States of Matter: Heating and Cooling

Aim:	**Success Criteria:**	**Resources:**
To 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) by investigating how heating and cooling can change a material's state. I can investigate materials as they change state.	I can understand how heat can cause solids to change to liquids and vice versa. I can identify materials that melt at different temperatures. I can investigate the melting and freezing temperature of a material.	**Lesson Pack** Thermometers Foil pie tins Chocolate broken into equal sized squares Three trays per group - each tray filled with a different temperature of water (approximately 5°C, 30°C and 40°C would work well) Stopwatches
	Key/New Words: Solid, liquid, particles, melt, freeze, thermometer, temperature.	**Preparation:** **Melting and Freezing Points Activity Sheet** - 1 per pair Differentiated **Melting Chocolate Investigation Activity Sheet** - 1 per child

Prior Learning: The children will have learnt about changing state in lesson 1.

Learning Sequence

Whole Class	**What Makes Materials Change State?** Ask the children to choose the correct labels for the diagram on the **Lesson Presentation**. Explain the processes of melting and freezing, and how a material's particles behave when they change state using the information and diagrams on the **Lesson Presentation**. Address any misconceptions or issues.	
	Melting and Freezing Points: Explain freezing and melting points, using the diagram on the **Lesson Presentation** to illustrate this concept.	
	Melting Points: Children match materials with their melting and freezing points using the **Melting Points Activity Sheet**. Reveal the answers using the **Lesson Presentation**.	
	Melting Chocolate: Introduce the context for the investigation using the **Lesson Presentation**. Model the investigation by placing a square of chocolate in three different foil tins, and then floating the tins on trays of water, each of which has a different temperature. State that they will observe how long it takes the chocolate at each temperature to melt. Children should plan their investigation and make a prediction on their differentiated **Melting Chocolate Investigation Activity Sheet** and then conduct the investigation. Look for children who have a good understanding of how materials change state by heating and cooling. ★ Children use the pictures and underline the correct words and phrases to plan their investigation. They should present their results on a bar chart on the labelled axes. ★★ Children use the prompts to plan their investigation. They should try to explain their prediction and conclusion. They will present their results on a bar chart that requires axes labelling. ★★★ Children plan their investigation without prompts. They should refer to the behaviour of the particles in their explanations. They should present their results and label their axes, considering suitable intervals to show the time taken.	
	Freezing Chocolate: Children discuss Maya's idea on the Lesson Presentation with a partner. *Their thoughts may depend on what the weather is like, leading to discussion of the freezing point of chocolate.*	

Task*it*

***Bake*it:** Why not use some melted chocolate to make your own chocolate crispy cakes? Mix some cornflakes or rice crispies into the melted chocolate, spoon the mixture into cake cases and leave to freeze solid. Enjoy!

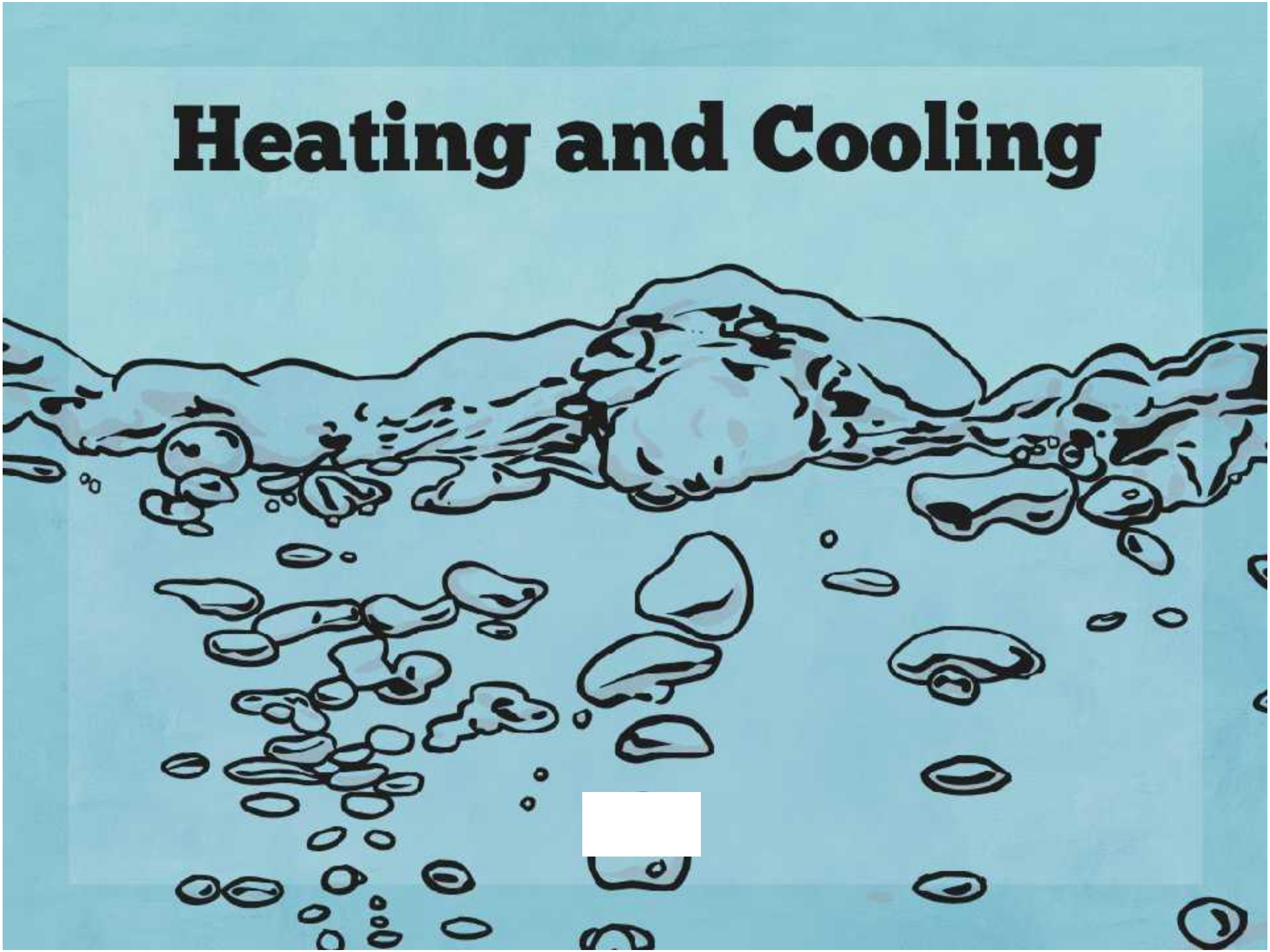
***Research*it:** Find out about how different materials are melted and their uses. For example, iron and glass.

