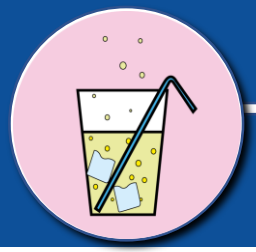
Properties and changes of materials

Understanding that changes of state are reversible

Science Week 5
Tuesday 2nd February 2021



Properties and changes of materials

Understanding that changes of state are reversible

Key Learning

- **Melting** is a **change of state** from solid to liquid. **Freezing** is a change of state from liquid to solid.
- **Boiling** and **evaporation** are both a change of state from liquid to gas. **Condensation** is a change of state from gas to liquid.
- All **changes of state** are **reversible**.

I can…

- observe and describe changes of state, including melting, freezing, evaporating and condensing.

Activities (pages 4-10): 30 - 40 mins

Household items to support learning:

- Chocolate drops or small chocolate bar
- Clear plastic or glass cup
- Kitchen foil
- Hot water* (*hot tap water - no more than 50°C)
- Use lined paper and a pencil for recording. *Alternatively you may wish to print page 7 as a worksheet.*

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Glossary of terms - DEFINITIONS

States of matter: There are three **states of matter**: **solid**, **liquid** and **gas**.

Change of state: **Changes of state** can occur when solids, liquids and gases are heated or cooled. For example, a solid can be heated and change to a liquid.

Melting: **Melting** is a **change of state** from solid to liquid.

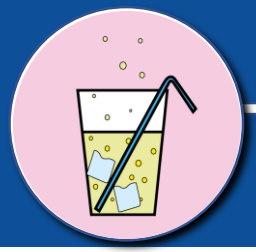
Freezing: **Freezing** is a **change of state** from liquid to solid.

Boiling: **Boiling** is a change of state from liquid to gas which happens **at a specific temperature.** When a liquid is boiling, bubbles of the gas can be seen inside the liquid. Water boils when it is heated to 100^{o}C.

Evaporation: **Evaporation** is a change of state from liquid to gas which can happen **at any temperature** and only at the surface of the liquid.

Condensation: **Condensation** is a change of state when a gas is cooled and changes to a liquid.

Reversible: A **reversible** change can be undone or reversed; no new materials are formed. A change of state is a **reversible** change.



Explore, review, think, talk…

What do you already know about melting and freezing?
(5 minutes)

Talk or think about these questions:

- *Can you name some substances that melt easily?*
- *What does 'melting point' mean?*

Now watch this BBC clip:
https://www.bbc.co.uk/bitesize/topics/zkgg87h/articles/z9ck9qt

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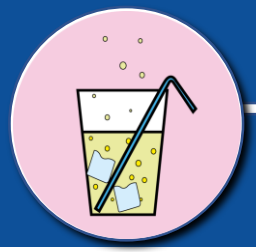

Explore, review, think, talk...

What do you already know about melting and freezing?
(5 minutes)

Melting is a **change of state**. A solid material is *heated* and becomes a liquid.

- Ice melts at zero degrees Celsius (0°C). This is the **melting point**.
- Chocolate melts at about 30°C.
- Iron melts at about 1500°C!

Freezing is also a **change of state**. A liquid is *cooled down* and changes to a solid.

melting

freezing

Solid chocolate can be melted to a liquid and then frozen to a solid. The change is **reversible**.

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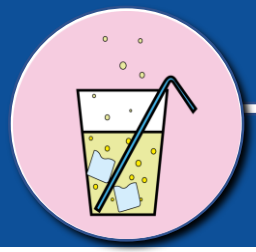

Explore, review, think, talk...

What do you already know about boiling, evaporating and condensing?
(5 minutes)

What is happening in these pictures?

- *Think or talk about what you see when you heat water in a pan.*
- *What do you think is in the bubbles at the bottom of the water in this kettle?*

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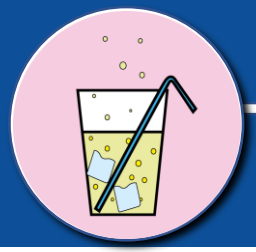

Explore, review, think, talk...

