SS John Fisher & Thomas More Catholic Primary School

A Voluntary Academy

Year Group: Year 5	Term: Spring 2 & Summer 1	Topic: Properties of materials

National Curriculum Links

Pupils in Key Stage Two should be taught 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.
- 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.

Working Scientifically

- plan different types of scientific enquiries to answer questions, including recognising and controlling variables where necessary
- take measurements, using a range of scientific equipment, with increasing accuracy and precision, taking repeat readings when appropriate
- record data and results of increasing complexity using scientific diagrams and labels, classification keys, tables, scatter graphs, bar and line graphs
- use test results to make predictions to set up further comparative and fair tests
- report and present findings from enquiries, including conclusions, causal relationships and explanations of and a degree of trust in results, in oral and written forms such as displays and other presentations
- identify scientific evidence that has been used to support or refute ideas or arguments

Prior Learning	Future Learning
• Identify and compare the suitability of a variety of everyday materials, including wood, metal, plastic, glass, brick, rock, paper and cardboard for particular uses. (Y2 - Uses of everyday materials) • Find out how the shapes of solid objects made from some materials can be changed by squashing, bending, twisting and stretching. (Y2 - Uses of everyday materials)	• Chemical reactions as the rearrangement of atoms. (KS3) • Representing chemical reactions using formulae and using equations. (KS3) • Combustion, thermal decomposition, oxidation and displacement reactions. (KS3) • Defining acids and alkalis in terms of neutralisation reactions. (KS3)

• Compare and group together a variety of everyday materials on the basis of whether they are attracted to a magnet, and identify some magnetic materials. (Y3 - Forces and magnets) • Compare and group materials together, according to whether they are solids, liquids or gases. (Y4 - States of matter) • 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). (Y4 - States of matter) • Identify the part played by evaporation and condensation in the water cycle and associate the rate of evaporation with temperature. (Y4 - States of matter)	• The pH scale for measuring acidity/alkalinity; and indicators. (KS3)

Common Misconceptions

Lots of misconceptions exist around reversible and irreversible changes, including around the permanence or impermanence of the change. There is confusion between physical/chemical changes and reversible and irreversible changes. They do not correlate simply. 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.

Some children may think:

- thermal insulators keep cold in or out
- thermal insulators warm things up
- solids dissolved in liquids have vanished and so you cannot get them back
- lit candles only melt, which is a reversible change.

Sustainable Development Goals & Social Catholic Teaching

These Sustainable Development Global Goals would be perfect to fit with this unit of learning:

These Catholic Social Teaching strands would be perfect to fit with this unit of learning:

Applied Write Opportunities	Enrichment Opportunities
• Write a NC report about an invention of their choice. Explain how the material is perfectly suited to its purpose.	

Assessment Opportunities
• Can create a chart or table grouping/comparing everyday materials by different properties • Can use test evidence gathered about different properties to suggest an appropriate material for a particular purpose • Separate mixtures by sieving, filtering and evaporation, choosing the most suitable method and equipment for each mixture. • Explore a range of non-reversible changes e.g. rusting, adding fizzy tablets to water, burning. • Carry out comparative and fair tests involving non-reversible changes e.g. What affects the rate of rusting? What affects the amount of gas produced? • Research new materials produced by chemists e.g. Spencer Silver (glue of sticky notes) and Ruth Benerito (wrinkle free cotton). • Can group solids based on their observations when mixing them with water • Can give reasons for choice of equipment and methods to separate a given solution or mixture such as salt or sand in water • Can explain the results from their investigations

Key Vocabulary
Tier Two: add vocab here Tier Three:

Knowledge and Skills Objectives	Activity	Differentiation
Lesson 1 I know about the different states of matter. *Add w/s here*	Add prior learning activity here Display the following questions and invite pupils to discuss what they already know about different states of matter. There will be lots of misconceptions (not covered in previous year group). Pupils to share responses.	Pupils will work together to sort each picture according to its properties, whether it is a solid, liquid or gas. Discuss reasons for sorting each item. Listen to explanations for individual choices and address misconceptions.

