

SS John Fisher & Thomas More Catholic Primary School



A Voluntary Academy

Year Group: Year 4 Term: Spring 2 (Cycle B)	Topic: States of matter (Solids, liquids & gasses)
 National Curriculum Links Pupils in Key Stage Two should be taught to: Compare and group materials together, according to whether they are so Observe that some materials change state when heated/cooled, and meas Identify the part played by evaporation and condensation in the water condensation 	sure or research the temperature at which this happens in degrees celsius (°C)
 Working Scientifically ask relevant questions and using different types of scientific enquiries to set up simple practical enquiries, comparative and fair tests make systematic and careful observations and, where appropriate, takin gather, record, classify and present data in a variety of ways to help in a record findings using simple scientific language, drawings, labelled diagu report on findings from enquiries, including oral and written explanation use results to draw simple conclusions, make predictions for new values, identify differences, similarities or changes related to simple scientific id use straightforward scientific evidence to answer questions or to support 	g accurate measurements using standard units and a range of equipment answering questions rams, keys, bar charts, and tables ns, displays or presentations of results and conclusions suggest improvements and raise further questions leas and processes
Prior Learning	Future Learning
 Distinguish between an object and the material from which it is made. (Y1 - Everyday materials) Identify and name a variety of everyday materials, including wood, plastic, glass, metal, water, and rock. (Y1 - Everyday materials) Describe the simple physical properties of a variety of everyday materials. (Y1 - Everyday materials) Compare and group together a variety of everyday materials on the basis of their simple physical properties. (Y1 - Everyday materials) 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) 	 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. (Y5 - Properties and changes of materials) Know that some materials will dissolve in liquid to form a solution, and describe how to recover a substance from a solution. (Y5 - Properties and changes of materials) Use knowledge of solids, liquids and gases to decide how mixtures might be separated, including through filtering, sieving and evaporating. (Y5 - Properties and changes of materials) Give reasons, based on evidence from comparative and fair tests, for the particular uses of everyday materials, including metals, wood and plastic. (Y5 - Properties and changes of 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)
- Demonstrate that dissolving, mixing and changes of state are reversible changes. (Y5 Properties and changes of materials)
- 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. (Y5 Properties and changes of materials)

Common Misconceptions

Some children may think:

- 'solid' is another word for hard or opaque solids are hard and cannot break or change shape easily and are often in one piece
- substances made of very small particles like sugar or sand cannot be solids
- particles in liquids are further apart than in solids and they take up more space
- when air is pumped into balloons, they become lighter
- water in different forms steam, water, ice are all different substances
- all liquids boil at the same temperature as water (100 degrees)
- melting, as a change of state, is the same as dissolving
- steam is visible water vapour (only the condensing water droplets can be seen)
- clouds are made of water vapour or steam
- the substance on windows etc. is condensation rather than water
- the changing states of water (illustrated by the water cycle) are irreversible
- evaporating or boiling water makes it vanish
- evaporation is when the Sun sucks up the water, or when water is absorbed into a surface/material.

Sustainable Development Goals and Catholic Social Teaching

This global goal would be perfect to fit with this unit of learning.

The following task focuses on climate change. It explores why the atmosphere is heating up and consequently what is happening to the ice caps.

It also has a scientific study attached.

https://www.twinkl.co.uk/resource/us-sc-341-climate-change-powerpoint

Applied Write Opportunities

• Explanation poster about the changing states of matter

• Explanation text on the water cycle

Assessment Opportunities



Enrichment Opportunities

- Can give reasons to justify why something is a solid liquid or gas
- Can give examples of things that melt/freeze and how their melting points vary
- From their observations, can give the melting points of some materials
- Using their data, can explain what affects how quickly a solid melts
- Can measure temperatures using a thermometer
- Can explain why there is condensation on the inside the hot water cup but on the outside of the icy water cup
- From their data, can explain how to speed up or slow down evaporation
- Can present their learning about the water cycle in a range of ways e.g. diagrams, explanation text, story of a water droplet

Key Vocabulary

<u> Tier Two:</u>

material, solid, liquid, gas, state change, melting, freezing, melting point, boiling point, heated, cooled, water, ice, steam, the sun, water droplets, temperature, water vapour, energy, particles, volume, water cycle,

Tier Three:

compact, evaporation, condensation, precipitation, substance, thermometer, Celsius, Fahrenheit

