

Year Group:	5	Strand: 1	Comparing materials: which shall we use and why?
CHEMISTRY			
Key NC Reference and Objectives	<ul style="list-style-type: none"> 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 give reasons, based on evidence from comparative and fair tests, for the particular uses of everyday materials, including metals, wood and plastic 		
Enquiry Approaches and Skills in Science	<div style="display: flex; justify-content: space-around;"> <div style="width: 45%;"> <p style="text-align: center;">ENQUIRY APPROACHES</p> <ul style="list-style-type: none"> <li style="background-color: #2c5e8c; color: white; padding: 5px; margin-bottom: 5px;"> Comparative / fair testing Changing one variable to see its effect on another, whilst keeping all others the same. <li style="background-color: #76b82a; color: white; padding: 5px; margin-bottom: 5px;"> Research Using secondary sources of information to answer scientific questions. <li style="background-color: #e74c3c; color: white; padding: 5px; margin-bottom: 5px;"> Observation over time Observing changes that occur over a period of time ranging from minutes to months. <li style="background-color: #3498db; color: white; padding: 5px; margin-bottom: 5px;"> Pattern-seeking Identifying patterns and looking for relationships in enquiries where variables are difficult to control. <li style="background-color: #e91e63; color: white; padding: 5px; margin-bottom: 5px;"> Identifying, grouping and classifying Making observations to name, sort and organise items. <li style="background-color: #27ae60; color: white; padding: 5px;"> Problem-solving Applying prior scientific knowledge to find answers to problems. </div> <div style="width: 45%;"> <p style="text-align: center;">ENQUIRY SKILLS</p> <ul style="list-style-type: none"> <li style="border: 1px solid #ccc; padding: 5px; margin-bottom: 5px;"> Asking questions Asking questions that can be answered using a scientific enquiry. <li style="border: 1px solid #ccc; padding: 5px; margin-bottom: 5px;"> Making predictions Using prior knowledge to suggest what will happen in an enquiry. <li style="border: 1px solid #ccc; padding: 5px; margin-bottom: 5px;"> Setting up tests Deciding on the method and equipment to use to carry out an enquiry. <li style="border: 1px solid #ccc; padding: 5px; margin-bottom: 5px;"> Observing and measuring Using senses and measuring equipment to make observations about the enquiry. <li style="border: 1px solid #ccc; padding: 5px; margin-bottom: 5px;"> Recording data Using tables, drawings and other means to note observations and measurements. <li style="border: 1px solid #ccc; padding: 5px; margin-bottom: 5px;"> Interpreting and communicating results Using information from the data to say what you found out. <li style="border: 1px solid #ccc; padding: 5px;"> Evaluating Reflecting on the success of the enquiry approach and identifying further questions for enquiry. </div> </div>		
Key Investigation	<ul style="list-style-type: none"> Investigate which materials dissolve in water Enquiry Approach: Identifying, grouping and classifying Enquiry Skills: Setting up tests, Observing and measuring, Recording data, Interpreting and communicating results Guidance: Children work scientifically to investigate which materials dissolve in water, and how quickly this happens. Pupils should discuss independent, dependent and control variables in relation to their investigations. Children could be given the opportunity to choose which variables are changing – such as amount of water, temperature of water, amount of solid etc. Changing the temperature allows pupils to present their results as a graph. 		
Other suggestions for investigations and activities	<p>Investigate which material is best thermal insulator Enquiry Approach: Problem-solving Enquiry Skills: Asking questions, making predictions, setting up tests, observing and measuring, recording data, evaluating Guidance: This investigation can be set in a range of different problem-solving contexts: keeping a teacher’s mug warm, a lunchbox which keeps things cool etc. Pupils need to investigate the properties of different materials, taking account of the different variables, and then establish which the best thermal insulator is. Pupils could record the temperature of the cup/lunchbox at five minute intervals to look at the rate of temperature change. Data loggers can be used to monitor temperature, and graphs can be drawn to show continuous data.</p> <ul style="list-style-type: none"> Investigate electrical conductivity of different materials Enquiry Approach: Problem-solving Enquiry Skills: Asking questions, making predictions, setting up tests, observing and measuring, recording data, evaluating Guidance: Children can investigate which metal is the best electrical conductor, by adding samples of different metal to an electric circuit. These could include: copper coin, iron nail, steel spoon, silver jewellery, gold jewellery. This could be set as a problem, such as which material to make a wire from to make floodlights as bright as possible for a football game. 		

