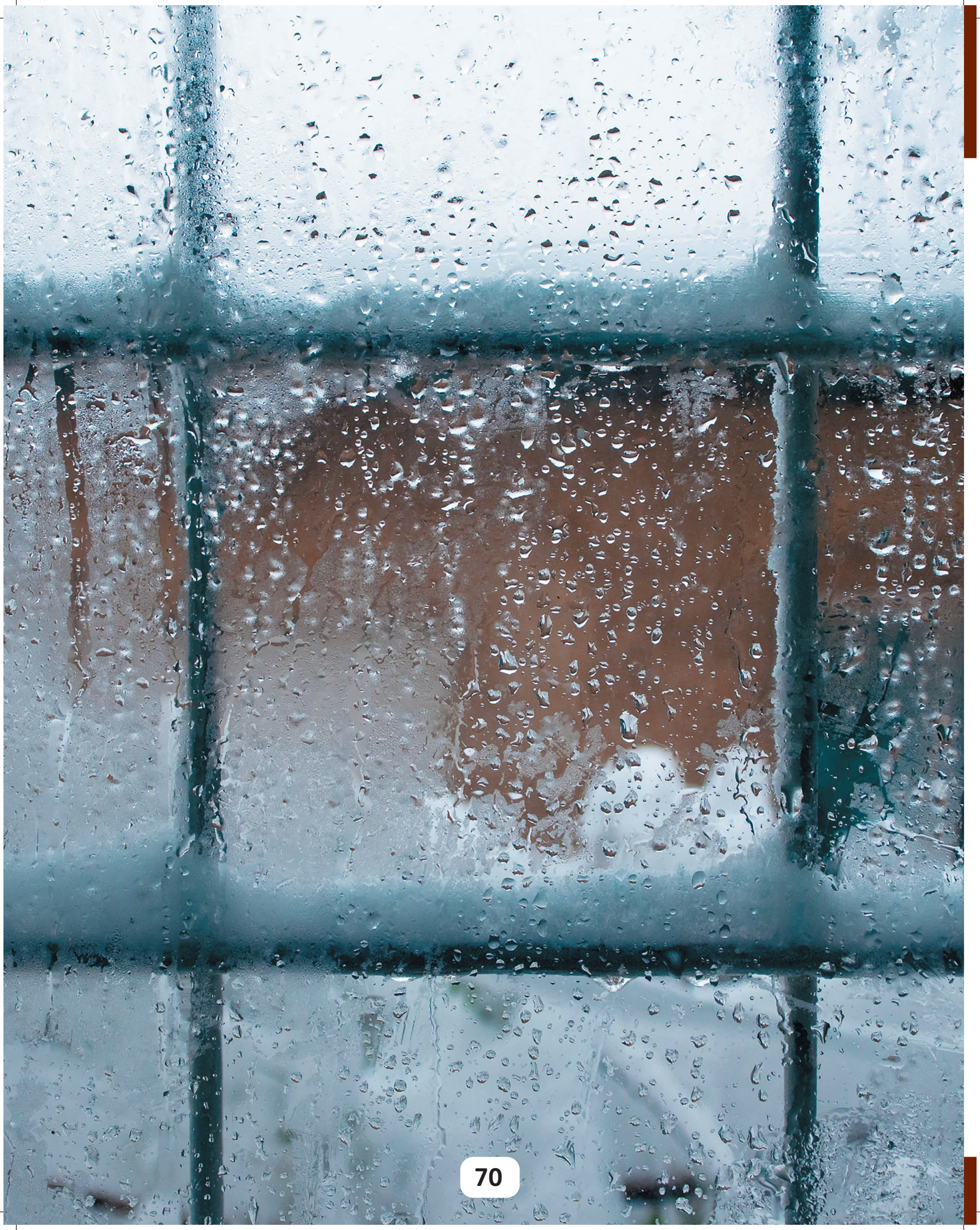


4 Solids, liquids and gases

Solids, liquids and gases have different properties. Let's look at some of them.

Materials can be solids, liquids or gases.

We call these states of matter.

When a solid is heated it can change state, first to a liquid and then to a gas.

When a gas is cooled it can change state, first to a liquid and then to a solid.

Look at the ice cubes in the picture. This is what water looks like when it is a solid. Can you see liquid water in the picture?

Can you see drops of water on the sides of the jug? We call this condensation.

Solids

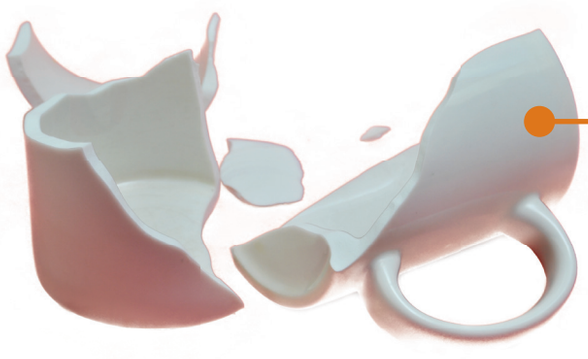
These objects are **solids**. They all have a fixed shape.






Solids keep their shape.

