


Mendell Primary School

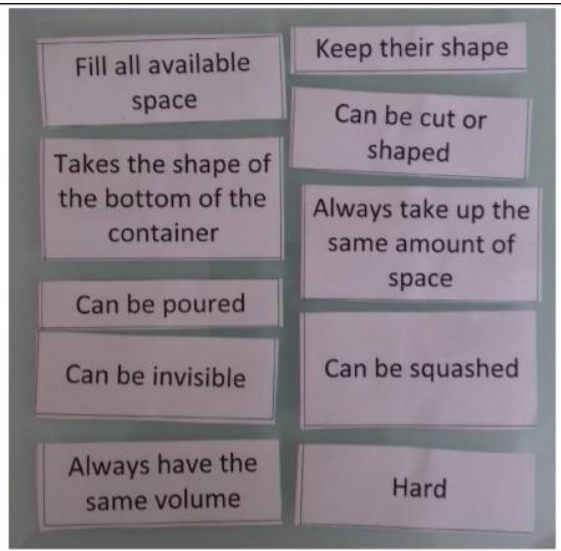
Aspire Challenge Achieve

Medium Term Plan Science



Year Group: 4	Term: Autumn 2	Teacher: Miss Jones	Subject lead: Sarah Bride	<p>Overview: States of Matter</p> <ul style="list-style-type: none"> • Compare and group materials together, according to whether they are solids, liquids or gases. • 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). <p>Spring 1:</p> <ul style="list-style-type: none"> • Identify the part played by evaporation and condensation in the water cycle and associate the rate of evaporation with temperature. <div style="background-color: #0056b3; color: white; padding: 5px; margin-bottom: 5px;"> <p>Comparative / fair testing Changing one variable to see its effect on another, whilst keeping all others the same.</p> </div> <div style="background-color: #e67e22; color: white; padding: 5px; margin-bottom: 5px;"> <p>Observation over time Observing changes that occur over a period of time ranging from minutes to months.</p> </div> <div style="background-color: #e91e63; color: white; padding: 5px;"> <p>Identifying, grouping and classifying Making observations to name, sort and organise items.</p> </div>	<p>Key End Points: By the end of this unit children will be able to:</p> <ul style="list-style-type: none"> • Talk about solids, liquids and gases • Describe the properties of solids, liquids and gases • Describe what happens when objects melt, freeze or solidify • Give everyday examples of melting and freezing • Talk about temperature being how hot or cold something is • Talk about how we measure temperature • Measure temperature using a variety of thermometers
<p>Common Misconceptions:</p> <ul style="list-style-type: none"> • '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. 				<p>Unit key Vocabulary:</p> <p>Solid, liquid, gas, state change, melting, freezing, melting point, boiling point, evaporation, temperature, water cycle</p>	
<p>Links to other learning:</p>	<p>Prior Learning:</p> <p>Distinguish between an object and the material from which it is made. (Y1 - Everyday materials)</p> <ul style="list-style-type: none"> • 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) 	<p>Future Learning:</p> <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. (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) • Demonstrate that dissolving, mixing and changes of state are reversible changes. (Y5 - Properties and changes of materials) 	<p>High Quality Text:</p> <p>Charlie and the Chocolate Factory – Roald Dahl</p> <p>Itch by Simon Mayor</p> <p>Scientist to study:</p>	<p>Risk Assessment/Healthy and safety</p> <p>Discuss with children how they should be careful handling warm water.</p>	<p>Teacher CPD:</p> <p>PLAN ASE Chaya Unit of work.</p> <p>Reach Out CPD - https://www.reachoutcpd.com/ sign up for free.</p>