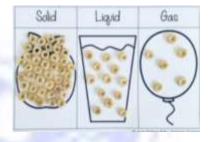
Knowledge and	Activity	Differentiation
Skills Objectives		
Lesson One		<u>SEND:</u>
I can identify if a material is	Prior Assessment Task:	Children to explore the materials
a solid, a liquid or a gas.		further.
Working Scientifically:		Children to pour liquids from one container to another; observing the
working Scientificulty:		liquid taking the shape of the new
		container.
		Children to manipulate solid
	Starter Question:	materials and discover that they
	Ask the children;	don't change shape on their own.
	What is a material?	Children to breathe air into a bottle
	Can all materials be held?	and watch it spread out.
	Discuss with Talking Partners before discussing as a whole class.	Veen 2
	Introduction:	Year 3: Children to read statements about
	Explain to children that all materials can be put into one of three categories or states;	solids, liquids and gases. Children to
	solid, liquid or gas.	sort according to characteristics.
	Give each table a selection of objects and images. Children to discuss which they	Children to stick statements under the 3
	think are solid, liquid and gas. (Use this as a pre-assessment opportunity)	headings; solid, liquid, gas.
	Ask the children, what they think the terms, solid, liquid and gas, mean.	
	• Solid- the shape of a solid does not change on its own – it is rigid. They also	Year 4:
	have a fixed volume.	Children to read statements about
	• Liquid- the shape of a liquid does change, it is not rigid. It fits the shape of the container it is put in. Liquids flow. They also have a fixed volume.	solids, liquids and gases. Children to sort according to characteristics.
	 Gas-gases do not have a shape; they completely fill any container they are 	Children to make mini posters about
	put into. They do not have a fixed volume but the same volume as the	each state.
	container.	
		Challenge:
	Activity 1:	Get three balloons and fill one with a
	Children to sort further objects and images into the different categories including rice	solid (sand), one with a liquid (water)
	and sugar.	and one with a gas (air).
		Children to explore how they feel.

	Discuss the groups and any misconceptions e.g. rice takes the shape of a container so must be a liquid. (Have some magnifying glasses available for children to use to look at rice and sugar more closely. Through this, children should notice each grain is a solid. It is when the solids are put together they behave like a liquid.)	
Resources Various objects for sorting e.g. a brick, playdough, plastic coin, chocolate, water, honey, oil, sugar, flour, rice etc. Various containers Balloons Sand Water Statements for sorting	Watch the following video to consolidate children's knowledge and understanding of the similarities and differences between solids, liquids and gasses. https://www.bbc.co.uk/bitesize/topics/zkgg87h/articles/zsgwwxs	Plenary Consolidate the terms; solid, liquid and gas. Play the game, corners; hold up an object and invite children to move to the corner with the correct state displayed in it. Use this as a post-assessment opportunity and to explore any further misconceptions.

Knowledge and Skills Objectives	Activity	Differentiation
Lesson Two I can explain how particles behave in solids, liquids and gases. Working Scientifically:	Prior Assessment Task:	SEND: Create the particles image using finger paints or cotton buds placed in paint. Use gloop to explore how a solid can change into a liquid.
	Starter Question:	Year 3:

Resources Balloons filled with sand, water and air from previous	 Ask the children. What are the three states of matter (material)? What are their similarities and their differences? Discuss with Talking Partners before discussing as a whole class. Introduction: Present the children with a solid (cheese), a liquid (coloured water) and a gas (air). Ask the children what would happen if we poured the three states of matter into a beaker. Children to discuss this with the TP before discussing as a whole class. Consolidate that the; solid would stay the same shape liquid would take the shape of the new container gas would spread out in the container and continue spreading into the air. Explain to the children that the reason solids, liquids and gases behave differently is because the particles of each substance behave differently. Discuss the term, particle. Use the children to help model particles and the behaviour of particles. Watch this video first (although aimed at KS3, it is quite easy to use) https://www.bbc.co.uk/programmes/pO0xcjtv or https://www.bbc.co.uk/bitesize/clips/zpbvr82 	Use cereal hoops to create images of the 3 states of matter. Children to answer true or false questions about the behaviour of particles in a solid, liquid and gas. <u>Year 4:</u> As above. Then research more about solids, liquids and gases using reference books. <u>Challenge:</u> Show pictures of syringes filled with sand, water and air. Ask the question; <i>What do you think will happen when</i> <i>each syringe is squashed down?</i> Plenary
water and air from previous lesson. Cereal hoops Containers Cheese Water Air Paint Cotton buds True or false questions Reference books Syringes Sand	 <u>Activity 1:</u> Now model the behaviour of the particles in a solid, liquid and gas with the children. Following the activity, consolidate how; In a solid, the particles are close together in ordered rows. They can't move, however, they vibrate a little bit on the spot. In a liquid, the particles are quite close together, but can move around each other easily. They move quite a bit, moving gently past each other. In a gas, the particles can move around very quickly in all directions. There is a lot of space between each particle. 	Replay the videos to consolidate children's understanding of particles in everyday matter. Ask the question; What is matter? What is a particle? What is a state? Use KO to find out the answers. Discuss as a whole class the new vocabulary.