***Make*it:** Can you make some frozen yoghurt or ice cream? Add your favourite fruits and put it in the freezer to change into a solid.

Science

States of Matter

Heating and Cooling



Aim

- I can investigate materials as they change state.

Success Criteria

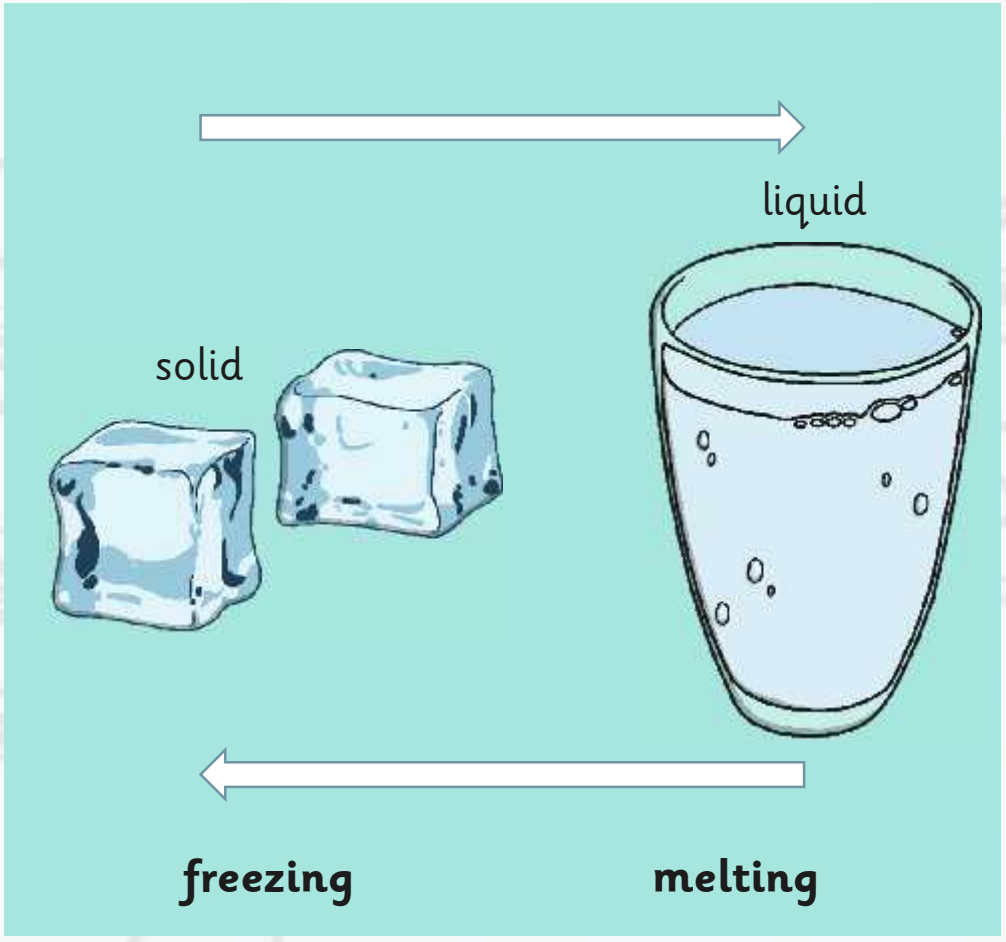
- I can understand how heat can cause solids to change to liquids and vice versa.
- I can identify materials that melt at different temperatures.
- I can investigate the melting and freezing temperature of a material.

What Makes Materials Change State?

Materials can be in three different states: solid, liquid or gas.

But how do materials change state?

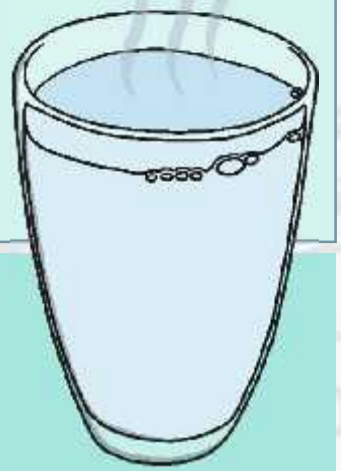
Have a look at the diagram opposite and choose the correct labels for each arrow.



What Makes Materials Change State?

When a solid turns into a liquid it is called melting.

The temperature at which a solid material melts is called its melting point. Different materials have different melting points.