	<ul style="list-style-type: none"> 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) 	<ul style="list-style-type: none"> 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) 			
	<u>Learning Intention</u>	<u>Lesson Outline</u> (<u>Key Questions in colour</u>)	<u>Resources</u>	<u>Vocabulary</u>	<u>Lowest 20% Adaptations</u>
1	<p>L.I. I can compare and group materials together, according to whether they are solids, liquids or gases.</p> 	<p>This is a Science lesson. In Science, we study nature and the behaviour of natural things. The skill we will be using this lesson is asking questions and making predictions.</p> <p>Recall prior learning: What is a material? – <i>The matter from which an object is made.</i></p> <p>Can you name any materials? Can you name a property of that material? e.g. wood – rigid.</p> <p>Show the children a picture of a wooden table, a drop of water and steam from a kettle. What do they notice? Ask the children to think about which one is the odd one out. Could all of them pictures be the odd one out? Do the children use the vocabulary solid, liquid, gas? If not introduce and discuss as a class.</p> <p>Watch the following clip and ask the children to recall as many examples of liquids, solids and gases they can remember. Then discuss how they are different? https://www.bbc.co.uk/bitesize/clips/zrdkixs</p> <p>Watch the following clip to explain the behaviour of matter in the three states - https://www.bbc.co.uk/bitesize/clips/zpbvr82</p> <p>After watching the videos – can the children explain more scientifically, what is happening to the raisins in the lemonade?</p> <p>Role Play: Being a solid, liquid and a gas.</p> <p>Using the video as reference put the children into groups; (you may need to use the hall) shout out a state of matter and ask the children to demonstrate how the particles behave in each state. Solid particles: all close together and moving slowly, liquids: remain in close contact but move around more gases: move around quicker and in a random fashion.</p> <p>Words of the week – solid, liquid and gas. Using the definitions below create a matching activity for the children to complete to ensure they understand the vocabulary discussed so far. Ask children to use drawing to support their definitions.</p> <p>Solid – A solid has a definite shape that remains the same unless a force is acting upon it.</p> <p>The particles in a solid are rotating, vibrating or moving about a fixed point, close to each other</p> <p>Liquid – A liquid has no fixed shape but a volume and takes on the shape of its container. A liquid can be poured and keeps a level, horizontal surface.</p> <p>The molecules in a liquid move more and have more energy than particles in a solid but remain in close contact with each other</p> <p>Gas – A gas no fixed shape or volume and will always spread out to fill the container that it is in.</p> <p>The particles have a lot of energy, moving around in a random way, hitting other particles and the walls of the container.</p> <p>Give groups a set of cards with some properties of the three states. In small groups, discuss each statement and decide whether it applies to a solid, liquid or gas or more than one of these.</p>	<p>Matching definition to vocabulary – solid, liquid, gas.</p> <p>Hall space.</p> <p>Rice.</p> <p>Odd one out quiz</p> <p>Range of materials to sort see example from ASE below.</p>	<p>Material, solid, liquid, gas, matter.</p>	




At this point, clarify that some solids made of small particles can be poured but this does not make them a liquid. Give the children some rice to handle. Ask; can we pour rice? So is it a liquid? Ask them to pour the grains of rice from one person's hand to another. Then ask each child to hold one grain and repeat the question. The children should realise that they could not pour this. Granular and powdery solids like sand can be confused with liquids because they can be poured, but when poured they form a heap and they do not keep a level surface when tipped. Each individual grain demonstrates the properties of a solid.

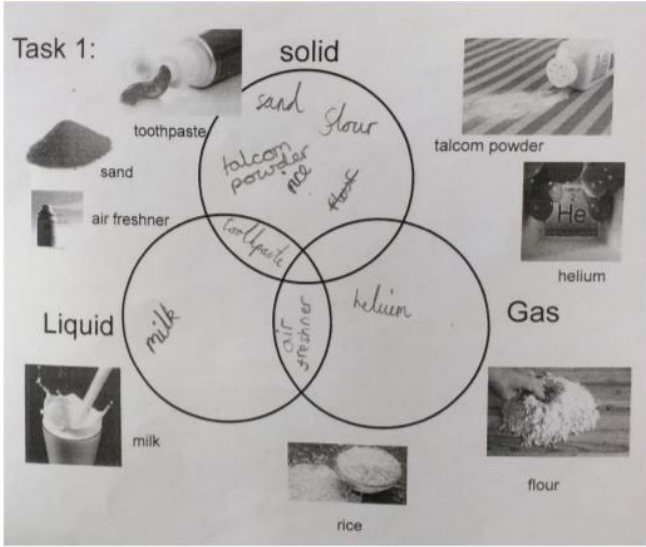
Big Question - Which state of matter are your materials?