	<p>They can either observe the brightness of the bulb with each material, or measure the light levels using a data logging box with a light sensor. They should order the materials on the basis of their conductivity.</p> <p>Extension for Greater Depth: Children can be encouraged to plan an increasing amount of investigations, and should comment on variables in investigation evaluations.</p>	
Key scientists to learn about	N/A	
Previously Taught Vocabulary	property, suitability, natural, synthetic, flexible, translucent, magnetic, strength, hardness, object, material, hard, soft, rough, smooth, bendy, stretchy, waterproof, not waterproof, absorbent, not absorbent, transparent, opaque, matter, mass, particle, solid, liquid, gas, water cycle, melting, freezing, evaporation, condensation, precipitation, temperature	
New Key Vocabulary	<p>Permeable: a material is permeable if it allows liquids or gases to pass through it</p> <p>Impermeable: a material is impermeable if it does not allow liquids or gases to pass through it</p> <p>Electrical conductor: a material that allows electricity to pass through it</p> <p>Electrical insulator: a material that does not allow electricity to pass through it</p> <p>Mixture: two or more materials combined together without chemical change</p> <p>Compound: two or more materials joined together through a chemical reaction</p> <p>Dissolving: if something dissolves it is mixed into a liquid to become a solution</p> <p>Solution: a mixture where one substance is dissolved into another</p> <p>Soluble: able to be dissolved</p> <p>Insoluble: not able to be dissolved</p> <p>Thermal conductor: a material that allows transfer of heat</p> <p>Thermal insulator: a material that does not allow the transfer of heat</p>	Previously taught but now have more advanced definitions:
Core Substantive Knowledge	<p>Key learning in this unit needs to focus on embedding and building on the substantive ideas from Materials 2.1 and 4.1. Many new scientific ideas, such as the particle model and changing states will need to be explored further with reference to real-life materials. This should primarily be done through comparative investigations, and extend children’s knowledge of fair testing and variables.</p> <p>Although the word ‘material’ is often used to describe fabric or textiles, it is used scientifically to describe any substance. Materials can exist as solids, liquids and gases, or mixtures of these. Children need to be exposed to a wide range of these in order to understand that there are many examples of solids, liquids and gases; often children assume that the only liquid is water. See 4.1 Materials booklet for in-depth teacher knowledge on states of matter.</p> <p><u>Classifying Materials</u></p> <p>Natural materials e.g. wool, cotton, linen, leather, wood, cork, stone, gravel, sand, salt, coal, gypsum, talc, gold, silver, silk, oil, gemstones, beeswax</p> <p>Man-made materials are split into two groups</p> <p>Converted raw materials are derived from natural products but are refined or altered by man for use. e.g. pottery, china, earthenware, steel, aluminium, coke, charcoal, rubber, paints, some medicines and drugs, paper, viscose</p> <p>Synthetics are substances originally derived from the Earth, and then changed chemically into new products e.g. plastics, polyester, acrylic, PVC, nylon, polythene, glass, medicines and drugs</p> <p><u>Mixtures and compounds</u></p>	

Everyday objects are often made from combinations of substances.

A **mixture** forms when two or more materials are combined together but do not undergo a chemical change. Although the mixture may be very different from its constituent parts, the original materials do not chemically change and no new material is made. Mixtures can usually be separated using physical processes, although not always. Mixtures can take the form of solids, liquids or gases, or they can even be a combination of all three.

A **compound** forms when two or more elements join together in a chemical reaction. Water is a compound formed from the reaction between hydrogen gas and oxygen gas. Each molecule of water is made from two hydrogen atoms joined to one oxygen atom (H₂O). Other compounds, such as plastics or the proteins in our bodies, can be made up of long chains of hundreds of atoms. Many of the materials we encounter each day are compounds. Many compounds can be put into mixtures without reacting further. For example, salt and water are both compounds, and can be mixed together to form salt water, which is a mixture.

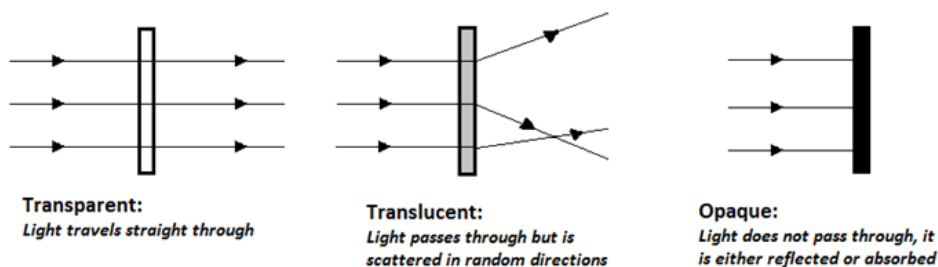
An element is the simplest form of a chemical substance, containing a single type of atom. Examples of elements include gold, copper, oxygen and hydrogen.