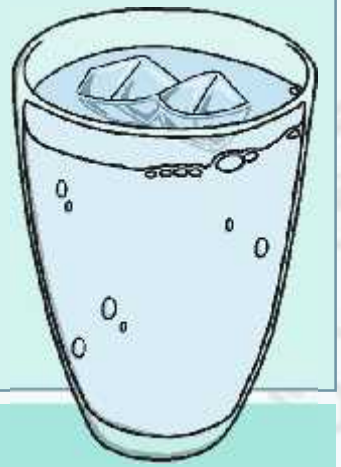
If a solid material is heated to its melting point, it will start to melt and will change state from a solid to a liquid.

In a solid, the particles are closely packed together and are vibrating on the spot. When a solid is heated, the particles start to move faster and faster. If enough heat is applied, the particles will have enough energy to move about. They are still close together, but can move over and around each other. At this point, the solid has melted to form a liquid.

What Makes Materials Change State?

When a liquid turns into a solid it is called freezing.

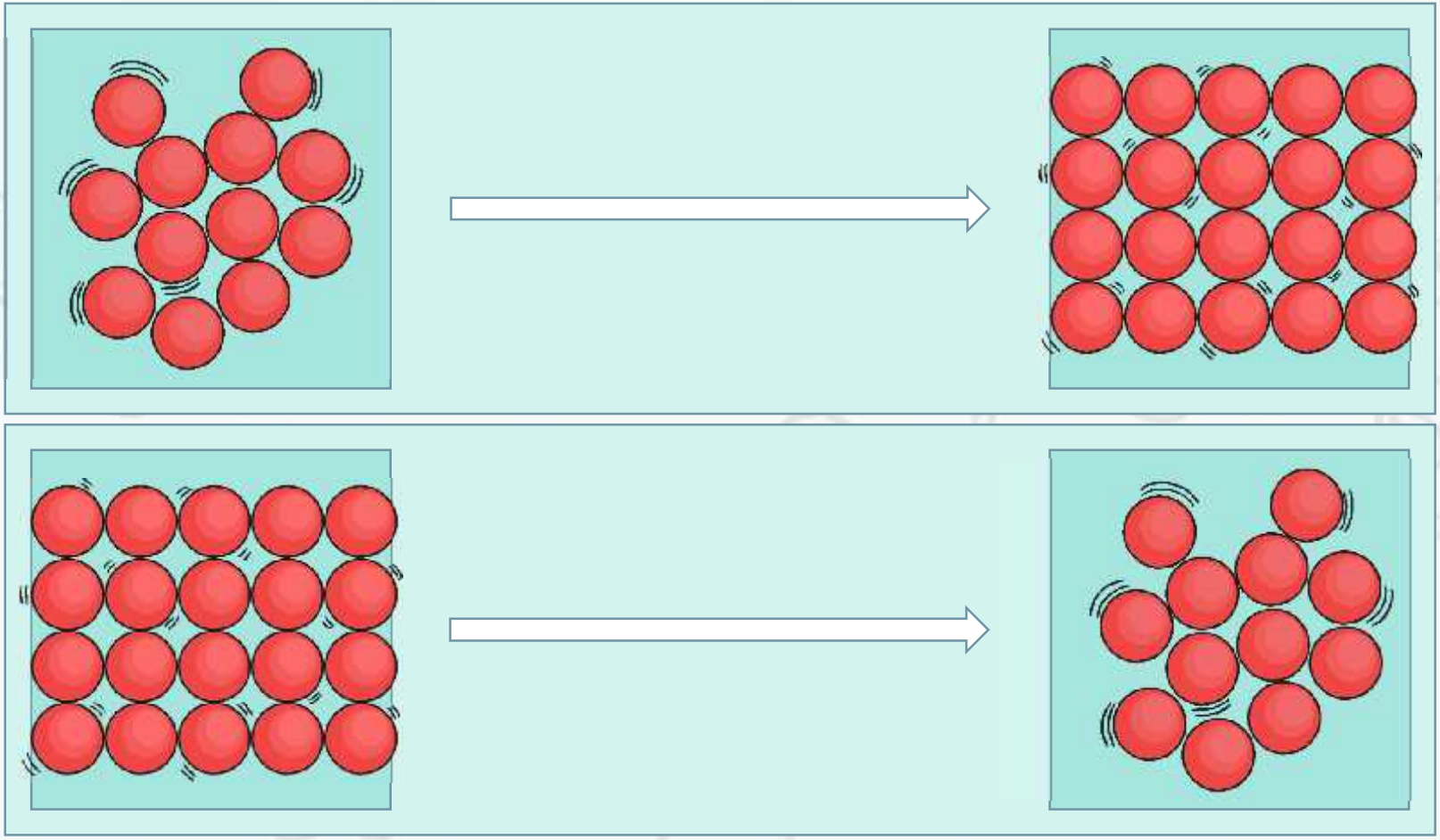
The temperature at which a liquid material freezes is called its freezing point. Different materials have different freezing points. It is important to remember that some materials have freezing points above 0°C. For example, the freezing point of iron is around 1550°C! Interestingly, this means its melting point is also its freezing point, just in reverse! Above this temperature, it will be liquid iron. Below this temperature, it will be solid iron.



If a liquid material is cooled to its freezing point, it will turn from a liquid to a solid.