We can use a force to change the shape of a solid, but it is difficult to do.



This mug is broken, but you can still see the shape of a mug.

Look at the other solid objects.

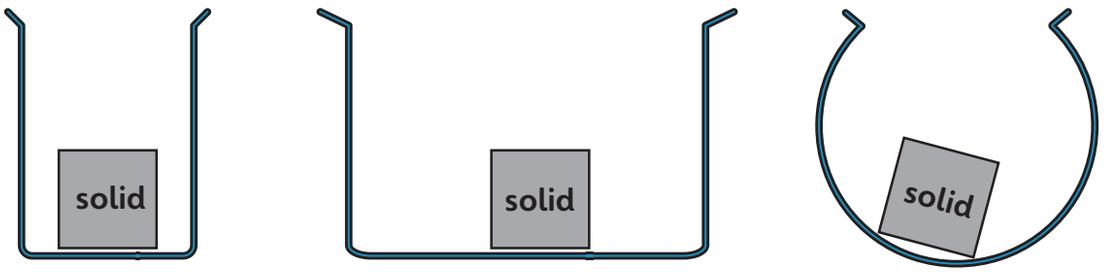
Do you think you could change their shape easily?

pouring water

Water is a not a solid.

We cannot pour solids.

Solids keep their shape in different containers.
Their size stays the same.



Solids cannot be compressed.

Compressed means **squashed** together.

Look at this solid wooden box.
The girl is stepping on it, but it does not compress.

Key words

solids | keep | pour | containers | compressed | squashed

Liquids

Each of these glasses **contains** a **liquid**.

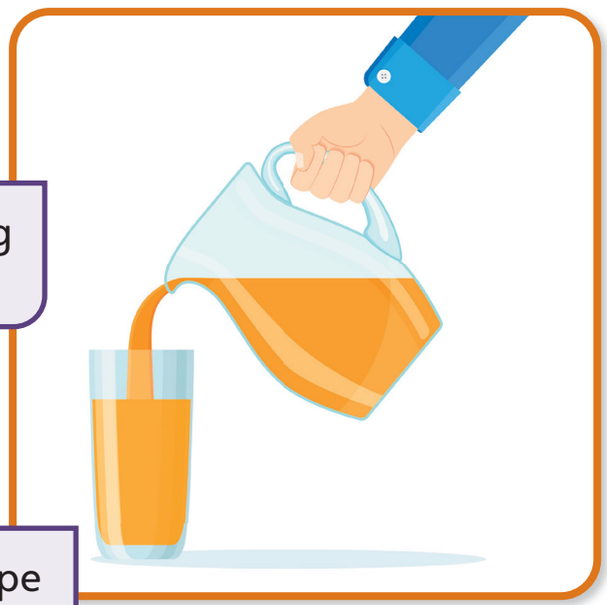
milk

water

orange juice

Each liquid takes the shape of the glass.

Liquids can be poured.



The **juice** in the jug is being poured into the glass.

The juice changes shape.

Now the juice takes the shape of the glass, not the jug.

Juice that does not go into the glass spreads out and makes a **pool**.

Liquids change their shape.
They take the shape of their containers.

Scientists put liquids in lots of different containers.

Which are beakers?

Liquids can flow.

This liquid is not in a container.
It is difficult to hold.

This liquid flows from one hand to the other.

Some liquids flow faster than others.

Liquids cannot be compressed easily.

Key words

contains | liquid | juice | pool

Gases

The **air** around us is a gas. We cannot see air but we can find evidence that it is there.

Blow some air onto your hands.

Can you feel the air on your hands?

This child is **blowing** air into the **straw**.

It makes **bubbles** in his drink.
The bubbles are full of air.

Try blowing bubbles like this.

You are putting air into each bubble.

There is some air inside this **balloon**.
The air can be compressed.

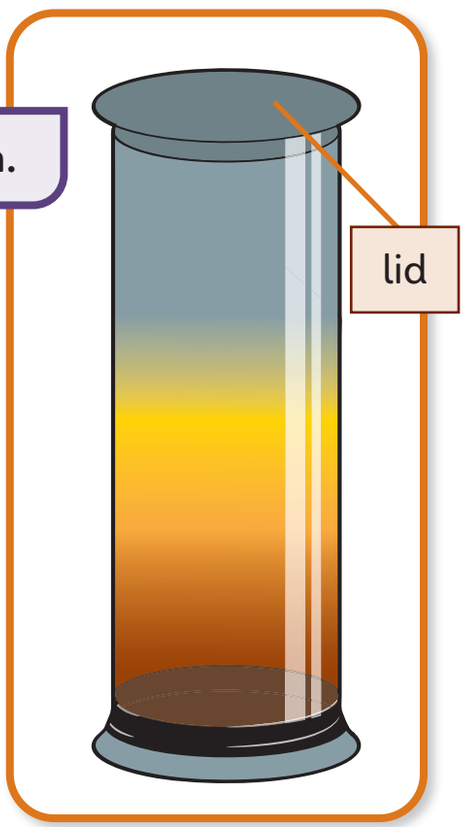
A gas can be compressed.