What do you already know about boiling, evaporating and condensing?
(5 minutes)

- When liquid water is heated it turns into a gas called **water vapour**.

- Water **evaporates** from the surface of the liquid as it is warmed.

- In **boiling water** you can see bubbles of water vapour forming in the liquid.

- Water vapour is invisible but it often **condenses** in the cool air above a pan, a kettle or cup of tea, forming tiny droplets of **steam**.

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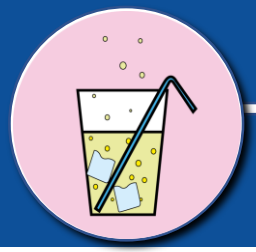


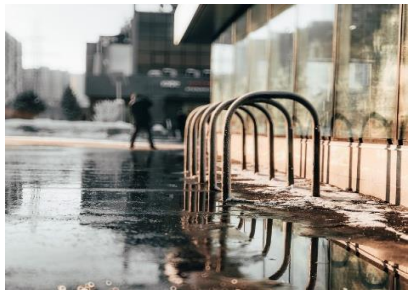
Changes of state are reversible

Understanding why a change of state is a reversible change
(10 minutes)

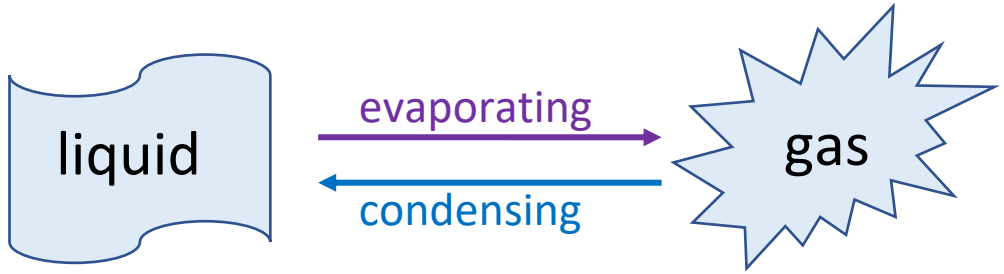
Boiling and **evaporation** are both changes of state when a **liquid changes into a gas**.

- **Boiling** happens when a liquid is heated to a **specific temperature** and **bubbles of the gas can be seen in the liquid**. Water boils at 100°C.

- **Evaporation** can happen **at any temperature.** Gas evaporates from the **surface of the liquid**, for example from the surface of puddles after rain.



- Watch this clip: https://www.bbc.co.uk/bitesize/topics/zkgg87h/articles/zydxmnb



Evaporation and **condensation** are examples of a **reversible** change.

- Liquid water is *warmed up* and changes to an invisible gas, water vapour.
- Water vapour can *cool down* and change back to water droplets.

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Observe and describe changes of state by investigating melting chocolate. Ask an adult to work with you.

You will need:

- Chocolate drops (or a small chocolate bar & knife)
- A clear plastic or glass cup
- Kitchen foil
- A cocktail stick or teaspoon
- Hot water* (*hot tap water, no more than 50°C)




Step 1:

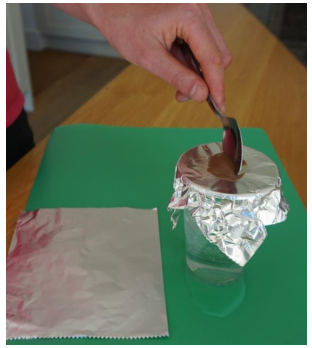
- Cut a square of kitchen foil large enough to fit over your cup.
- Fill the cup about ¾ full with hot water*. Place it on a flat surface.
- Put the foil carefully over the top of the cup and fold down the sides to make a lid.

Step 2:

- Cut one cube of your chocolate into 4-6 pieces (or use chocolate drops).
- Put the pieces onto the foil lid.
- Watch for a few minutes. You may like to touch the foil gently.
- Stir the chocolate carefully with a cocktail stick or teaspoon.