Provide a variety of materials in different states. They must decide whether they are solid, liquid or a gas. They must explain to each other the decisions that they have made.

Recording – see example below.

	Year	4	Topic	States of matter
	Focus of assessment (National Curriculum statements)			
	<ul style="list-style-type: none"> Compare and group materials together, according to whether they are solids, liquids or gases. 			
	Description of activity			

The children were then given images and, where possible, the actual materials to consider and explore. These examples were chosen as the state is harder to define. The children were asked to discuss and justify their ideas.

EVIDENCE OF LEARNING		ASSESSMENT
Oral evidence	Examples of work	Knowledge
<p>"Toothpaste is a little bit like a solid, as it keeps its shape, but also like a liquid, as you can squeeze it out of the tube.</p> <p>"You can pour the sand, flour and talcum powder, but they are not liquids.</p> <p>The air freshener is a liquid, but the smell then fills the room like a gas."</p> <p>Teacher observations</p>		<p>Chaya is using the properties of the three states to justify her opinions.</p> <p>Working scientifically</p>

Toothpaste refer back to definition of a liquid.

Discuss any of the materials that the children found tricky to sort. Ask **why?** Encourage the use of scientific terms linked to their properties.

2 L.I. I can explore and observe the properties of gas.



This is a Science lesson. In Science, we study nature and the behaviour of natural things. The skill we will be using this lesson is making observations and predicting.


Recap from previous lesson play the ASE PowerPoint odd one out quiz.