A gas can change shape.

This balloon has a gas called **helium** inside it.

A gas can be poured into a container.

Gases move around and fill the space they are in.



Some scientists work with this brown gas.
Predict what happens if they take the lid off.

Key words

air | blowing | straw | bubbles | balloon | helium

Solid, liquid or gas?

Let's look for some solids, liquids and gases.

Find six things in your classroom that are solids.

Now look for some liquids. These are a bit harder to find.

Can you think of any gases in your classroom?

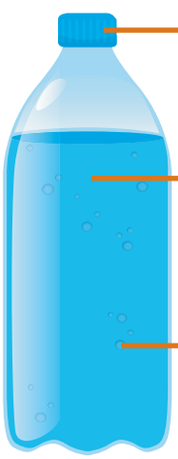
There is one all around you.

Look what I have found.

It has all three!

Fizzy liquids have bubbles of gas in them.

They are put into solid containers.



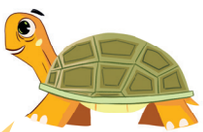
Look at this sand.

sand

Compare it to this liquid.

liquid

Sand looks a bit like a liquid.



Sand is not a liquid.
Look closely at the sand.

Each **grain** is a **tiny** solid.

Sand makes a **pile**.
It is a pile of lots of tiny solids.

Liquids do not make a pile. Look at the orange juice on page 74. Liquids make a pool, not a pile.

Key words

fizzy grain tiny pile

Comparing liquids

Have you tried to pour **syrup** or **honey**?

Both liquids flow very slowly. They are **viscous**.

Can you think of any liquids that flow more quickly? Are you sure they do?

I think you need evidence.

Here is a scientific question to investigate: 'Which is the most viscous liquid?'

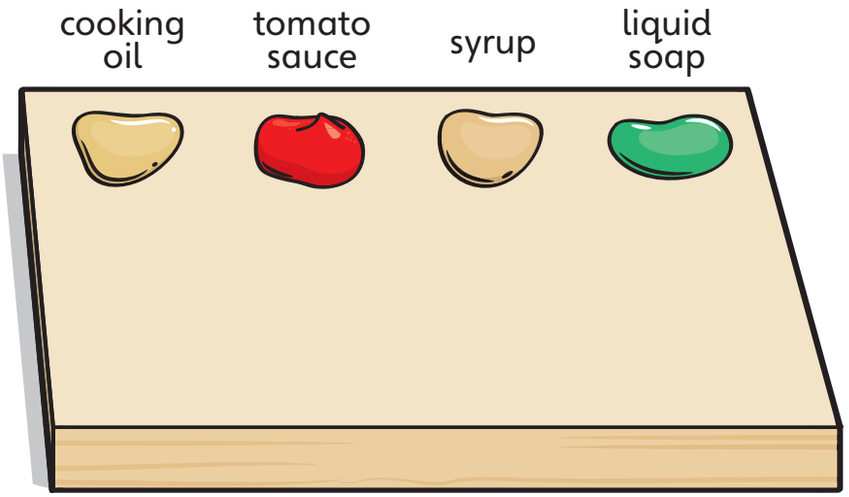
You are changing the liquid, so everything else must be the same.

What will you observe or measure?

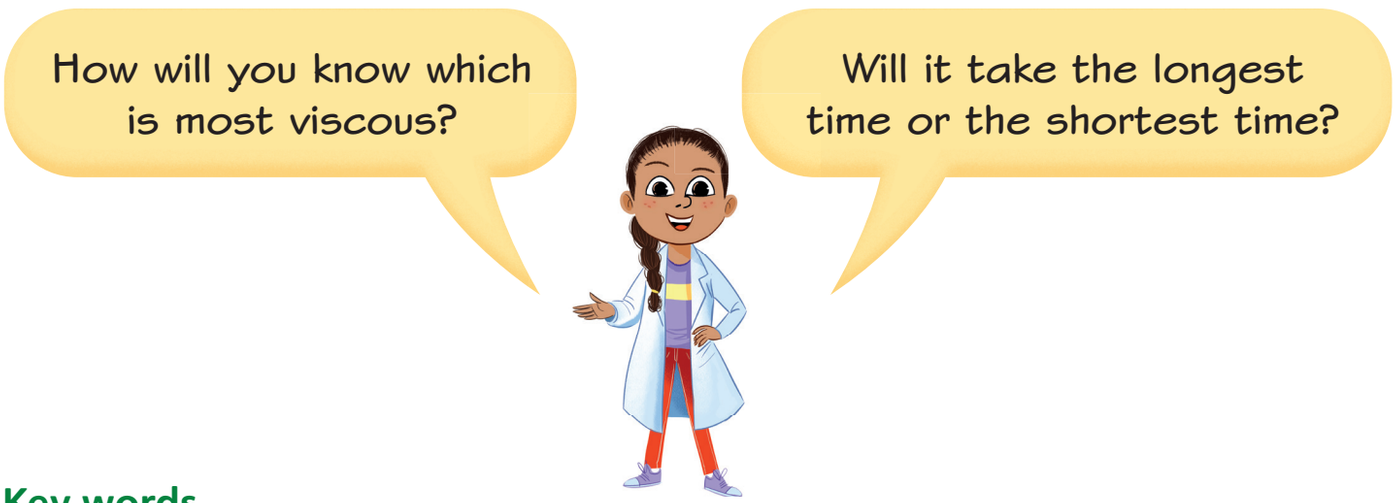
Liquid race investigation

You will need:

- four liquids (you could try cooking oil, tomato sauce, syrup and soap)
- a plate or board.



