight of wet fabric over time in different locations, in a table, then transferred to graph (e.g. water weight loss over time) **Write conclusions** relating to evaporation rate experiments offering explanations / suggestions for findings.
Year 5			
To compare and group together everyday materials on the basis	*Revise Yr 4 knowledge and vocabulary: Give examples of solids/ liquids/ gases; how are particles arranged in solids/ liquids/ gases? What is evaporation/ condensation?* To be able to group materials together based on their properties e.g. solubility/	Soluble, insoluble, dissolve, Conductor, conductivity, insulator, electrical, thermal,	**Gather and record data:** collect data in table following testing of solubility/ hardness or based on their own previous knowledge. Can chn

of their properties, including their hardness, solubility, transparency, conductivity (electrical and thermal), and response to magnets	hardness/ conductivity (revision of Yr 3 magnets/ Yr 4 electricity; Yr 2 testing materials).	temperature, heat, energy, magnet, magnetic	provide evidence of a material's thermal conductivity? How do you know if a material is transparent/ soluble/ magnetic? Separate sand/ iron filings **Classification**- create groups of materials based on their properties.
To know that some materials will dissolve in liquid to form a solution, and describe how to recover a substance from a solution	To explain what dissolving is (solid loses its solid form/ state and becomes part of the liquid) and give examples of items that will dissolve e.g. salt / sugar in water To understand that dissolving can look like disappearing but that the solid has made a solution with the liquid (the substance e.g. salt, is still there but in another state) To be able to explain the difference between melting and dissolving (chocolate melts due to heating- it's still chocolate; sugar loses its solid form/ state and mixes with liquid/ water to create a *new* sugary solution) To be able to explain that dissolving is reversible and the original substance e.g. solid, can be recovered through evaporation of the liquid	Dissolve, solution, mix, reversible, evaporation, liquid, solid Melt, heat, difference,	**Predicting & testing**: which materials will dissolve in water? **Gather and record** in table. **Research:** Which other materials will dissolve in water? Answering questions: **write conclusions** to 'Which materials will dissolve in water?' and suggest other materials they might like to test/ find out more about. **Written explanations about the difference between melting and dissolving (English) using key scientific language** Answer questions: What is dissolving? Which material is melting and which is dissolving? (**Test and observe or research**).

To use knowledge of solids, liquids and gases to decide how mixtures might be separated, including through filtering, sieving and evaporating	To be able to explain how mixtures (solid + liquid) can be separated e.g. by filtering/ sieving (applying understanding of the physical properties of the solids/ liquids e.g. solid is too big/ has fixed structure so will not fall through holes of sieve, whereas water will pour through holes in sieve/ filter paper). To be understand that evaporating the liquid will leave behind the solid from a solution e.g. salty water leaves salt behind	Mix, mixture, solution, dissolve, separate, sieve, filter, evaporate, solids, liquids, gases	**Observe** how mixtures can be separated by filtering/ sieving (e.g. how to clean dirty water) **Presenting findings**: write up description of how to separate mixtures; **use labelled diagrams** to show the equipment used/ method.
To give reasons, based on evidence from comparative and fair tests, for the particular uses of everyday materials, including metals, wood and plastic	To be able to link the material with its physical property to its use (with particular reference to metals/ electrical and thermal conductivity, plastic / electrical and thermal insulators)	Material, physical; property (e.g. hardness/ thermal insulator/ electrical conductor)	**Perform comparative test** to answer questions e.g. Which material is a better thermal insulator? How might this property be made useful to people? **Describe the physical properties** and uses of e.g. 6 materials: wood, plastic, metal, fabric, glass, leather. **Answer questions and present findings orally**: why is the outside of an electrical cable made of plastic? Why are electrical wires made of metal (link to Yr 4 electricity testing)
To demonstrate that dissolving, mixing and changes of state are reversible changes	To be able to describe and understand how to demonstrate dissolving, changes of state and mixing as reversible changes.	Reversible, irreversible, mixing, change state, dissolving	**Perform simple tests/ make observations**. How could you show that mixing/ dissolving/evaporating is reversible?
To explain that some changes result in the formation of new materials, and that this kind of	To understand that not all changes are reversible.	Reversible, irreversible, burning, rusting, reaction	**Classification / sorting**: Which changes are reversible/ irreversible?

change is not usually reversible, including changes associated with burning and the action of acid on bicarbonate of soda.	To understand that heating can lead to burning and metal exposure to water and air to rusting. To know that acid + bicarbonate of soda is an irreversible reaction (as evidenced in gas being created and escaping)		Which changes are useful? Fire/ burning, cooking bread, engine combustion, Demonstrate acid+ bicarb (volcano?); what **evidence** is there that new substances are being formed? (bubbles/ fizzing) We are witnessing a chemical reaction.