Word of the week – particles

<http://www.bbc.co.uk/learningzone/clips/gases-and-their-uses-no->

Gas, particles, invisible, surface, solid,


		<p>Ask the children what they recall about solids, liquids and gases. Can the children remember key properties of each state? If not recap together using the video from the previous lesson. https://www.bbc.co.uk/bitesize/clips/zpbvr82</p> <p>Gases surround us, but how many can children name? Which ones make up the air around us? Which gases are important for human life or plant life? Show children the table of gases and discuss the contents. How many of these gases have they heard of? Show children the video clip (no commentary) showing gases being used in everyday life. How many can children spot? Moving air can be very useful, turning wind turbines, blowing washing on a washing line or filling the sail of a yacht, but it can also be damaging. Pass an air pump around the classroom and ask the children push the plunger so they can feel the air against their skin. Remind children that all materials are made up of particles - solids, liquids <u>and</u> gases! Even though many gases are not visible they are there and they are matter! Explain that they will carry out some demonstrations to show that air is a material.</p> <p>Split the class into three groups. Children will rotate around each activity two will be independent group work and the third guided with the teacher.</p> <p>Activity 1: Is the plastic bottle empty? – Empty plastic bottle on table with resource card.</p> <p>Activity 2: How does the smell travel? – oils on tissue hidden in the classroom.</p> <p>Guided: Remind the children that on the Earth's surface air fills every available space, even those tiny spaces between and within solid objects. But what evidence is there of this? Provide children with a variety of solids in containers (soil, stones, marbles). With a magnifying glass in hand, ask children to investigate what happens as they slowly pour water over them. Bubbles of air/gas escape as water fills the spaces. Where do the bubbles come from? (From the gaps between the solids.) In a bowl of water, children submerge a sponge and squeeze it. Can they explain what is happening? Where are the bubbles coming from? (From the spaces and gaps within the sponge.) Ask children to record what they have observed through annotated drawings use the table in the session resource as a guide for the layout of children's work. Encourage the children to look closely using the magnifying glasses, make their sketches as detailed as they can and describe what they have seen using scientific terms. Lower ability will benefit from a word bank.</p> <p>Take feedback from the children about their learning from the independent tasks. Ask them: How does the smell travel? Do gases weigh anything? Is this plastic bottle empty? Explain that you are looking for the use of scientific language in their response.</p> <p>Exit pass: Explorify: Odd One Out Gas - https://explorify.uk/en/activities/odd-one-out/gas</p>	<p>narration/1610.html</p> <p>ASE odd one out quiz. States of matter resource list on google drive.</p>	<p>liquid, gas.</p>	
3	<p>L.I. I can set up tests to answer questions about gas.</p> 	<p>This is a Science lesson. In Science, we study of nature and the behaviour of natural things. The skill we will be using this lesson is asking questions and setting up tests.</p> <p>Recap: Use drama to model the three states: children (particles, i.e. atoms/molecules) arranged in tidy rows holding hands, packed together (and vibrating, i.e. shaking, slightly) = solid; rows of children sliding over each other (moving back & forth in their lines), rows beginning to break as hands let go = liquid, children separate and move away from each other to fill whole space = gas.</p> <p>What can we find out about gases? - children can split into groups and each complete a simple test and share with the other children in class what they found out.</p> <p>Simple test - Does gas have weight?</p> <p>Ask the children to devise a test to find out whether gas has weight. They might choose simply to measure a balloon before inflating and then compare it to an inflated balloon. They could tie a deflated balloon on one end of a stick and an inflated balloon on the other. By holding the stick horizontally by a piece of string tied to the middle they can see which end is heaviest.</p> <p>Simple test - What happens to gas when it is heated?</p>	<p>Balloons</p> <p>Light lengths of dowelling</p> <p>String</p> <p>Small plastic bottles</p> <p>Elastic bands</p> <p>Bowls</p> <p>Warm water</p> <p>Vitamin C effervescent tablets</p>		

		<p>Give each group a balloon, a small plastic bottle and a bowl of warm water. Ask them to find out what happens to gas when it is heated. They should place the balloon over the neck of the bottle and then place the bottle into the warm water. They could investigate this further by changing the size of the bottle, or changing the temperature of the water.</p> <p>Simple test - Can gas be made from a solid and a liquid?</p> <p>Provide children with a small plastic bottle, water, an effervescent tablet and a balloon. The children should place the water and tablet in the bottle. The balloon can be fitted over the neck of the bottle in order to capture the gas (carbon dioxide) created.</p> <p>For each of these tests, the children can draw what they did and draw what happened.</p>			
4	<p>L.I I can observe that some materials change state when they are heated or cooled , and measure the temperature at which this happens in degrees Celsius (°C).</p> 	<p>This is a Science lesson. In Science, we study of nature and the behaviour of natural things. The skill we will be using this lesson is setting up tests, making observations and communicating results.</p> <p>https://www.stem.org.uk/resources/elibrary/resource/315591/what-temperature-does-chocolate-melt</p> <p>Positive, Minus, Interesting - The children were asked to share their ideas about chocolate chairs</p> <p>Word of the week – solidify</p> <p>Big Question - What happens to solids when they are heated?</p> <p>Discuss with the children the different ways they could find the answers to this question.</p> <p>Discuss with children the unit of measurement for measuring temperature. Allow the children some time to explore using thermometers and temperature probes attached to data-loggers.</p> <p>Show children the equipment that they are going to use and ask them to work out how they could use this equipment to answer the question. They can then place different materials (e.g. soft and hard fats, chocolate and wax) in separate transparent bags or in small metal trays and place them in warm water (up to 60 degrees Celsius) inside of a bowl.</p> <p>Health and Safety – discuss with children how they should be handling warm water.</p> <p>Recording; table and a bar graph.</p> <p>Problem solving: can we return the chocolate to a solid form? Help children to identify the key process words: 'melt' and 'solidify', and the means by which the changes occurred: 'heating' and 'taking away heat ('cooling').</p> <p>Research</p> <p>The children could use secondary sources to find out more about the melting point of a range of materials.</p>	<p>Bowls, warm water, chocolate buttons, data loggers, metal trays or plastic zip bags.</p>	<p>Solid, liquid, change of state, heated, cooled, solidify,</p>	



Year	4	Topic	States of matter
Focus of assessment (National Curriculum statements)			
• 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).			
Description of activity			
The children were given two chocolate buttons to look at and consider how they were the same and different. They were asked to predict which chocolate button they thought would melt the quickest and given equipment to test this out.			