1. Put a small amount of each liquid in a line at the top of a board.
2. Predict which liquid will reach the bottom first.
3. Slowly tip the board until the liquids start to move.
4. See which liquid reaches the end first.
5. Write down your results.

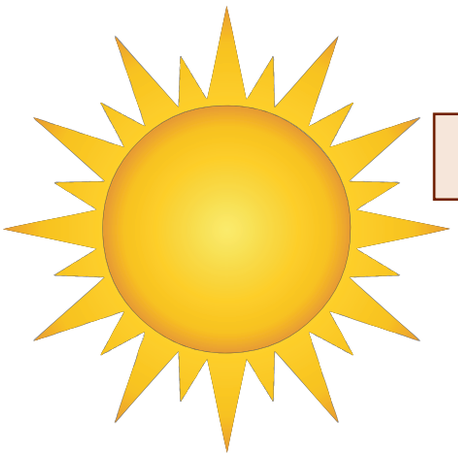


Key words

syrup | honey | drip | viscous

Temperature

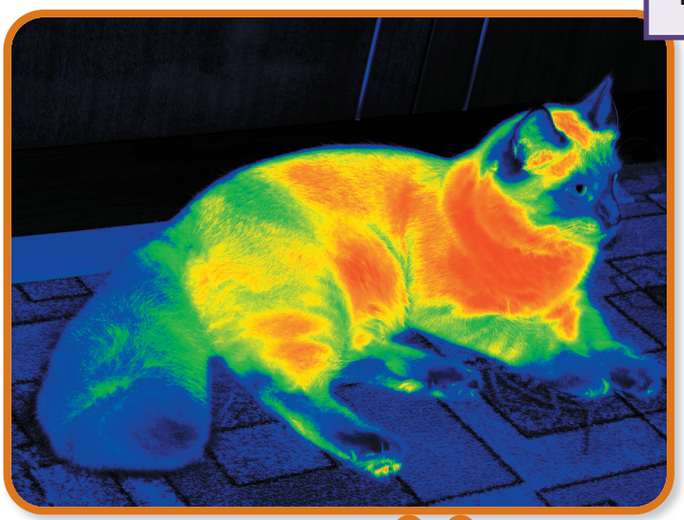
Temperature is a measure of how **hot** or **cold** something is.



hot

cold

This picture of a cat shows where it is hot and cold.



Red shows the hottest parts of the cat.

Blue shows the coldest parts.

Which parts of the cat are coldest?

Which are hottest?

We know which parts of the cat are hotter than other parts.

But is the cat hotter than me?

To find out how hot or cold something is, we need to measure its temperature.

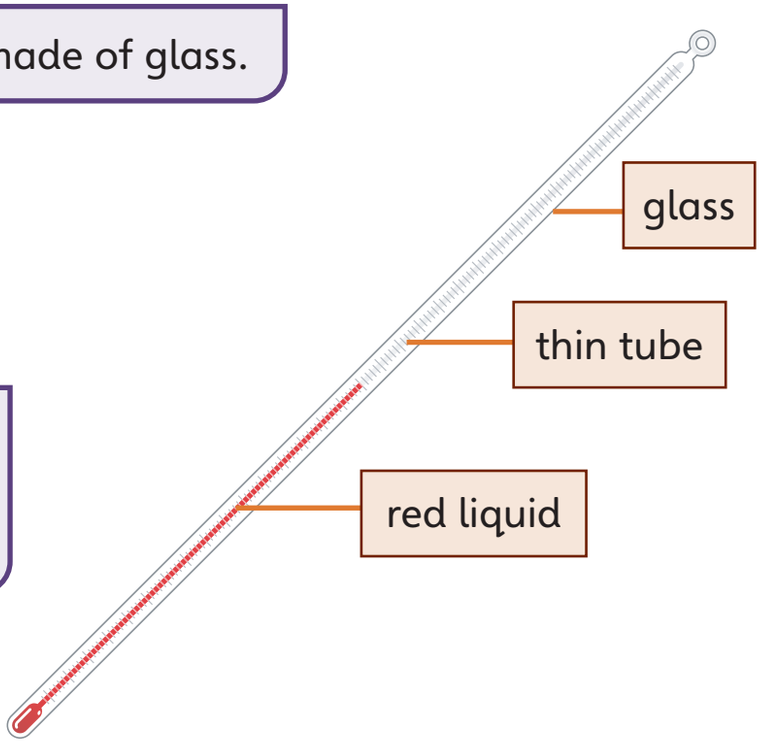
We measure temperature using a piece of equipment called a **thermometer**.