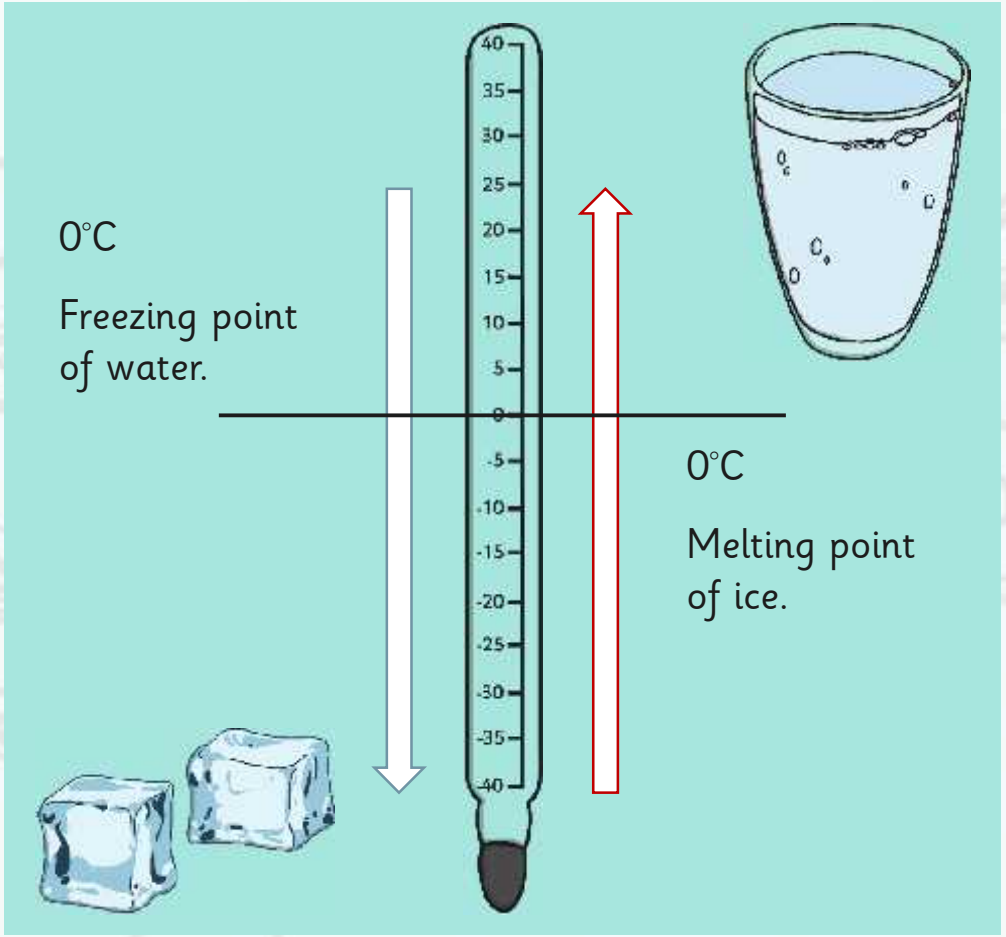
The particles in a liquid are close together, but can move quite quickly around and over each other. As it is cooled, the particles start to slow down. Eventually, they slow down so much that they only move gently on the spot, and a solid structure is formed. The material has frozen.

What Makes Materials Change State?



Melting and Freezing Points

For most materials, their melting and freezing points are the same. Although it sounds strange, think of the melting and freezing point as a barrier. If the material is heated to a temperature higher than this, it will melt. If the material is cooled to a temperature lower than this, it will freeze.



Melting Points

Can you match these materials with their approximate freezing and melting points?

wax	butter	gold
aluminium	silver	ice cream
35°C	50°C	1060°C
660°C	0°C	960°C

Melting Points

How did you do? Why would it be useful for someone to know the freezing and melting points of these materials?

wax	butter	gold
aluminium	silver	ice cream
35°C	50°C	1060°C
660°C	0°C	960°C

Melting Chocolate

This is Maya. She is getting the food ready for her birthday party, and wants to make some chocolate crispy cakes.

Her party is only a few hours away, so she needs to make them fast! She needs to know the best temperature for melting chocolate.

When she has melted the chocolate, she can then add the cereal, shape the mixture into cakes and leave them to freeze in time for her party!

Can you help her find the best temperature for melting chocolate?

Melting Chocolate

You will place a piece of chocolate in a foil tin and float each tin on a different temperature of water.

You will see how long it takes for the pieces of chocolate to melt at the different temperatures.

Complete your Melting Chocolate Investigation Activity Sheet with your ideas about the equipment you will need, how you will carry out the investigation and your prediction.

Then carry out your investigation in groups.

Freezing Chocolate

I want to make sure the chocolate crispy cakes are solid before my party guests arrive!

I am going to put them outside so the chocolate freezes and changes into a solid quicker.

Do you think Maya's idea is a good one?

Talk to your partner then share your thoughts with the class.

