The Canons CE Primary School

Y5 Science – Properties and changes of materials

Targets to be covered:

- 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.

Learning Ladders:

I can compare and group everyday materials on the basis of their properties e.g. hardness, solubility, transparency, conductivity (electrical and thermal) and response to magnets.

I can recognise that some materials will dissolve in liquid to form a solution.

I can describe how to recover a substance from a solution.

I can use my knowledge of solids, liquids and gases to decide how mixtures might be separated.

I can use evidence from my tests to decide how to use everyday materials effectively.

I can demonstrate that dissolving, mixing and changing are reversible processes.

I can explain that certain changes are irreversible and new materials can be formed e.g. burning.

Working Scientifically

I can plan different types of scientific enquiries to answer questions, including recognising and controlling variables where necessary.
I can record data and results of increasing complexity using **scientific diagrams and labels**, **classification keys**, **tables**, scatter graphs, **bar** and line graphs.
I can use test results to make predictions to set up further comparative and fair tests.
I can report and present findings from enquiries, including conclusions, casual relationships and explanations of result, in oral and written forms such as displays and other presentations.

Week	Order of Study – Main plots and Subplots
1	**LI- I can compare and group everyday materials on the basis of their properties and test them to decide how to use everyday materials effectively.** **Identifying and classifying enquiry- Can you group these materials based on whether they are transparent or not?** Put several objects made of different materials on each table in a bag. Ask different children to try and identify what they are made of by feeling them. Get them to try and describe how they knew (the metal coin was cold and smooth, the sponge was soft and rough and I could squeeze it, etc.). Discuss why children think things were made with specific materials. Discuss with the children the term 'property'. Brainstorm the different properties of materials that could be used for grouping and classifying. Take children's ideas on flipchart. Introduce/reintroduce children to scientific concepts: permeability, absorbency, hardness, solubility, transparency, conductivity (electrical & thermal) and response to magnets. For each property ask children to identify a way of testing whether materials have the property or not. Children to record their results as a tick diagram and then make groups of materials up from their table e.g. flexible materials. Take pictures or record 'groups' of materials in their books. Children to explain how they've grouped the materials using correct vocabulary. Teacher mark: Possible marking task- give children pictures of everyday objects. Children to explain why they are made from certain materials. See marking task sheet. **Resources needed**: opaque bag with a range of materials e.g. paper, tin foil, coin, salt, wood, transparent plastic for each table, jug of water, sample of text, simple circuit with lightbulb, magnets, tick sheet. **Key terminology** – material, magnetic, transparent, opaque, thermal/electrical insulator/conductor, hardness, soluble, insoluble, dissolve, permeable, impermeable, flexible, absorbent
2	**LI- I can recognise that some materials will dissolve in liquid to form a solution.** **Comparative testing enquiry- Which type of sugar dissolves the fastest?** Recap meaning of solubility from last lesson. Match up definition word cards. Do all substances/materials dissolve? Can chn give examples that do/don't? sugar/salt vs rice/sand. Tell them that if a material is soluble in liquid a solution will be created, the material and the liquid become

	one new material e.g. orange squash! If it is insoluble a mixture of the two materials is created. Pupils will be exploring which type of sugar dissolves fastest. Most pupils will have had some experience of dissolving solids in water – either in school or at home. The teacher should discuss with the pupils their everyday experiences of dissolving solids. You could use the familiar examples to prompt discussion about their experience and explore their understanding of dissolving in the real world e.g. water soluble paints, fizzy drinks dissolving enamel (link to Yr 4 science), introduce the idea that nail polish is not soluble in water but is soluble in acetone. Therefore, nail polish remover cannot be made of water but can be made of acetone. Give chn a range of statements. Ask the pupils in pairs or small groups to discuss whether they agree or disagree with each statement. If provided with cards with the statements on, the pupils could sort them into True / False / Not sure categories. What is the class consensus? Address any misconception about what happens to a solid when it dissolves. It is important pupils recognise the solid has not 'disappeared' or 'vanished' but is still in the liquid; it has just combined with the particles in the liquid to become part of the liquid. This is not a permanent change. Show the pupils the four different types of sugar they will be testing. How are they different? Chn might notice the size of the granules. The aim of this lesson is for pupils to understand that the size of a solid (in this case sugar granules) affects the rate of dissolving (i.e. the smaller the granules the quicker they will dissolve). Explain that a sugar cube is actually made of the same size granules as granulated sugar, but that they are all stuck together. Do they think that this will make a difference to how quickly it dissolves? Discuss this and see if they can come up with some explanations so they are then ready to move onto the experimental task. First they need to predict which of the four sugars will dissolve most quickly. Suggest they use the magnifying glass to look at each sugar. They should then write down their prediction with a reason why. Tell the pupils they can only use equipment they have been given and warm water. Tell them you have the warm water which they can collect as needed. (Have a large container of warm water to hand – around 40°C, and a kettle to keep topped up – you may like to have a thermometer to keep a check on the temperature.). Link to work on Fair tests during Forces topic. What variable will they change? Which variable will they measure? What will stay the same? Chn complete investigation, record results in table and bar graph and then explain their reasons for the results. If there is time at the end of the lesson, ask pupils to discuss in their groups what variables they could change if they were investigating how quickly just one type of sugar dissolves. (Examples include water temperature, rate of stirring, volume of water, mass of sugar.) Once they have come up with a list of different variables ask them to think about how each variable will affect the time taken for the sugar to dissolve and why. Self assessment. **Resources needed:** definition word cards, True/False statements, warm water, sugar cube, caster sugar, granulated sugar, icing sugar, transparent cups/jars, stirrers/spoons **Key terminology** - mixture, dissolve, solution, soluble, insoluble, solvent (water), solute (sugar), liquid, solid, variable, fair test
3	**LI- I can explain that certain changes are irreversible and new materials can be formed.** In a reversible change you are always left with the same substances, they might just have been separated. In an irreversible change you will end up with new substances, you no longer have the original substances. No matter what you do you cannot get them back! https://www.bbc.co.uk/bitesize/topics/zjty4wx/articles/zk9mt39 Use the following experiments to demonstrate this and how to generally spot an irreversible change: Self-inflating balloon: Use an empty glass milk bottle and fill the bottom with vinegar. Put a few tea spoons of bicarbonate soda in to a balloon then stretch the balloon over the top of the bottle. Ask the children to predict what they think is going to happen. Lift the balloon up and let the bicarb fall in. Make the students aware of what is happening - gas is being produced (effervescing). This is a sign that an irreversible change has occurred. You cannot get back the vinegar or bicarbonate of soda. Cooking an egg: this should be done at the front using a Bunsen burner or Camping stove. Get the students to observe the changes. In general, a colour change indicates an irreversible change. Glowsticks: Glowsticks are another great irreversible change, you can normally find tubes of 20 at Pound land. Give the students a chance to play with them, but get them to note that light is being produced, this is normally a good indicator that an irreversible change has occurred. Ask children what are some good indicators of irreversible changes: gas, colour change, light – what would you feel if I burned wood? Heat. They need to be aware that these signs are not always true, just a general rule. To emphasise this pass around a reusable hand warmer. It gets hot on its own but it is reusable. In fact it is hard to tell if