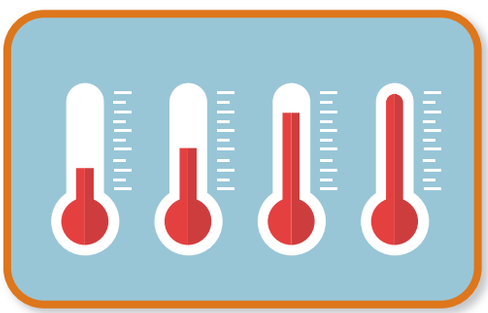
This thermometer is made of glass.

There is a liquid inside. It is usually red.

As the red liquid gets hotter, it takes up more space.

It moves up the thin tube.





increasing temperature

Think about why a **thin** tube is used.

Key words

temperature | hot | cold | thermometer | increasing

Using a thermometer

We use a thermometer to measure temperature.

The unit for measuring temperature is **degrees Celsius**.
We write the unit like this:

°C

small circle at the top in front of the C

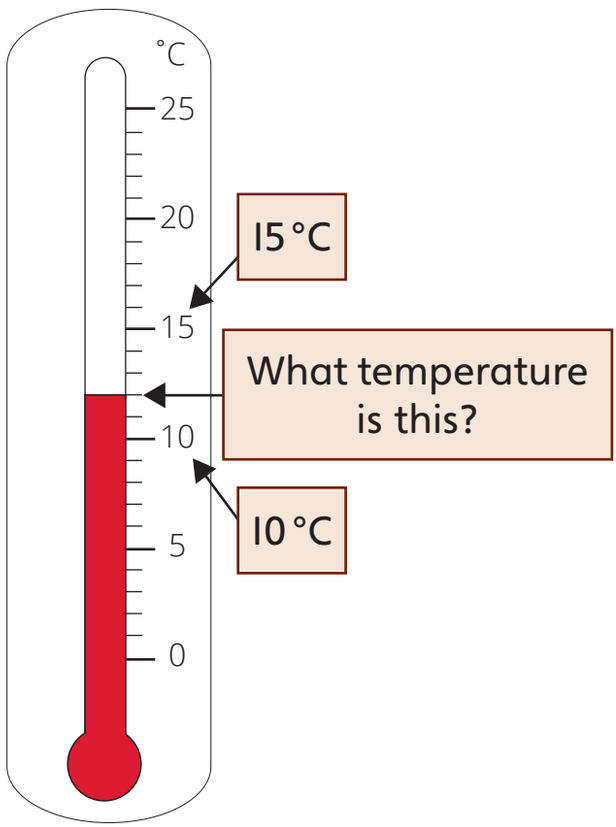
capital letter C for Celsius

The small circle means degrees.

A thermometer has a **numbered scale** on it.

We look at the numbers to see what the temperature is.

We look at the top of the red liquid.



What is the highest temperature this thermometer can measure?

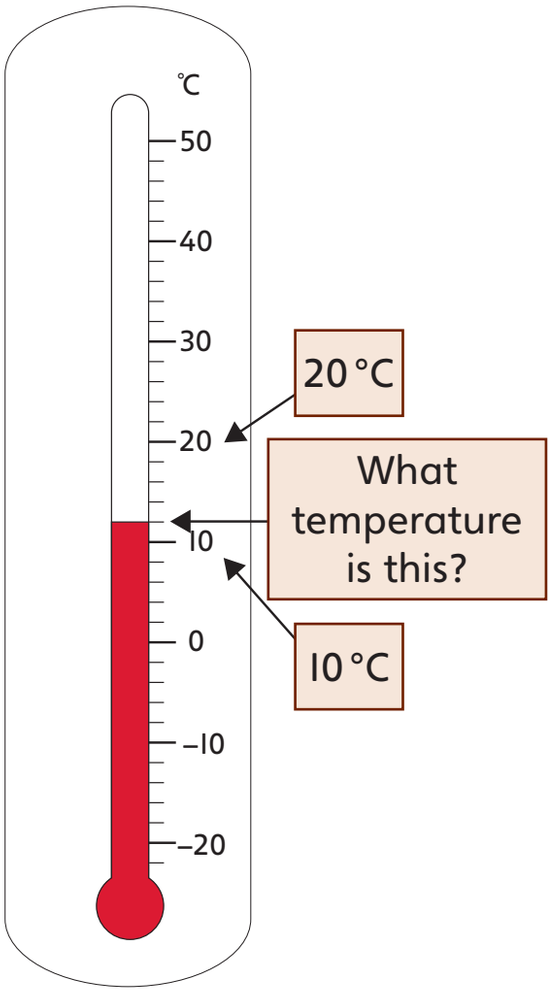
This thermometer has a different scale.

When you use a thermometer, make sure you know what the scale is before you start to use it.

It can also measure very cold temperatures.
There are numbers **below 0** on the scale.

What is the highest temperature this thermometer can measure?

The temperature of a human body does not change very much.



You may have your temperature measured with an **electronic** thermometer like these.

Key words

degrees Celsius / °C | numbered | scale | below | 0 / zero | electronic

Changing state

All the materials and all the other things in the world such as air and water are called **matter**.