Step 3:

- Scoop the melted chocolate off the lid and transfer it to another fresh piece of foil.
- Take the foil lid off the cup and turn it over. What can you see?
- Put the chocolate in a fridge/cool place for an hour then look at it again.



The water and the chocolate have both changed state!

- Some of the warm water **evaporates**.
- The water vapour spreads out and some **condenses** on the underneath of the foil lid. This warms the foil.
- The chocolate **melts** on the warmed foil.
- The chocolate **freezes** again in the fridge/cool place.

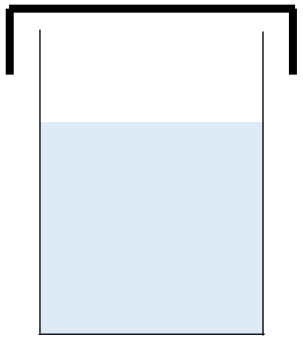
Use this worksheet or your own labelled diagrams to *describe and explain* each change of state taking place.

I can observe and describe changes of state.

1. *Draw the chocolate on the diagrams and add labels.*
2. *Explain what happened to some of the **water.***
3. *Explain what happened to the **chocolate**.*

Word bank: evaporate, condense, melt, freeze, liquid, solid, gas, heat, warm, cool.

During the investigation



After an hour in a cool place

Find out more...

Find out more about melting chocolate or try making chocolate ice cream!

THIS CHALLENGE IS OPTIONAL

In this Royal Society clip, Brian Cox explores chocolate making:

https://www.youtube.com/watch?v=OnE_84GtPdU&list=PLg7f-TkW11iV563gfcXjRlafm2jlklQOc&index=12&t=0s

Why does the chocolate maker check the temperature of the liquid chocolate?

How do you make a 'perfect bar' of creamy chocolate?

Ask an adult if you can try freezing chocolate milk to make ice cream with them:

- Use the link to the RSC's Chemistry in your Cupboard 'Making ice cream' activity.

https://www.youtube.com/watch?v=-JcNMN0uvvE

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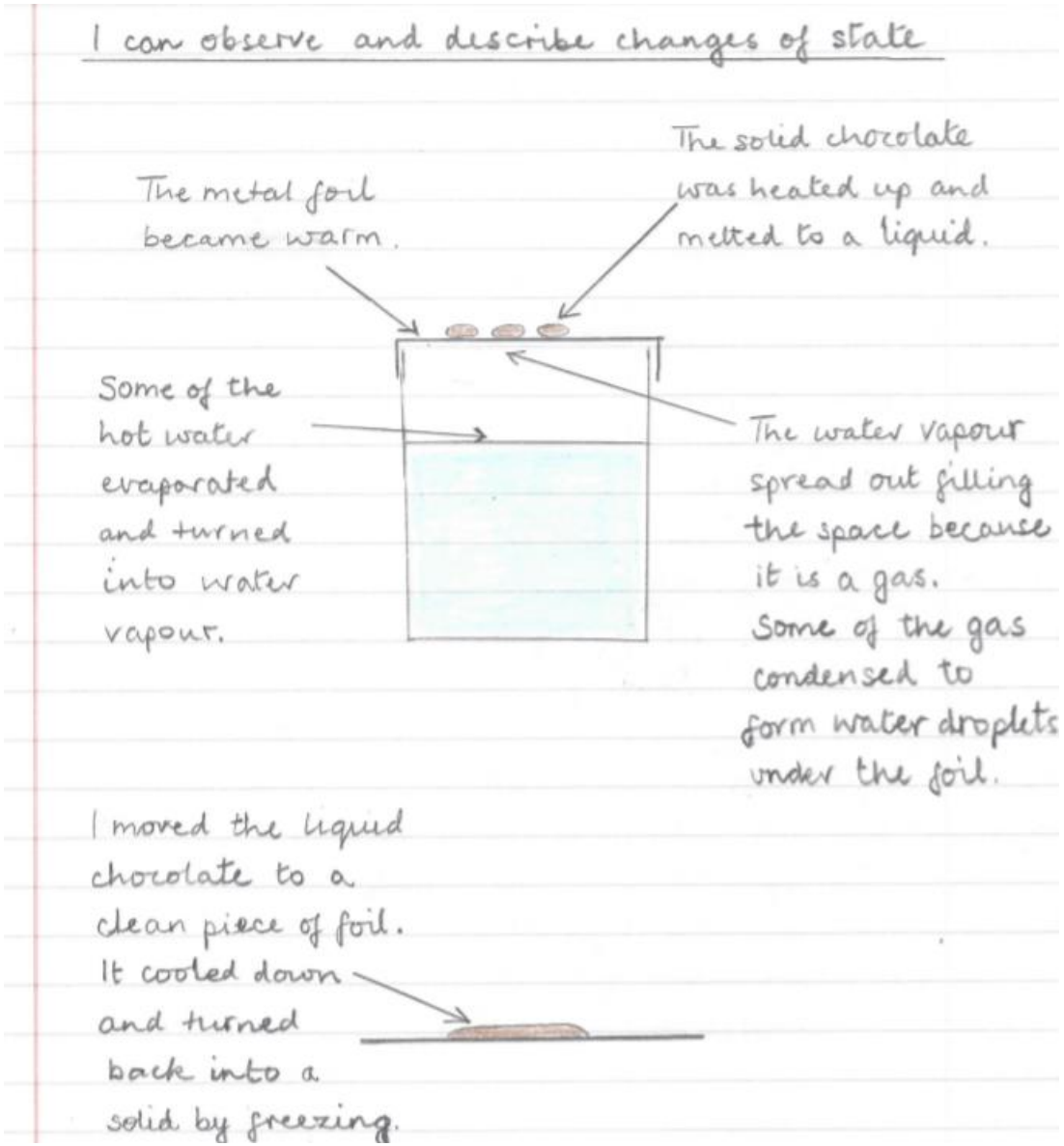
Some of the hot water will evaporate. The water vapour spreads out. It reaches the foil and condenses, warming the foil.