Aim

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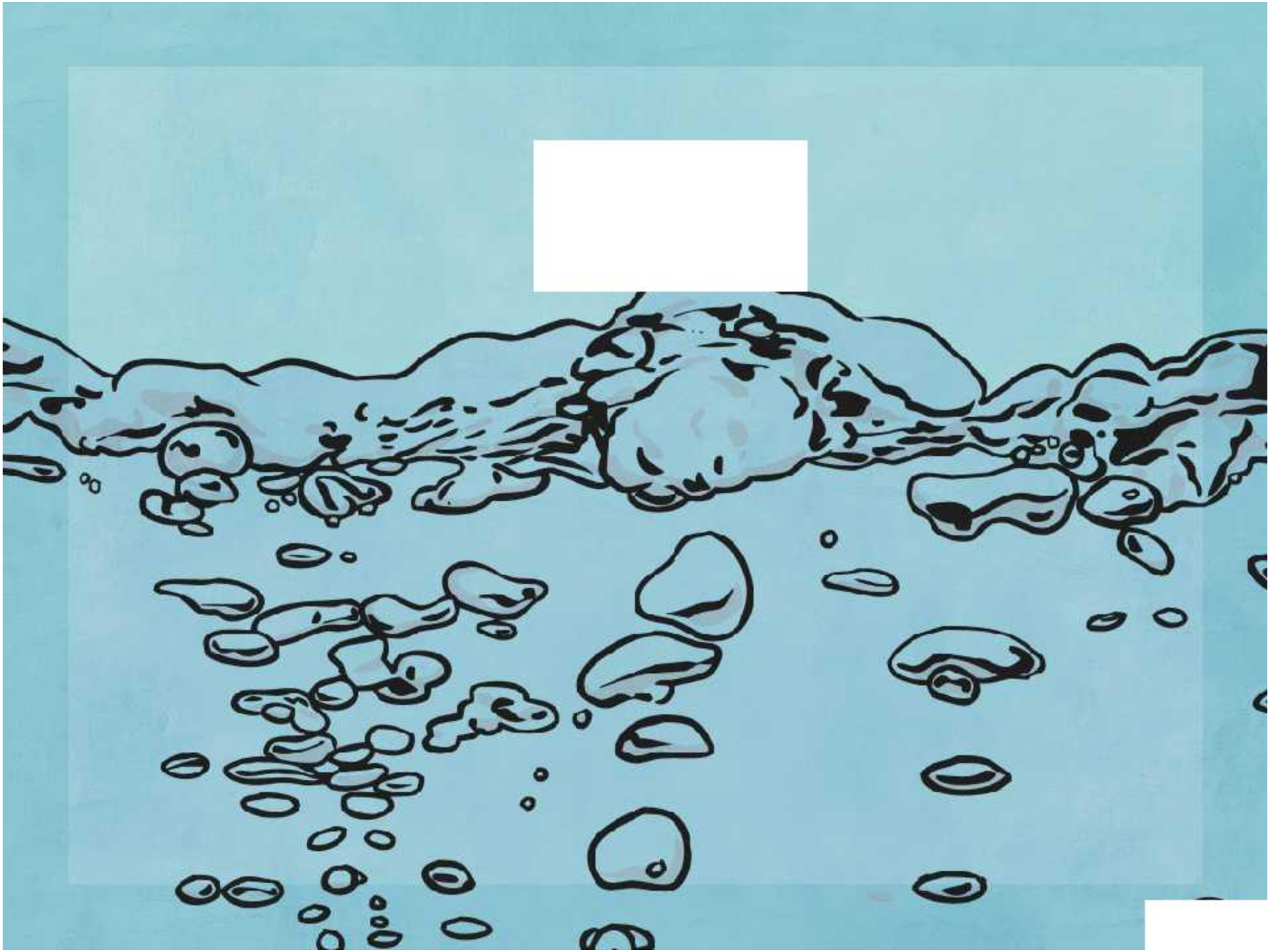
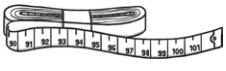
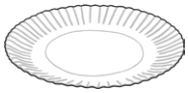
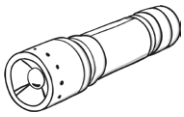
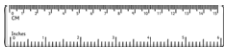
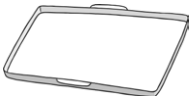


Chocolate Investigation

Can you help Maya find the temperature that melts chocolate the fastest? Plan your investigation then carry it out!

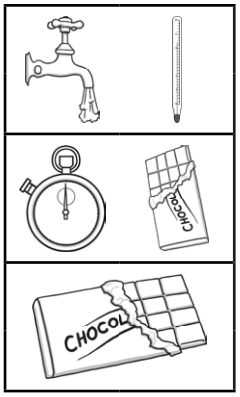
Equipment: Circle the things you will need.		
thermometer 	tape measure 	magnifying glass 
foil tins 	sand 	stopwatch 
torch 	chocolate 	water 
ruler 	pipette 	trays 

You will float the pieces of chocolate in foil tins on trays filled with different temperatures of water. Underline the correct words or phrases below to show how you will make sure your investigation is reliable.

I will make sure each piece of chocolate is the same/a different size. I will use the same/different amounts of water in each tray. The temperatures of the water in each tray should be the same/different.

What will you measure and observe in this investigation? Use the pictures to help you.

I will measure the...



I will measure the...

I will observe the...