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

We can watch some things **change state**.

cold butter

melting

warm butter

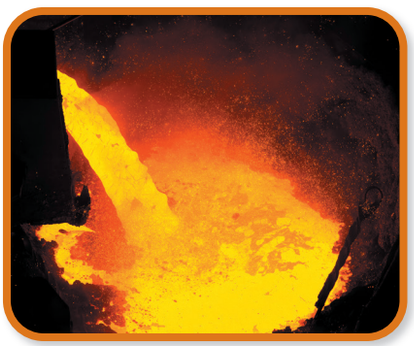
These solids need to be **heated** to change state.

cold ice cream

melting

warm ice cream

The liquid metal needs to be **cooled** to change state.

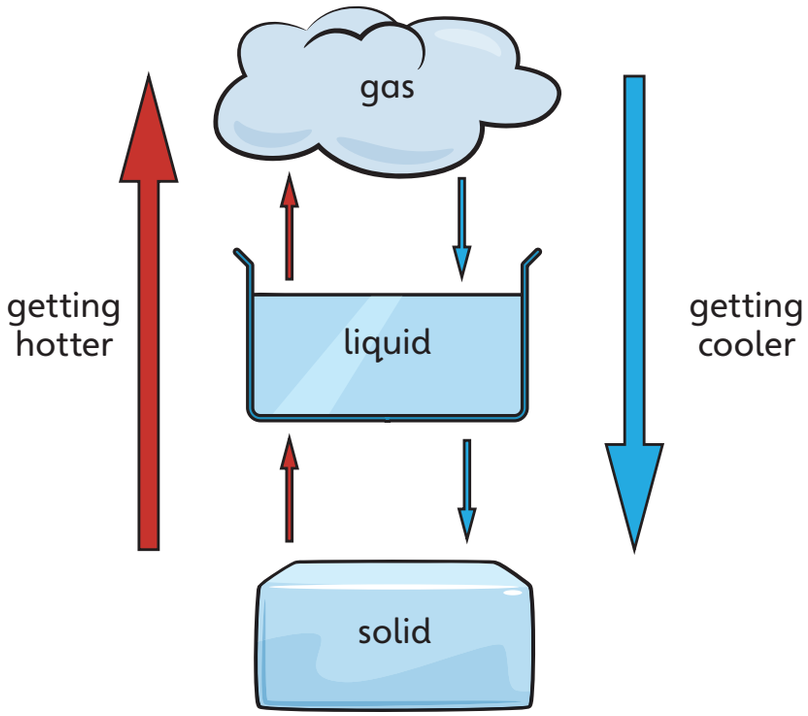


liquid metal

cooling

solid metal

Different substances change state at different temperatures.



Which melts at a lower temperature?

chocolate?

metal?

Could you cook things in a pot made from chocolate?

Key words

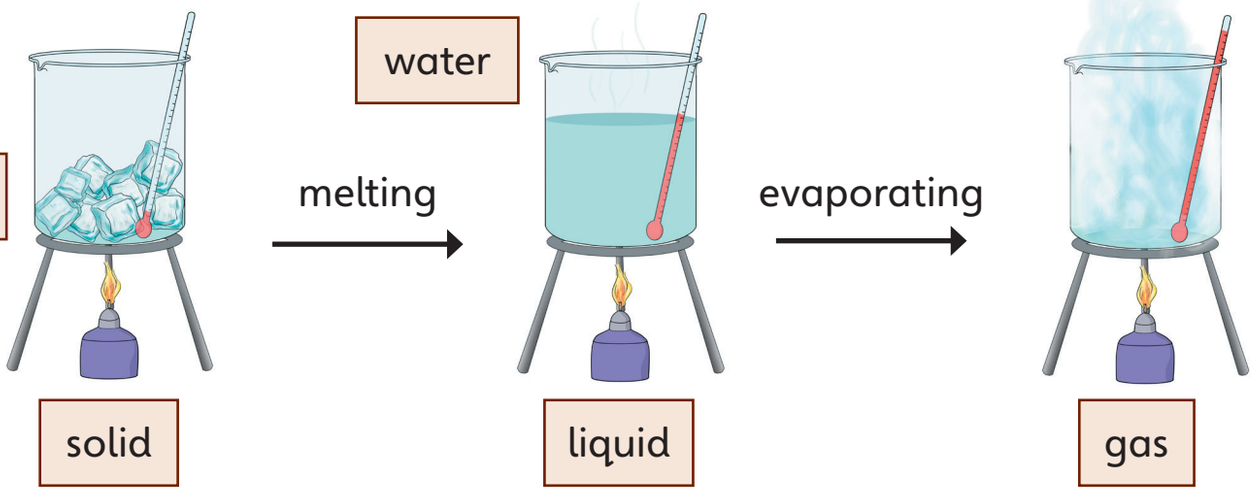
matter | change state | heated | cooled

States of water

Water can be in three different states:

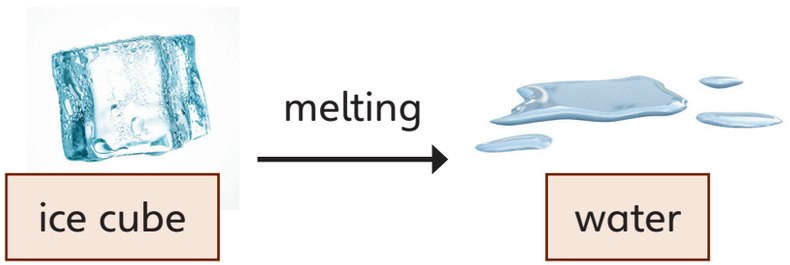
- solid 
- liquid 
- gas. 