	What is a solid? What is a liquid? What is a gas? The properties of solids include: solids stay in one place and can be held, solids keep their shape, they do not flow like liquids, solids always take up the same amount of space, they do not spread out like gases, solids can be cut or shaped, even though they can be poured, sugar, salt and flour are all solids. Each particle of salt, for example, keeps the same shape and volume. The properties of liquids include: liquids can flow or be poured easily, they are not easy to hold, liquids change their shape depending on the container they are in, even when liquids change their shape, they always take up the same amount of space, their volume stays the same. The properties of gases include: gases are often invisible, gases do not have a fixed shape, they spread out and change their shape and volume to fill up whatever container they are in, gases can be squashed.	Do pupils disagree with some classifications? Why? Pupils to work in mixed ability pairs to sort **items/objects. Take photos of each pair's** work for books. Will this task 2 hours?
Knowledge and Skills Objectives	**Activity**	**Differentiation**
Lesson 2 I can explain the different states of matter Add w/s here	Add prior learning activity here Pupils will use the information that they have learnt previous to draw and explain the 3 different states of matter. Show video which video? that explains why each state behaves like they do. Discuss particles and how their make up explains their behaviour. Movement of particles in solids, liquids and gases Particles in solids have the least energy and have less space to move. The particles **don't move and it keeps it's shape.**	Watch the following video https://www.bbc.co.uk/bitesize/topics/zkgg87h/articles/zsgwwxs Pupils will use post it notes to draw a particle model for a solid, liquid and gas. https://www.youtube.com/watch?v=-_Whwdh7D6M LA- Draw a particle model for a solid, liquid and a gas

	Particles in liquids have more energy than solids and have space to room, this allows it to flow/pour. Particles in gas have even more energy than liquids. They easily move far apart and spread out through the available space.	MA- Draw a particle model for a solid, liquid and a gas Write some of the properties for each diagram. HA- Draw a particle model for a solid, liquid and a gas. Explain how the arrangement of particles affects how it behaves. Year 4 children do this. Can this be extended for Year 5?
Knowledge and Skills Objectives	**Activity**	**Differentiation**
Lesson 3 I can explain how materials can change states Add w/s here	Materials can be heated or cooled to change state. What is the difference between reversible and irreversible. Some changes of state are reversible and others are irreversible. Melting When a solid is heated, its temperature rises and its particles gain energy until it reaches its melting point. The particles have enough energy to move and break away from their neighbours so that the solid melts. https://www.stem.org.uk/resources/elibrary/resource/34080/understanding-reversible-change As the solid cools it loose energy and solidifies again. Evaporation Fill kettle and turn on. Watch as the kettle heats up and causes the water to heat up. The water (liquid) gains energy and the particles move about much more freely and collide regularly. This continues until the particles move around rapidly and have enough energy to escape. The water boils and the particles escape in the form of steam (water vapour).	What does this worksheet look like? Can it be inserted? LA- Complete changing state worksheet. MA- Use changing state worksheet as a guide to create an information page to show how water changes state. HA- Pupils to create an information page to show and explain different examples of changing state. Draw a diagram with a caption to show an example of each change.

	Condensation Use a cold metal oven tray to hold above the kettle. This will show the water vapour (gas) condenses onto the tray and lose energy. It returns to a liquid. Freezing When a liquid cools enough, it sets or freezes. The particles have low energy and cannot move. It is now a solid.	Note: teachers should avoid using materials where heating is associated with chemical change, for example, through baking or burning.
Knowledge and Skills Objectives	**Activity**	**Differentiation**
<u>Lesson 4</u> I can explain how The Water Cycle works Add w/s here	Recap the changes of state- evaporation and condensation. Quickly discuss the properties of solids, liquids and gases. Watch this video about the water cycle. https://www.youtube.com/watch?v=al-do-HGuIk Identify whether each action is condensation or evaporation. washing drying on a line, mirror misting in a bathroom, paint drying, puddles drying up, hair dryer, water droplets on the inside of a window, a **plant's leaf wilting, water droplets on a cold can of coke**	Pupils will create water cycle models using sharpies and plastic bags. Once finished these to be displayed in the classroom. Label key terminology and explain what happens at each section. Take a photo of the projects displayed for books. Pupils to be expected to explain their water cycle model in a small group. LA- use key vocabulary and point to each part of the model. draw a picture of their model label solid, liquid and gas.