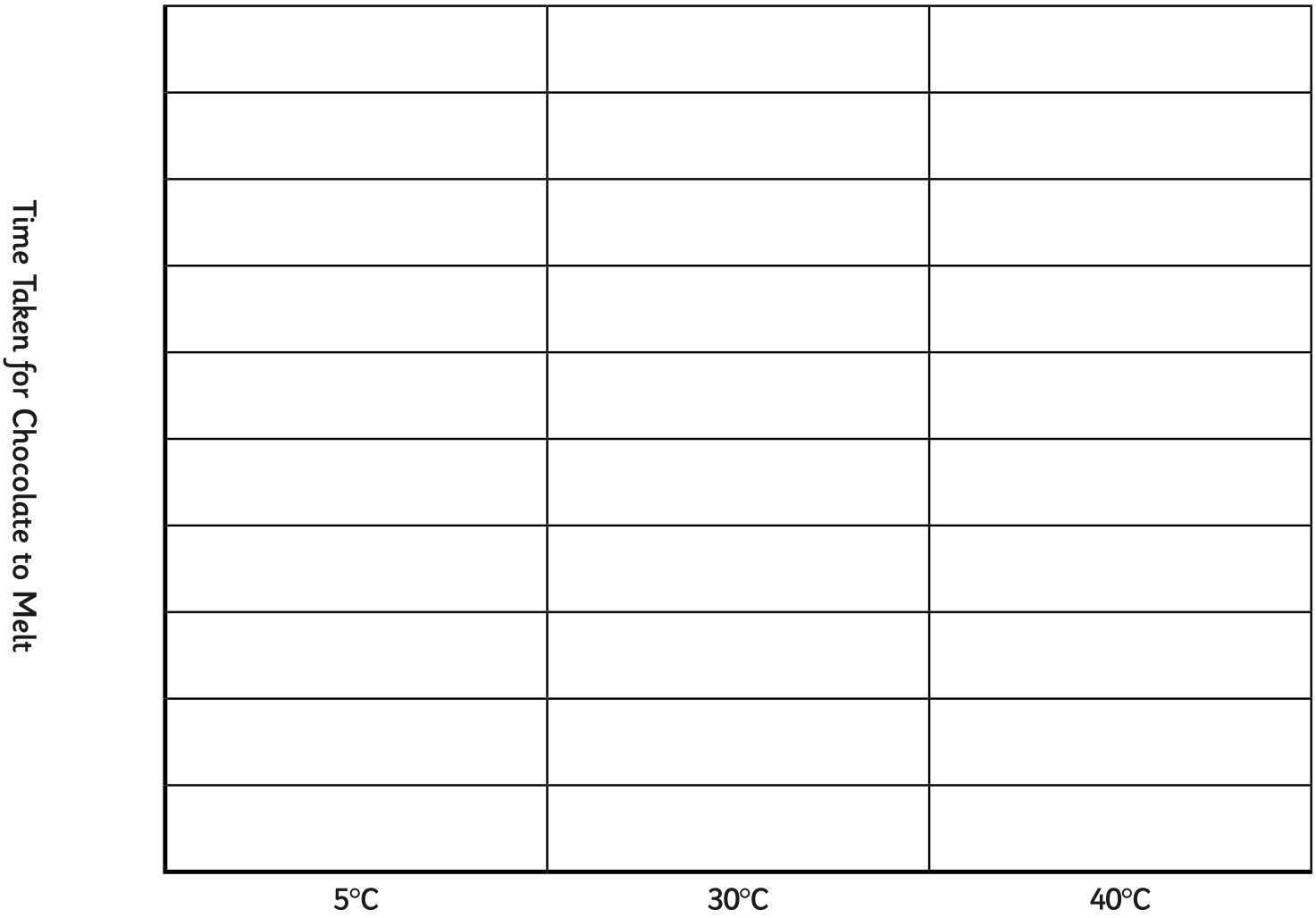
What do you predict will happen? Which temperature of water will melt the chocolate fastest?

Chocolate Investigation

Complete this table with your results:

	Tray 1	Tray 2	Tray 3
Temperature of water			
Time taken for chocolate to melt			

Draw a bar chart using your results:



What is your conclusion? Can you tell Maya which temperature melts chocolate the fastest?

Use these words to help you.

chocolate	water	hot	cold	faster	slower	shorter	longer

Chocolate Investigation

Can you help Maya find the temperature that melts chocolate the fastest? Plan your investigation then carry it out!

Equipment: Draw or write the things you will need.

You will float the pieces of chocolate in foil tins on trays filled with different temperatures of water. How will you make sure your results are reliable? Think about what you will keep the same and what you will change.

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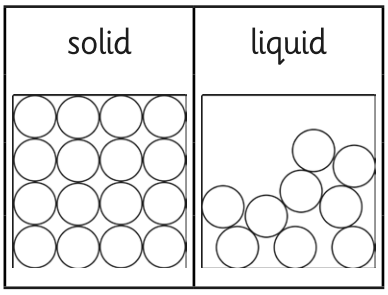
What do you predict will happen? Which temperature of water will melt the chocolate fastest? Why do you think this will happen? Refer to the behaviour of the particles in the pieces of chocolate in your answer.



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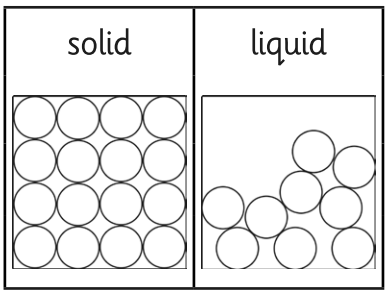

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Melting and Freezing Points

I can identify materials that melt at different temperatures.

Can you match these materials with their approximate freezing and melting points?