EVIDENCE OF LEARNING		ASSESSMENT
Oral evidence	Examples of work	Knowledge
<p>"Both are milk chocolate. They are both round. They both have a flat bottom with writing on them."</p> <p>"One is bigger than the other. The small one is thicker than the big one."</p>		
Teacher observations		Working scientifically
<p>Chaya and the rest of the class thought that the small button would melt the fastest.</p>		<p>Chaya makes careful observations of the similarities and differences between the two types of chocolate buttons.</p>

	Year	4	Topic	States of matter
	Focus of assessment (National Curriculum statements)			
	<ul style="list-style-type: none"> 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). 			
	Description of activity			
The children carried out the enquiry and wrote a conclusion.				

EVIDENCE OF LEARNING		ASSESSMENT
Oral evidence	Examples of work	Knowledge
		<p>Chaya is secure in explaining the process of melting.</p>
<p>Teacher observations</p> <p>Chaya makes good use of the key vocabulary throughout – solid, liquid, heat, melt.</p> <p>Chaya's group decided the test would be better if they melted both buttons at the same time as the temperature of the water may have changed.</p>		<p>Working scientifically</p> <p>This conclusion shows that the results did not match Chaya's prediction, but she has thought about this and come up with a new reason – the thickness is more important than the size.</p> <p>Chaya makes a suggestion of how to improve the method.</p>

5 L.I I can observe that some materials change state when they cooled.



This is a Science lesson. In Science, we study of nature and the behaviour of natural things. The skill we will be using this lesson is setting up a test, making observations and communicating results.

Observation - Freezing and melting

Give each group of children a balloon that has had water frozen inside it. They can peel off the balloon and explore the ice balloon. Ask them to work out how the ice balloon was made. They can try placing a few drops of food colouring on the ice and observe what happens over time

Drama/modelling – Being a solid and liquid

Act out being a solid: children line up in line to form a large square. Each of the children can represent a particle of solid. Ask the children to wriggle a little on the spot. Apply more energy to this model by calling out 'heat energy'. The children can now begin to form a long line and move around the room. To initiate solidification/freezing, call out 'remove heat energy'. The children should now begin to move more slowly until they are back wriggling in their square.

Big Question – Do all liquids freeze?


Children can plan and carry out their own investigation to find out whether all liquids will freeze.

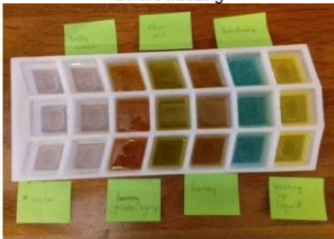
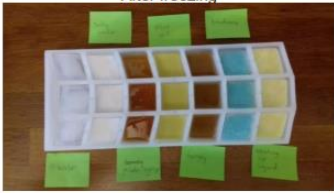
Recording


They can draw their liquids at different stages; before going in the freezer, immediately when removed, and one hour later. Discuss which liquids turned to solids – **what do they notice after an hour?**

A range of liquids to freeze – water, honey, veg oil, golden syrup, washing up liquid, hand soap and salt water, -