Properties of Materials

Hardness

At primary level, hardness is tested by how easily a material is to scratch or make an indentation in. Metals, ceramics and concrete are generally harder than plastics or wood. Materials that are not scientifically very hard can be described as soft. Moh's Hardness Scale is used to rank and describe the hardness of minerals such as gemstones.

Transparency is the capability of a material to let light through

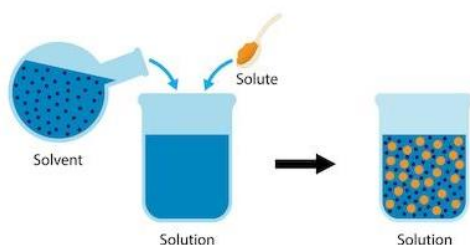


Response to magnets

Magnetic materials are always made of metal, but not all metals are magnetic. Iron, nickel and cobalt are metals which are magnetic, as are any alloys of these. Iron is magnetic, so any metal with iron in it will be attracted to a magnet. Steel contains iron, so a steel paperclip will be attracted to a magnet too.

Most other metals, for example aluminium, copper and gold, are NOT magnetic.

Solubility



Some substances dissolve when you mix them with water.

When a substance dissolves, it might look like it has disappeared, but in fact it has just mixed with the water to make a transparent liquid called a **solution**.

Substances that dissolve in water are called **soluble** substances. When you mix sugar with water, the sugar dissolves to make a transparent solution. Salt is soluble in water too.

Substances that do not dissolve in water are called **insoluble** substances. When you mix sand or flour with water, they do not dissolve.

Electrical Conductivity is how easily electricity can pass through a material.

Conductors Very good conductors of electricity have a low resistance to electrical current, so electricity can pass through. Many metals, such as copper, iron and steel, are good electrical conductors. That is why the parts of electrical objects that need to let electricity pass through are always made of metal.

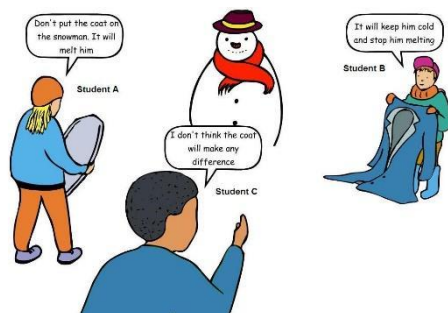
Resistance is a term that describes the forces that oppose the flow of electron current in a conductor. All materials naturally contain some resistance to the flow of electron current. We have not found a way to make conductors that do not have some resistance.

Insulators Some materials do not allow electricity to pass through them. These materials are known as electrical insulators. Plastic, wood, glass and rubber are good electrical insulators. That is why they are used to cover materials that carry electricity, such as wires.

Thermal Conductivity is a measure of how well a material can conduct heat. In general, good conductors of electricity (metals like copper, aluminium, gold, and silver) are also good heat conductors, whereas insulators of electricity (wood, plastic, and rubber) are poor heat conductors.

Thermal insulators are good for keeping heat out as well and in. Some examples of good insulators are - a thermos - keeps hot things hot and keeps cold things cold, a picnic cooler - keeps the heat out and keeps the inside cool, and a polystyrene cup keeps the heat in and keeps it hot.

Misconceptions



A common misconception related to thermal insulators and conductors, is that insulators will 'warm something up' rather than keep it cold. Exploring this through investigations or concept cartoons such as 'The Snowman's Coat' can provide opportunities to challenge this.

Prior Knowledge

4.1 Year 4 Materials – Is water always wet? Children know that materials can exist in different states of matter. Children understand that particles make up materials, and how this affects the properties of materials. Children know that states of matter can be changed through: evaporation, condensation, boiling and freezing. Children know how water changes state in the water cycle.

Assessment

Thorough assessment of outcomes in books and folders, quizzes and written scientific investigations, also supported by observations and questioning in lessons, assessing the following:

Knowledge:

- Pupils can describe the properties of a range of materials using scientific vocabulary.
- Pupils know that materials have different properties, including: hardness, solubility, transparency, conductivity (electrical and thermal), and response to magnets
- Pupils can select a material for its suitability to a task or use

Skills:

- Pupils have gathered evidence from comparative and fair tests about the properties of different materials
- Pupils have discussed variables in the context of fair tests
- Pupils can record their findings from tests in different ways
- Pupils can use scientific equipment safely when working with heat or electricity

Useful Planning Resources and Links	Project based on plastics: their creation, uses and impact on our lives and environment: https://www.sustainablelearning.com/resource/science-plastic-ks2-0 Grouping and Classifying Materials (Royal Society of Chemistry) https://www.stem.org.uk/system/files/elibrary-resources/legacy_files_migrated/28364-Groupingandclassifyingmaterials.pdf
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