wax	butter	gold	aluminium	silver	ice cream
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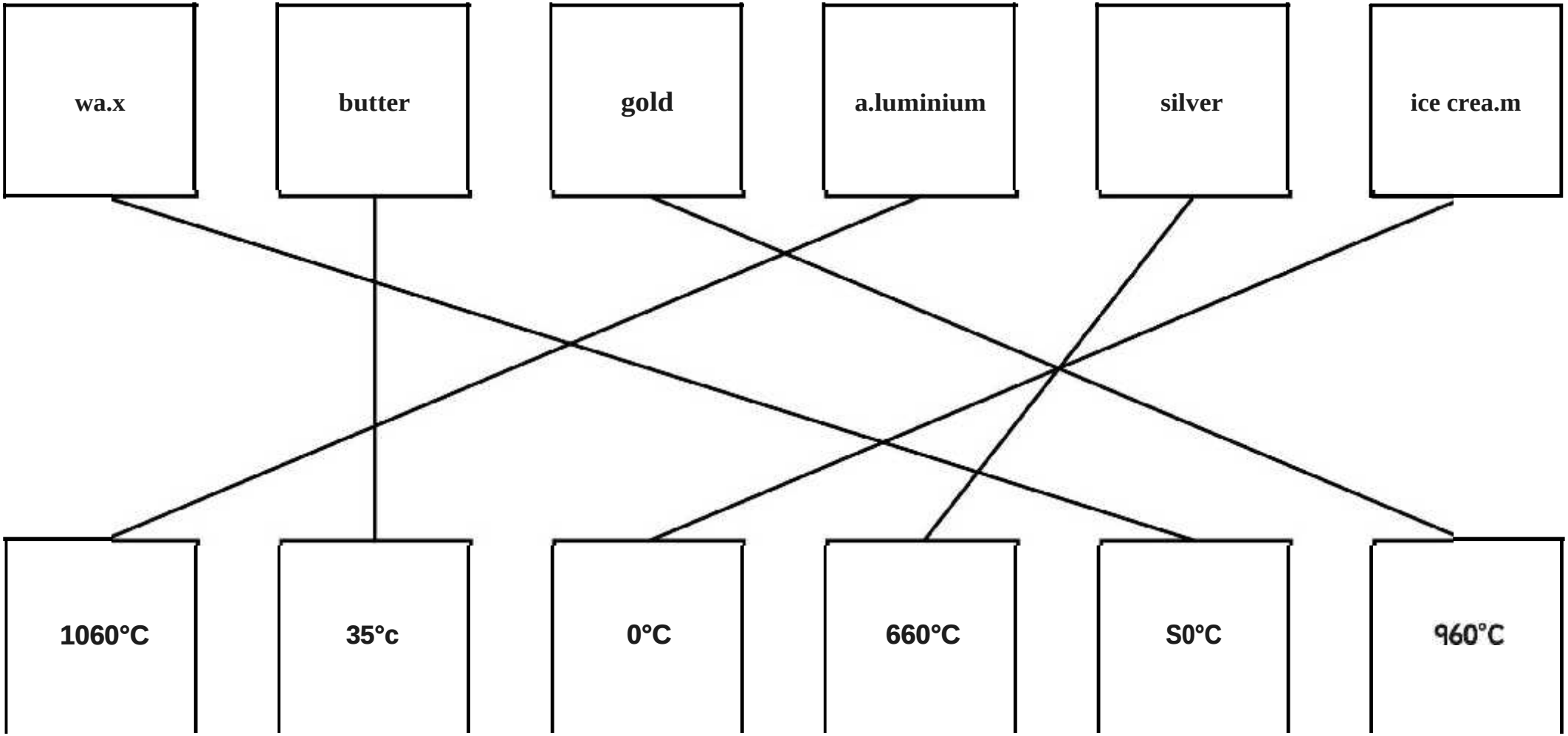
Why would it be useful for someone to know the freezing and melting points of these materials?

Melting and Freezing Points Answers



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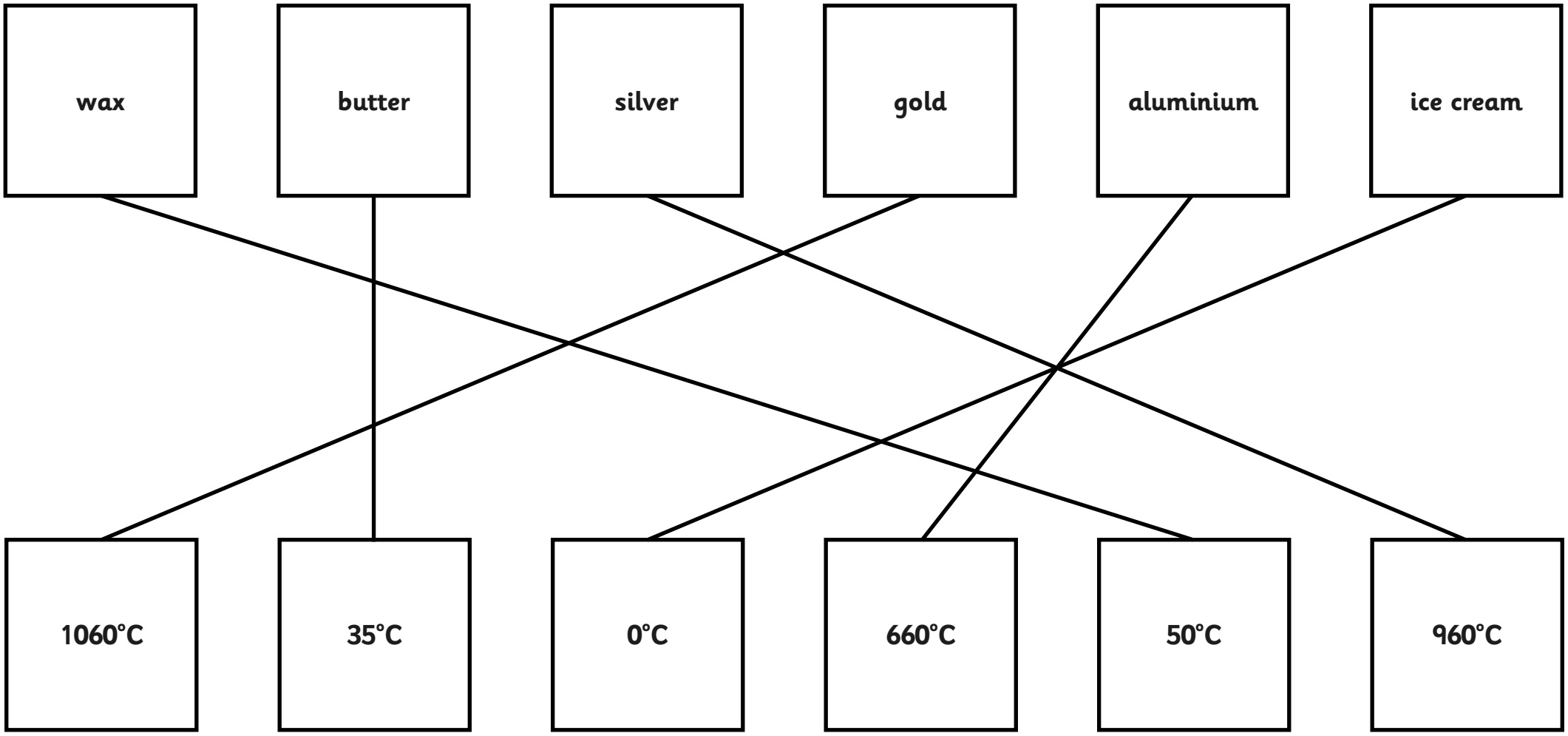