Solid, liquid, change of state, heated, cooled, solidify,

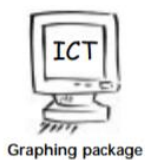
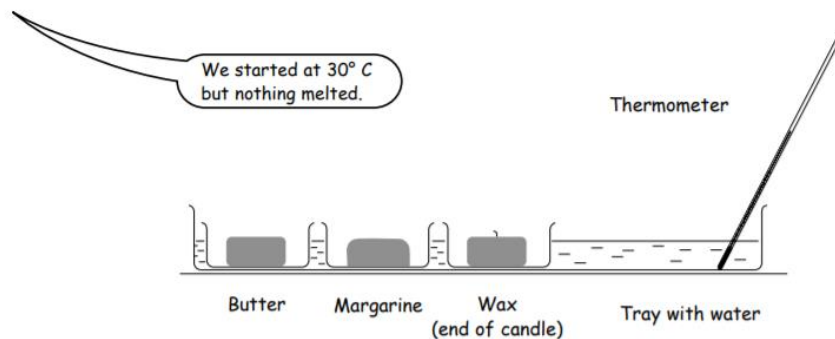
	Year	4	Topic	States of matter
	Focus of assessment (National Curriculum statements)			
	<ul style="list-style-type: none"> Observe that some materials change state when they are heated or cooled, and measure or research the temperature at which this happens in degrees Celsius (°C). 			
	Description of activity			
The children were given small amounts of seven liquids to explore. The teacher had previously put these liquids in an ice cube tray and placed in them in the freezer. The children were then given the frozen cubes to explore.				

EVIDENCE OF LEARNING		ASSESSMENT
Oral evidence	Examples of work	Knowledge
<p>"They are all liquids because they fill the bottom on the pot and the surface is flat. Some of them are thicker and are not as easy to pour.</p> <p>"You can push your finger in the honey cube. It hasn't really changed. It is still a thick liquid. The salt water cube is white and doesn't feel as smooth. The oil melted back into a liquid quickly."</p>	<p>Before freezing</p>  <p>After freezing</p> 	<p>Chaya describes how things change as they are heated and cooled.</p>
Teacher observations		<p>Working scientifically</p> <p>Chaya makes careful observations of the similarities and differences between the liquids and the frozen cubes.</p>

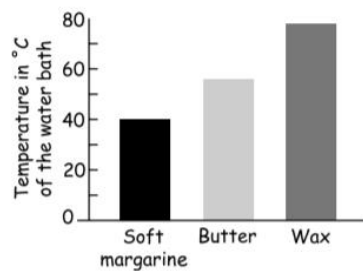
6	<p>L.I. I can observe that some materials change when they are heated.</p> 	<p>This is a Science lesson. In Science, we study of nature and the behaviour of natural things. The skill we will be using this lesson is fair testing and observing over time.</p> <p>Explorify zoom in zoom our – White Crystals https://explorify.uk/en/activities/zoom-in-zoom-out/white-crystals</p> <p>Big Question – Do solids melt at the same time?</p> <p>Put small quantities of different substances eg chocolate, wax, butter, margarine, ice cube, cheese, pasta, plasticene into small, plastic 'mousse' pots or tin-foil pastry cases, and stand them or float them on hot water. The children can observe the substance melting. Do they all melt, if not, why not? Now put them in cold water and watch them solidify.</p> <p>Children investigate 'which melts the fastest?' To keep the test fair, compare the same quantities, eg equal cubes of margarine, butter and chocolate.</p> <p>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. Use small, equal cubes of each substance and place each one into a dish. Place these into a large container of water with a thermometer. Begin the activity with warm water (30 °C) and see if any substance begins to melt. Remove the dishes, add hot water to the water bath, stir and take the water temperature. Replace</p>	<p>chocolate, wax, butter, margarine, ice cube, cheese, pasta, plasticene into small, plastic 'mousse' pots or tin-foil pastry cases</p>	<p>Solid, liquid, change of state, heated, cooled, solidify.</p>
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the dishes to see which substance melts at the higher temperature. Record the water temperatures as different materials melt. A graph can be made of the results.

HEATING AND COOLING MATERIALS 2:2 RS•C



Graphing package



A graph to show the temperature at which materials begin to melt