	Create water cycle models – THIS IS DONE IN Year 4 for the topic, The Water Cycle On transparent bags, draw a diagram of the water cycle. Include the sun, clouds and water accumulation. Fill bags up to the line with coloured water.	MA- Pupils will draw their experiment and explain how their model shows the water cycle. HA- Pupils will independently draw and explain their model and use key terminology to describe the water cycle process in detail. Challenge- How does temperature affect the rate of evaporation? Pupils will be expected to explain that heat causes the rate of evaporation to increase. Things will dry quicker in hotter temperatures and slower in colder temperatures.
Knowledge and Skills Objectives	**Activity**	**Differentiation**
Lesson 5 I know about reversible and irreversible changes Add w/s skills here	Watch this video that explains reversible and irreversible changes. https://www.bbc.co.uk/bitesize/topics/zcvv4wx/articles/z9brcwx Model some examples of reversible and irreversible changes and get the pupils to predict whether or not each action is reversible or irreversible. Can they work scientifically here???? Irreversible changes A change is called irreversible if it cannot be changed back again. In an irreversible change, new materials are always formed. Sometimes these new materials are useful to us. Heating Heating can cause an irreversible change. For example you heat a raw egg to cook it. The cooked egg cannot be changed back to a raw egg again. Mixing	Pupils will fill out a table, making a prediction of whether the change is reversible or irreversible. Use pictures on ppt to support predictions about each change. Pupils to create a poster about reversible and irreversible changes. They can use resources as a support.

	Mixing substances can cause an irreversible change. For example, when vinegar and bicarbonate of soda are mixed, the mixture changes and lots of bubbles of carbon dioxide are made. These bubbles and the liquid mixture left behind, cannot be turned back into vinegar and bicarbonate of soda again. Burning Burning is an example of an irreversible change. When you burn wood you get ash and smoke. You cannot change the ash and smoke back to wood again. Irreversible changes are permanent. They cannot be undone. For example you cannot change a cake back into its ingredients again. Reversible changes Reversible and irreversible reactions are different. A reversible change is a change that can be undone or reversed. If you can get back the substances you started the reaction with, that's a reversible reaction. A reversible change might change how a material looks or feels, but it doesn't create new materials. Examples of reversible reactions include dissolving, evaporation, melting and freezing.	
Knowledge and Skills Objectives	Activity	Differentiation
Lesson 6 I can identify and explain which substances dissolve Add w/s here	**Ask pupils, "What does** dissolve **mean?" Present the pupils with the different** scenarios on ppt. add the scenarios to the planning Which one applies to the sugar cubes in the water? Encourage discussion. Dissolving occurs when the particles of certain solids mix with the particles of certain liquids. When a material dissolves, it looks like it disappears, but it has actually just dissolved in the liquid to make a transparent solution. A	Explain that we are going to try and mix some different solids into a liquid to form a solution. Make a prediction by ticking or crossing whether the solid will dissolve or not.

	solution is formed when a solid dissolves in a liquid. Not all solids will dissolve, and not all liquids will allow solids to dissolve. When you mix sugar with water, the sugar dissolves to make a transparent solution. What is the difference between dissolving and melting? Soluble or Insoluble? What does each word mean? Which word describes the sugar? Clarify the meaning of each word.	Each table will have a cup of warm water. Investigate whether the 7 solids dissolve or not: soil, salt, sugar, flour, coffee, sand and rice. Discuss the independent, control and dependant variables in the investigation. SEN/LA will have missing word sheets to support their findings.
Knowledge and Skills Objectives	**Activity**	**Differentiation**
Lesson 7 I can investigate which materials are thermal insulators and conductors. Add w/s here	What does thermal mean? Where have you heard this word before? Get pupils to touch the table. Does it feel hot or cold? Touch a window, touch a metal door handle. Why do these objects feel cold? Explain that they feel cold because of heat transfer. Heat is transferred from hot to cold areas. If something feels cold then it is because it is a colder temperature and therefore the heat from their body is transferred to the colder object. Heat always transfers from hot to colder objects. Pupils will work together to sort which materials they think are insulators and conductors. Heat can travel easily through thermal conductors. Metals are good thermal conductors, as they allow heat to move through them. Thermal conductors are used to make items that need heat to travel through them, like a pan or a radiator. Thermal insulators do not let heat travel through them easily. Some fabrics, wood and plastics are good thermal insulators. Thermal insulators can keep heat out or in. For example, a vacuum flask stops heat from the air travelling through to the food or drink inside,	Pupils will help the teacher to complete the thermal investigation. The task is to investigate which material is the best at keeping a cup of tea hot. How will you know if it is a good insulator or a good conductor? Poor hot tea into different containers and wait 2 minutes. Pupils will help the teacher to take measurements of the tea using thermometers at set intervals. 1. Pupils to identify the independent, dependent and control variables. 2. Make a prediction. 3. Complete the experiment, pupils to fill out table at set times. 4. Write an explanation of results. SEN/LA will have missing word sheets and partners to support when filling out data.