Activity 2: Use cereal hoops to show what particles look like in a solid, liquid and a gas.



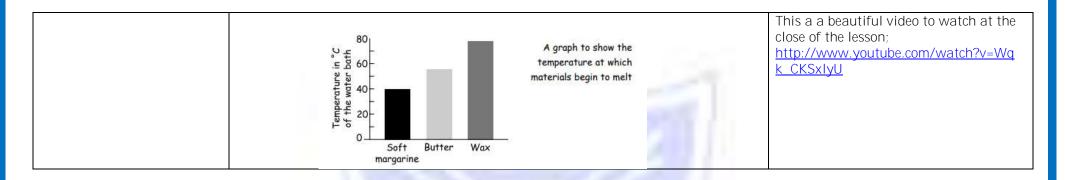
Knowledge and Skills Objectives	Activity	Differentiation
Lesson Three I can explain how a solid can change into a liquid.	Prior Assessment Task:	SEND: Children to order pre-drawn and labelled images of the substances according to the order in which they
Working Scientifically:	Starter Ouestion: Ask the children; Can I change a solid into a liquid? How could I change a solid into a liquid? Discuss with Talking Partners before discussing as a whole class. Introduction: Give children a candle (one between two). Ask the children if the candle is a solid, liquid or a gas. Explain to the children that I am going to change the state of the candle from a solid to a liquid. Light the candles and let the children observe what happens. Discuss their observations and explain what helped to change the state from a solid to a liquid - heat. Explain that this change is known as, melting. Ask the question; Can you think of other solids that could change into a liquid when heat is added? Children to discuss with the TP before discussing as a whole class. Make a list of the materials they suggest could be changed from solid to a liquid depending on the temperature.	 melted (or not). Children to give a reason why some substances melted and some substances didn't melt. Year 3: Children to draw the substances inside pre-drawn pots in order of which melted first. Children to write a reason why some substances melted and some did not. Year 4: Children to record their learning creatively in their books, giving multiple explanations for their thinking about the melting point of substances. Challenge:

Resources Candles Wax	Ask the question; Do all these materials we have thought of melt at the same temperature? Activity 1: Explain to the children that they are going to investigate the melting and freezing point of some solids. Model how to set up a simple practical enquiry. 1. Put small quantities of different substances e.g. chocolate, wax, butter, margarine, ice cube, cheese, pasta, plasticine into small, plastic 'mousse' pots	Children to record the freezing/melting point of water and the boiling point of water onto a thermometer. Order temperatures given.
Butter Chocolate Ice Butter Margarine Cheese Pasta Plasticine Plastic pots Kettle thermometers	 or tin-foil pastry cases. 2. Stand them or float them on hot water (talk to the children about safety when using hot water). 3. Children observe the substances melting. Do they all melt, if not, why not? Discuss which material melted the fastest and why they think this. 4. Now put them in cold water and watch the materials solidify. 	Give out white-boards. Use the following website; display a temperature on the scale. Children to read scale and record it on their white- boards. <u>https://www.topmarks.co.uk/Flash.aspx</u> <u>?f= Temperaturev2</u> Assess children's ability to read scales. Consolidate by asking which is larger or smaller e.g. which is hotter, -20C or 20C?
	Activity 2: Explain to the children that water (a liquid) can be a solid (ice), a liquid and a gas (vapour). Ask the children if they know when water turns to ice; what temperature does it need to be? When does water turn to vapour; what temperature does it need to be? This will link to children experiences on seasonal changes and habitats, as well as their Geographical unit on the water cycle. Introduce the children to a thermometer. Children to look at the scale and discuss what they notice (negative and positive numbers, intervals etc). Discuss degrees Celsius and Fahrenheit. Explain that we use both scales; however, in science we mainly use oC. Talk about the freezing and melting point of water is OoC and the boiling point of water is 100oC. Get the children to find these on the scale.	For Year 4, you could use decimal numbers e.g. 1.5 Oc.

Explain to the children that they are going to practice reading the degree Celsius scale. This is going to be important for future investigations.	
Before exploring the temperature of water, explain the safety of using thermometers and hot water, and ensure all children understand the expectations of working safely in science.	
Give each pair a thermometer and a cup containing water. Children to record the temperature on a post-it note and attach it to the cup. Repeat with more cups of water of differing temperatures. Once all recordings have been done, ask the children to order the temperatures from smallest (coolest) to largest (hottest).	
Take photographs of this learning for their books.	