The foil is metal, a good thermal conductor. The warmth can travel through the foil and start to melt the chocolate.

When chocolate is stirred gently, it makes a 'pool' of liquid chocolate which spreads over the foil.

THIS IS WHAT YOU MAY HAVE REOCORDED. CHECK YOUR WORK WITH THIS EXAMPLE.



The liquid chocolate can be transferred to a clean piece of foil for cooling down.

When you take off the foil lid, you can see water droplets on the under side of the foil. The water vapour has condensed to form liquid water.

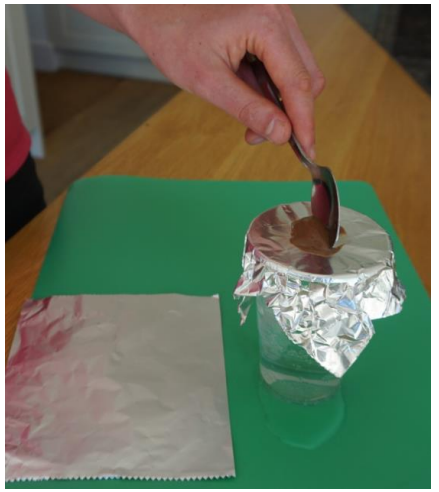
The liquid chocolate will freeze on the cool foil. It will freeze faster in a fridge.

Additional pictures and notes for reviewing your investigation

Some of the hot water will evaporate. The water vapour spreads out. It reaches the foil and condenses, warming the foil.

The foil is metal, a good thermal conductor. The warmth travels through the foil and starts to melt the chocolate.

Eventually all the solid chocolate melts to form liquid chocolate. It can be stirred gently to make a ‘pool’.



The liquid chocolate can be scooped off the top. The foil feels warm if you touch it.

The liquid chocolate can be transferred to a clean piece of foil for cooling down.

When you take off the foil lid, you can see water droplets on the underneath of the foil. This is condensed water.

The chocolate will freeze on the cool foil. Freezing can be speeded up by putting the chocolate in a fridge.