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| Subject: Science Year: 5NC/PoS: **Properties and changes of materials** •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•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 |
| Prior Learning (what pupils already know and do)* Objects can be made from one or more materials. E.g. School desks are made from wood and metal; pencil from wood and lead
* Know water, wood, rock and air are natural materials
* Know these man made materials: plastic, metal or glass
* Children name a type of material and its properties - **Metal**: Metals are shiny, strong and (usually) hard. They are good conductors of heat and electricity. **Ceramic**: Ceramics are hard and strong but inflexible and brittle. They are good insulators of heat and electricity. **Glass**: Glass is transparent. It is hard but inflexible and brittle. It is a good insulator of heat and electricity. **Plastics:** Plastics can be manufactured to have many different properties. Some can be transparent whilst others can be translucent or opaque. Some are flexible while others can be quite stiff. They are good insulators of heat and electricity.
* Know igneous rocks are basalt, granite, pumice, obsidian and they all contain minerals, can be fine-grained or close-grained and often have a glassy texture
* Know sedimentary rocks are chalk, limestone, shale, sandstone and are not crystalline but grainy
* Know metamorphic rocks are slate, marble, quartzite, anthracite and are crystalline
* know that a solid material is firm and stable in shape
* know that a liquid material is a substance that flows freely but is a constant volume
* know that a gas is a substance which will expand freely to fill the whole of a container
* Know that a solid material can change its state into a liquid when heated, this is melting
* know that a liquid can change its state into a gas when heated, this is evaporation
* know that a gas can change its state into a liquid when cooled, this is condensation
* know that a liquid can change its state into a solid when cooled, this is freezing
* Know water evaporates faster if the temperature is higher.
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| End goals (what children MUST know and remember)To know that heat travels from warmer materials to colder onesTo know that some materials let heat pass through them easily; these are thermal conductors (metals)To know some materials do not let heat pass through them; these are called thermal insulators (plastic, cork, wood and fabrics)To know that thermal insulators are good for keeping heat out as well as inTo know soluble materials dissolve in waterTo know if a material doesn’t dissolve, it is insolubleTo know dissolving a solid in water makes a solutionTo know there are three ways to separate mixtures: sieving, filtering and evaporationTo know sieving is when you pass a mixture of solids of different sizes through meshTo know filtering is when you pass a mixture of a solid and liquid through a meshTo know evaporation separates soluble solids from water; the water evaporates and leaves the solid behindTo know in a reversible change a material turns into something that looks and feels different but isn’t changed forever – it can be changed backTo know all changes of state are reversibleTo know mixing and dissolving are reversible changesTo know in an irreversible change a completely new material is formed and cannot be changed backTo know some things react when you mix them (vinegar and bicarbonate of soda) to make new materials |
| Key VocabularyMatter, natural, filtering, sieving, evaporation, condensation, freezing, melting, dissolving, solute, solvent, solution, soluble, insoluble, decanting, waterproof, absorbent, thermal conductor, insulator, reversible, irreversible, formation |
| Session 1:Review prior learning – (revisit properties of materials)Compare and group every day materials including liquids and gases (water in a balloon, air in a balloon) Show me an item that is a natural material, a conductor of heat etc.Revisit rocks, sates of matter |
| Session 2: Lo: Using observation to recognise soluble and insoluble materials<https://www.youtube.com/watch?v=73Iu9RzZ9tI> soluble vs insoluble Watch up to the first part showing that sugar is insolubleGive children a variety of materials to test: flour, oil, salt, coffee, vinegar, sandVocabulary: soluble, insoluble, solubility |
| Session 3:LO: To record and present results linked to dissolving<https://www.youtube.com/watch?v=k3MhImN8Jmc> dissolvingChildren investigate increasing the time taken to dissolve through:* Number of stirs or time stirring
* Increasing temperature of water
* Changing size of solute

How might I get my solute back? Evaporating the water off.Model this through putting salt or sugar solution in a warm place to evaporateVocabulary: solute, solvent, solution, dissolve, dissolving, evaporate, evaporation  |
| Session 4:LO: To record the method for separating a mixture<https://www.youtube.com/watch?v=JJeY-muIqhw> separation techniques Children separate a mixture e.g. sand, salt and stones. The children could prepare their own mixture to separateVocabulary: sieving, filtering, mixture, separation, evaporation, decanting |
| Session 5:Lo: to compare materials and give reasons for their effectivenessChildren to complete the following investigations:* What other material could be used to filter sand from a sugar solution?
* Different types of cup to keep a drink warm (wood, plastic, ceramic, polystyrene)

Ensure there is a variety of materials for them to choose fromVocabulary: waterproof, absorbent, thermal conductor, insulator |
| Session 6:Lo: to research reversible and irreversible changes<https://www.youtube.com/watch?v=U6cxHOnEBo4> <https://www.youtube.com/watch?v=bHlP1lRc0Tg> irreversible reactionsAlso show let children explore irreversible reaction:e.g vinegar and bicarbonate of sodadenture tablet in watervitamin C tablet etcCommon misconception: burningThe difference between burning and melting. Burning is a chemical reaction in which new products, such as smoke and ash, are produced, whereas melting is a physical change in which a solid turns into a liquid. Burning is irreversible, as it is not possible to turn smoke and ash back into unburned fuel. To distinguish between smoke and steam. Smoke is a combination of different chemicals that results from an irreversible chemical reaction, whereas steam is a form of water vapour that results from a reversible physical change. When something burns, part of it vanishes and no longer exists.  Vocabulary: reversible, irreversible, formation |
| Career: Materials engineerChemist <https://www.youtube.com/watch?v=8tRv0Cs2GR8>  |
| Scientists who have helped develop understanding in this field: Spencer Silver <https://www.youtube.com/watch?v=ij9bgRRY6x8> and Ruth Benerito <https://www.youtube.com/watch?v=UtSdDv-m0E8>  |