	keeping it cool. A coat stops the heat from your body travelling through to the air outside, keeping you warm.	
Knowledge and Skills Objectives	**Activity**	**Differentiation**
Lesson 8 I can investigate which materials are electrical insulators and conductors. Add w/s here	https://www.bbc.co.uk/bitesize/topics/zcj6yrd/articles/zb6mt39 Conductors Some materials let electricity pass through them easily. These materials are known as electrical conductors. 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. Metal is used in plugs to allow electricity to transfer from the wall socket, through the plug, and into a device such as a radio or TV. In a light bulb, the metal filament conducts electricity and causes the light bulb to light up. 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. The plastic covering that surrounds wires is an electrical insulator. It stops you from getting an electrical shock.	In this project you will make and demonstrate a simple electric circuit. You will learn about electrical conductors (such as wires and metals), insulators (such as plastic coating on the wire) and the concept of electrical circuits. n electric current is a flow of microscopic particles called ELECTRONS flowing through wires and electronic components. It can be likened to the flow of water through pipes and radiators, etc. As water is pushed through pipes by a pump, electric current is pushed through wires by a battery. Electricity always flows from negative to positive. Pupils will create simple circuits to ensure that the circuit is complete and the component works (lightbulb/buzzer etc) Break the circuit and use crocodile clip wires attached to different sides of the materials they are testing. Pupils will

		record whether the material is an electrical conductor or insulator. SEN/LA will work in mixed ability pairs for the experiment. Template to record results on. MA/HA- Pupils to design a safety plug to keep young children safe.
Knowledge and Skills Objectives	**Activity**	**Differentiation**
Lesson 9 I can investigate how to separate mixtures. Add w/s here	What is a filter? What would you do if your paddling pool was full of stones, leaves and bugs? You could empty it out and start again or you could filter out the debris. Filters are used to separate mixtures. For example a fishing net is a type of filter, it traps the fish, but lets the water out as water is small enough to pass through the holes, but the fish is too big. When you boil vegetables and then sieve them to remove the water, that is also filtration. The sieve filters out the vegetables separating them from the water. Can you think of any more examples of a filter? Soluble or insoluble Filtration only works when the solid you want to separate is insoluble, **which means it doesn't dissolve in water. Imagine a cup of tea with sugar** added, the sugar dissolves in the hot tea, it is no longer a solid particle. If you pass the tea through a filter, the sugar would not be left behind, but if **you added sand to your tea, which is insoluble (doesn't dissolve) this would** be left behind in the filter. We can filter sand. We have already left salt water solution on the window sill to observe separation through evaporation in class.	Filtration Activity Materials • Funnels • Filter Paper – available here or you can use kitchen roll or coffee filters. • Beaker • Warm water • Sugar • Sand Method 1. Pour about 300 ml of warm water into a beaker. 2. Add about a tablespoon of caster sugar and stir until it dissolves completely. 3. Place filter paper inside a funnel and place the funnel over a beaker. 4. Slowly pour your sugar solution into the funnel, observing what happens. 5. Repeat with fresh water and sand.

		Results The sugar dissolved in the water passes through the filter into the beaker below. The sand gets trapped by the filter with just water passing through into the beaker below. Pupils will design the perfect tea bag. They will explain how their tea bag lining will be suited to the task. SEN/LA will have support and differentiated worksheets to help support thinking and explanations.