Knowledge and Skills Objectives	Activity	Differentiation
Week Four I can explore the melting points of different solids.	Prior Assessment Task:	<u>SEND:</u> Children to use Lego to build a graph. Children to talk about the results.
Working Scientifically:	Starter Questions: Ask the children; What is temperature? What do we measure tempertaure in? What do we know about the temperature of water? Children to discuss with Talking Partners before discussing as a whole class. Introduction: Explain to the children that they are going to investigate at what temperature some solids melt.	 <u>Year 3:</u> Children to be given pre-drawn chart paper to record their results on. Children to write simple sentences about what they have found out. <u>Year 4:</u> Children to draw their axis and to place their data onto their chart. <u>Challenge:</u> Using additional data, children to use data to answer the following questions;

Resources Water Butter Margarine	 For this investigation, limit the children to a few materials that will melt at the temperature of very hot water (80 °C) or below, such as soft and hard fats, chocolate and wax. Model how to set up another simple practical enquiry. 1. Children to predict at what temperature the materials will melt. Ask the question; Will they melt at OoC like water or would they have a higher or a lower melting point? Children to write prediction in their book. 2. Use small, equal cubes of each substance and place each one into a dish. 	Which material has the highest freezing temperature? Which has lowest freezing point? Which are solid at room temperature? Which are liquid at room temperature? Which material needs to be cooled the most for it to freeze?
Wax	 Place these into a large container of water with a thermometer. Begin the activity with cool water (10oC) and see if any substance begins to melt. 	Plenary
Chocolate Tray Kettle Lego Thermometer Graph paper	 4. Remove the dishes; add warm water to the container (30oC). Replace the dishes to see if any substance begins to melt. 5. Remove the dishes; add hot water to the container (50oC). Replace the dishes to see if any substance begins to melt. 6. Repeat at 70oC and 90oC if needed. 7. As the investigation is taking place, encourage the children to record the water temperatures as different materials melt. A bar graph can be made of the results later. Take photographs of the enquiry for their book. Activity 1: Children to use their results to create a bar graph. Both the results and graph can be drawn into their books. Year 4 could use ICT to produce graphs.	Discuss how different materials melt at different temperatures. Ask the children questions, such as, which material will melt first, butter or a plastic whiteboard? A car's metal or a glass? Through this discussion, the main learning is children understanding that things melt at different temperatures and that's why a specific material is chosen for a specific job. Consolidate what is meant by freezing point. Watch the following video of wax solidifying and water turning to ice. Discuss how liquid is changing into a solid because it has been left to cool to its freezing point. https://www.youtube.com/watch?v=uW OETby2DyI https://www.youtube.com/watch?v=xFR u2mt6SgQ.



Knowledge and Skills Objectives	Activity	Differentiation
<u>Week Five</u> I can explain how a liquid can change into a gas. Working Scientifically:	Prior Assessment Task: Starter Question: Ask the question; What is evaporation? When a liquid is heated and the water turns into invisible vapour that rises into the air. Children to discuss with their Talking Partners before discussing as a whole class. Introduction: This session may need to run over a few days, depending on the weather. Alternatively, do the input and the setting-up of the experiment first thing in the morning, and make observations throughout the day. Explain to the children that they are going to explore another change of state; this one is called boiling point but we also call it evaporation (the children would have studied evaporation as part of the water cycle).	SEND: Children to write a simple prediction. Children to stick an image of their puddle measurements into their book and write a simple conclusion.Year 3: Children to write a simple prediction. Children to stick an image of their puddle measurement into their books and write about what they did. Children to write a conclusion.Year 4: Children to complete the same task as a Year 3. However, children should use scientific language and reasoning.Challenge:

	 Explain to the children that we are going to explore what happens to a puddle in the playground over time (create one if it has not been raining!). Ask the children; What do children think will happen? How can we measure what is happening? Perimeter? Diameter? Length across widest point? What could we use to draw around the puddle to show its size at different points in 	https://planbee.com/products/states-of- matter
Resources	the investigation? chalk, playdough sausage shape How often should we check on the puddle? half hour, hour	Plenary
Blue material Wellies Sunshine Water	Activity 1: Model how to plan an investigation using a planning sheet. Children to predict what will happen, and record this in their book with a reason.	
Chalk or playdough iPad	Go outside and find a puddle (or create one). More than one puddles could be investigated e.g. in sunlight, on a shady path. This could promote further discussions on the air temperature or exposer to light.	Go through the challenge with challenge as a whole class. Can they invent a solution to the problem and how could they test their
	Children to draw around the puddle. Repeat throughout the course of the day. At the end of the investigation, children to take a photograph of their 'puddle'. Display images on the IWB, and discuss what has happened.	ideas? This task could be sent as home- learning.
	Ask the question; What do they think causes the drying? Wind, sunshine Can you think of any other everyday examples of when evaporation takes place? Washing drying on a line, water boiling in a saucepan, kettle boiling*. How can we use evaporation? Hair dryers, tumble dryers, rotary clothesline.	Consolidate what evaporation is.
	Consolidate evaporation. Ensure the children understand that water hasn't simply 'disappeared' but has become an invisible gas. It is all around us.	
	*steam is composed of tiny droplets of water, which can be seen, and then which become invisible water vapour (gas).	