	something is R/I without looking at its chemical structure and it is a big grey area at this stage of science. Chemical changes result in a new material being formed. These are mostly irreversible. Physical changes are often reversible but may be permanent. These do not result in new materials e.g. cutting a loaf of bread. It is still bread, but it is no longer a loaf. The shape, but not the material, has been changed. Chn to complete worksheet to show which changes are reversible or irreversible or children to be given a picture of each experiment to stick in their books. Beside each one they have to write down: observations (explain what you saw and what happened). Plenary Recap on the 4 ways that you can typically identify an irreversible change. Can the students come up with anymore that have not been talked about? Maybe see if each student can come up with an individual change. Peer assessment. **Resources needed:** balloon, glass milk bottle, vinegar, bicarbonate of soda, egg, frying pan, hob, glow sticks, worksheet/pictures **Key Vocabulary** - reversible/non-reversible change (irreversible), burning, rusting, new material, cooking, melting, freezing, mixing, dissolving, gas, effervescing, light energy, heat energy, physical change, chemical change
4	**LI- I can use my knowledge of solids, liquids and gases to decide how mixtures might be separated to recover a substance from a solution.** **I can demonstrate that dissolving, mixing and changing are reversible processes**. (don't show chn until after lesson) Review reversible/irreversible changes from last lesson. Show chn a tub of tap water. Explain that we're going to be recreating what dirty 'river' water might look like. What might be in 'river' water? Show chn stones, gravel, sand and salt. Ask chn to predict what might happen when they're added to the water e.g. they'll sink/they'll dissolve etc. Why? Can they give reasons? Encourage them to use the correct vocabulary. Add the materials to the water. Were the children's predictions correct? Now look at the 'river' water. What do the children notice? When shaken, the sand is carried by the water, when left to stand the sand starts to settle. Why does the sand not dissolve? Link to lesson 2. Is it a mixture or a solution? What about when we add the salt? What would help the salt to dissolve faster? Warm water. Interesting fact- Ancient Egyptians used to collect water from the Nile in large jars. They were left to stand to allow mud, sand & silt to settle at the bottom. Tipping the jar carefully allowed the solid (silt) and water to be separated, so that the water could be used. This process is called decanting. Ask the children to predict whether they believe the mixture can be separated. Is it reversible or irreversible? How can we remove the stones/gravel? A sieve! How does it work? How can we remove the sand? Tell the children that you need a sieve with very small holes to remove tiny grains of sand! Pass some filter papers amongst the children. What do they notice when they look at them closely using a magnifying glass? – There are very small spaces between the fibres. Model how to use a funnel and a carefully folded filter paper to separate the sand and salt water mixture. How can we remove the salt? Evaporation! Link to Yr 4 materials topic. Model this using a hob. Show chn the salt left in the pan upon evaporation. Chn to write up, with labelled diagrams, how the mixture was separated. Were they right? Was it a reversible or irreversible change? NB. Explain the water vapour could be turned back into water with the right equipment. Teacher mark. **Resources needed:** https://www.stem.org.uk/resources/elibrary/resource/315596/how-can-we-clean-our-dirty-water, tub of tap water, stones, gravel, sand, salt, sieve, jug, funnel, filter paper, hob, saucepan. **Key Vocabulary** – solid, liquid gas, mixture, solution, dissolve, soluble, insoluble, sieving, mixing, filtering, evaporating, condensation, transparent, reversible change, irreversible change, material, substance
5	**Assessment time** – Children complete the 'What I have learnt' section of their KWL. Possible assessment questions (see sheet) to review understanding.