If we heat water, it can change state.



When **ice melts** it changes to become liquid water.

This change of state is **melting**.



As the water gets hotter and hotter, it leaves the beaker and goes into the air. It is now a gas called **water vapour**.

This change of state is **evaporation**.

Water vapour in the air changes to liquid water on a cold surface.

This change of state is **condensation**.

Water often condenses on windows.

Look at the condensation on this cold can.

If liquid water is cooled more it will change state to become a solid.

The water on this tap has **frozen**.

This change of state is **freezing**.

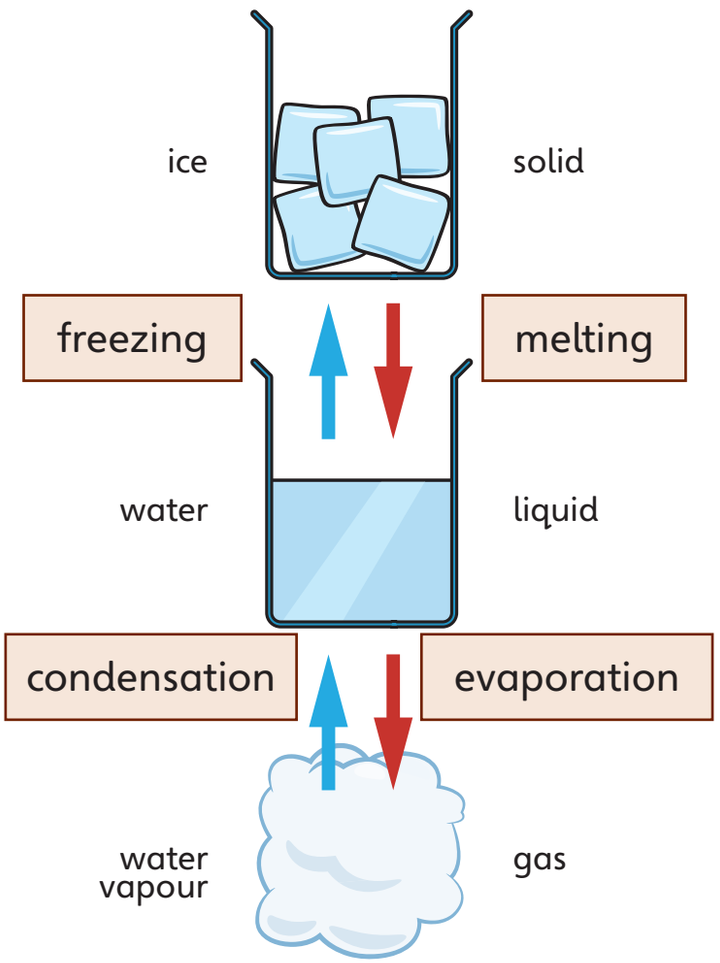
Key words

ice | melts | melting | water vapour | evaporation | condensation | frozen | freezing

More about water

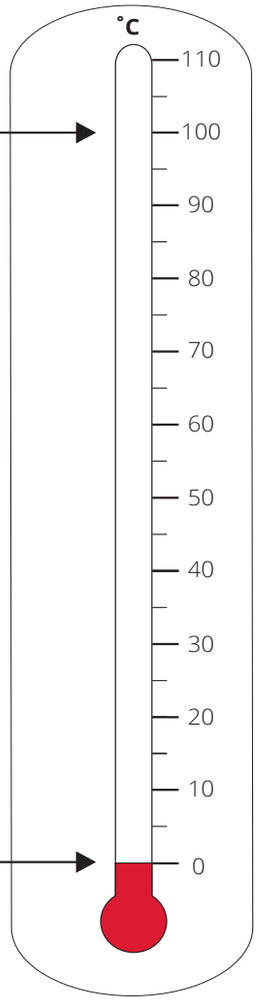
Water changes from one state to another at different temperatures.

Look at the diagram. The red arrows show ice being heated. It changes to liquid water and then to water vapour.



The blue arrows show water vapour being cooled. It changes to liquid water and then to ice.

The arrows on this thermometer show two important temperatures for water. These were used to make the Celsius scale.



water **boils**

above 100 °C
water is a gas

water is a
liquid

ice melts /
water
freezes

below 0 °C
water is a solid

The water on these leaves is frozen. The temperature is below 0 °C.

The water on this grass is liquid. The temperature is above 0 °C.

What is the air temperature where you live?

Use a thermometer to find out.

Does the temperature differ **indoors** and **outdoors**?

Key words

boils | indoors | outdoors

End of topic questions

Solids, liquids and gases

Accurate measuring is very important in science.