Knowledge and	Activity	Differentiation
Skills Objectives		
Week Six I can explain how a gas can change into a solid.	Prior Assessment Task:	SEND: Take a picture of condensation using an iPad. Using an app, children to insert image and type what makes condensation e.g. when hot air meets a cold surface, the air cools and turns to liquid. Year 3:
Working Scientifically:	Starter Questions: Ask the children; What is freezing point? What is melting point?	
	What is boiling point? What do you think condensation is? (the children would have met this as part of their learning on the water cycle) Children to discuss with Talking Partners before discussing as a whole class.	Children to write their prediction prior to the investigation. Children to draw their observations, and then explain what they saw and why this happened.
	Introduction: Explain to the children that they are going to investigate how a gas can turn back into a liquid. This is the final stage of the States of Matter cycle. Watch the following video on evaporation and condensation; <u>https://www.bbc.co.uk/bitesize/topics/zkgg87h/ar_ticles/zydxmnb</u>	Year 4: Children to write their predictions prior to the investigation. Children to draw a number of their observations, and then explain what
	Talk to the children about the everyday scenario of taking a hot shower in a closed bathroom. Ask the question; If you have a mirror, what happens to the mirror when you are having this hot shower? The mirror is likely to "fog" up.	they saw and why this happened. Year 4 should be able to use more scientific vocabulary and reasoning than Year 3. Their explanations should be more in- depth.
	Explain, the "fog" consists of tiny droplets of water that form on the cool surface of the mirror. Some of the hot water from the shower evaporates, so the air in the bathroom contains a lot of water vapour. When the water vapour contacts cooler surfaces, such as the mirror, it cools and loses energy. The cooler water particles no longer have enough energy to overcome the forces of attraction between them. They come together and form droplets of liquid water. Ask the question;	

Resources	At what temperature does water vapour cool to turn into a liquid? (can they recall from the previous discussion on boiling point) Activity 1: Give children a mirror that has been stored in a cool location e.g. in an ice box. Children to breathe onto the mirror and watch what happens. Get the children to draw onto the 'fog' and notice not only what is happening on the mirror but how	
Cold can of pop Ice box Mirrors Ice cubes Glass jam jars (wide neck) Plates Hot tap water Images for labelling	their hands feel too. <u>Activity 2:</u> The children are going to make it rain inside the classroom. Model how to set up the investigation, without actually doing the enquiry with them. Ask the children what they think they might see during the enquiry and make a prediction. Children to record their predictions.	Challenge: Complete the image
iPads	In groups, children to set up the following investigation and throughout make observations. Children could take photographs of these observations to support their journaling of the investigation. (This investigation can also be conducted using a jam jar, plastic cover and elastic band.) What you need: • Ice cubes • Wide glass jam-jar • Plate	Consolidate all learning on States of Matter. Using a quizzing app or a template, children to answer questions on States of Matter. Use this as a post-assessment. Go through questions if misconceptions or misunderstandings are still present.
	 Very hot tap water Method: Put the ice cubes on the plate. Pour around 3 centimetres of very hot water into the glass jar. Place the plate and ice cubes on top of the jar. Watch what happens! Can you see droplets forming on the bottom of the plate? If you tap the plate they will fall down like rain! 	The Area Cancer of States 1 for Area Interface on the sector target target Interface on the sector target target Interface Interface
	Explain to the children that when hot air hits the bottom of the cold plate, water vapour in the air condenses. The water vapour forms water droplets on the bottom of the plate. The water droplets drip down like rain. The same thing happens in the	

atmosphere. Warm, moist air rises. The rising warm air meets colder air high in the atmosphere. The water vapour in the warm air condenses and forms water droplets. The water droplets fall to Earth as rain.
Consolidate; condensation occurs when water-vapour molecules in the air lose heat energy (cool), slow down, and join together to form liquid-water droplets when they come near something cold.