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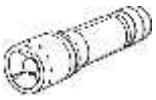
foil tins 	sand 	stopwatch 
torch 	chocolate 	water 
ruler 	pipette 	trays 

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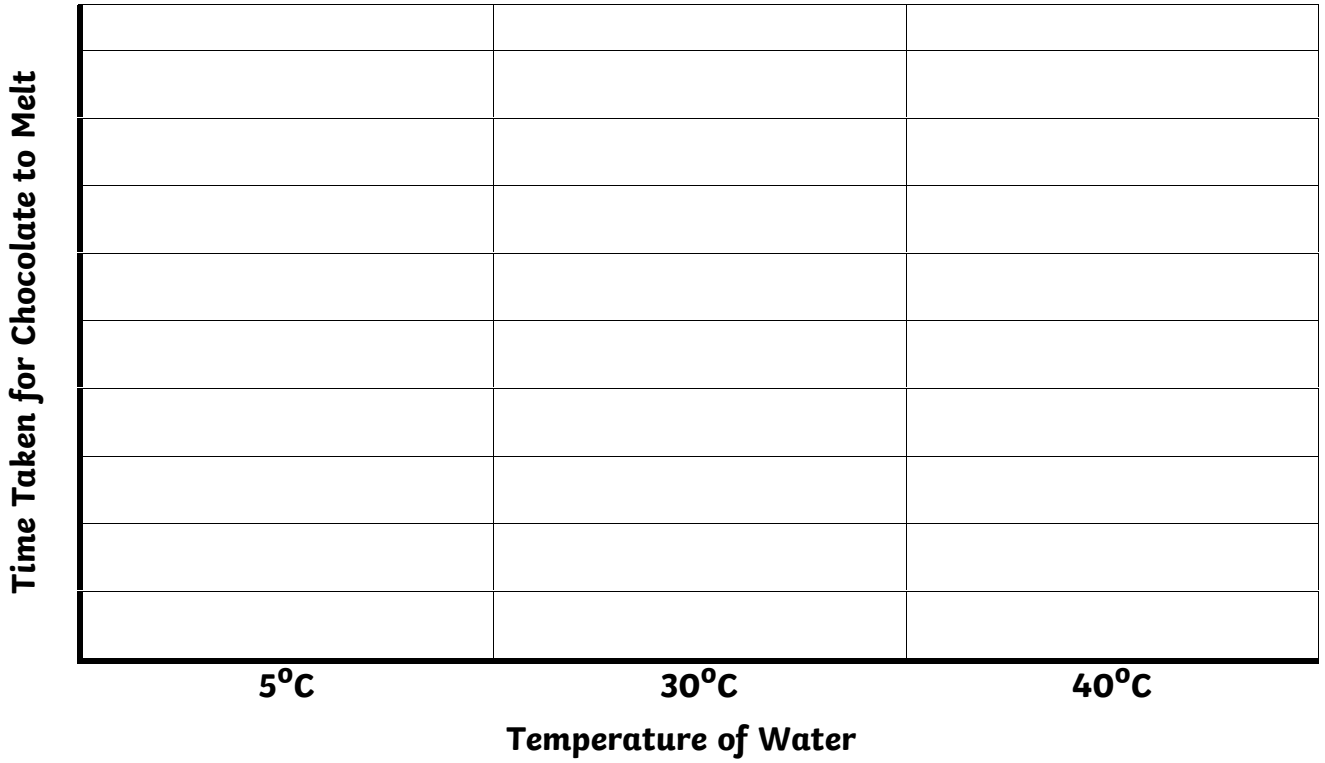

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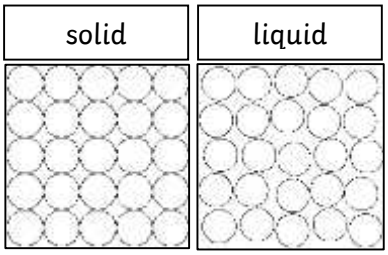

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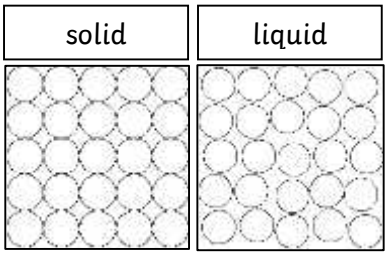

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