A measurement that is accurate is one that is as close to the real measurement as possible.

Here is an example.

On Monday the real temperature outside is 20 °C.

Nikesh measures the temperature and says it is 18 °C.

Nikesh's measurement is **not accurate**.

Rafia measures the temperature and says it is 20 °C.

Rafia's measurement is **accurate**.

Faiza measures the temperature and says it is 19 °C.

Faiza's measurement is **more accurate than Nikesh's, but less accurate than Rafia's.**

Can you measure temperature accurately?

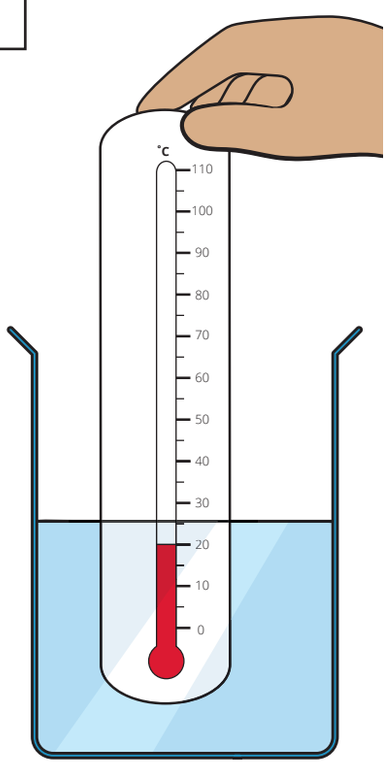
Hold the thermometer and stir the liquid with it.

Keep the bulb of the thermometer in the liquid.

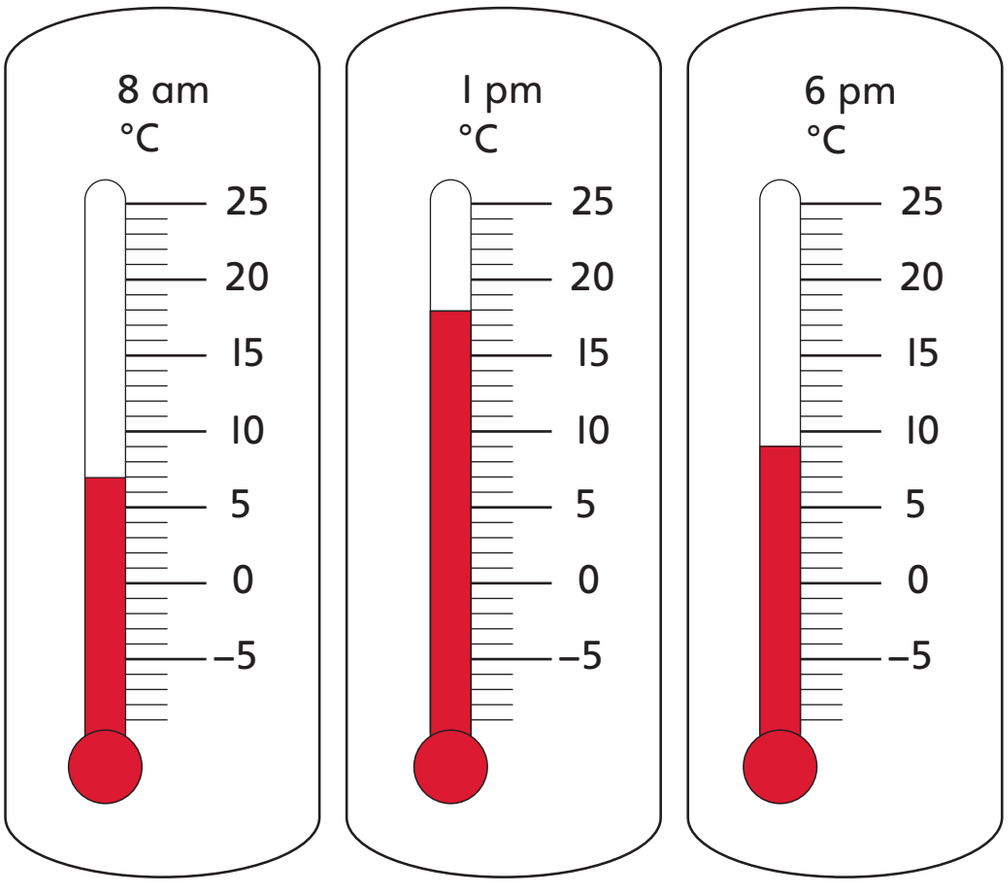
Read the thermometer scale at eye level.

You may need to bend your knees, so you do not take the thermometer out of the liquid.

Discuss these answers to these questions with a partner.



A learner measures air temperature in a garden at three different times on the same day.



1 a) What temperature was it at:

(i) 8 am? (ii) 1 pm? (iii) 6 pm?

b) Describe how the temperature in the garden changed.

2 The learner says that the hottest temperature that day was at 1 pm.

The teacher says that the learner does not have enough evidence to support their statement.

a) What do you think? Explain your reasons.

b) What would you tell this learner to do next time they measure temperatures in the garden?