

## Properties of Materials

**Solids, liquids and gases have different properties.**

**Liquids and gases can flow. Solids keep their shape. Gases can be squashed.**

### Solids

- Solids stay in one place and can be held.
- Solids keep their shape. They do not flow like liquids.
- Solids always take up the same amount of space. They do not spread out like gases.
- Solids can be cut or shaped.
- Even though they can be poured, sugar, salt and flour are all solids. Each **particle** of salt, for example, keeps the same shape and volume.
- Heating some solids can turn them into liquids.



- Cooling a liquid can turn it into a solid.



### Liquids

- Liquids can **flow** or be **poured** easily. They are not easy to hold.



- Liquids change their shape depending on the container they are in.
- Even when liquids change their shape, they always take up the same amount of space. Their **volume** stays the same.
- Heating a liquid can turn it into a gas.



- Cooling a liquid can turn it into a solid.



- Heating a solid can turn it into a liquid.



- Cooling a gas can turn it into a liquid.



## Gases

- Gases are often invisible.
- Gases do not keep their shape or always take up the same amount of space. They spread out and change their shape and volume to fill up whatever container they are in.
- Gases can be squashed.
- Heating a liquid can turn it into a gas.



- Cooling a gas can turn it into a liquid.



**Irreversible changes, like burning, cannot be undone. Reversible changes, like melting and dissolving, can be changed back again.**

**Mixtures can be separated out by methods like filtering and evaporating.**

## Irreversible changes

A change is called **irreversible** if it cannot be changed back again. For example you cannot change a cake back into its ingredients again.

Irreversible changes are permanent. They cannot be undone.

In an irreversible change, new materials are always formed. Sometimes these new materials are useful to us.

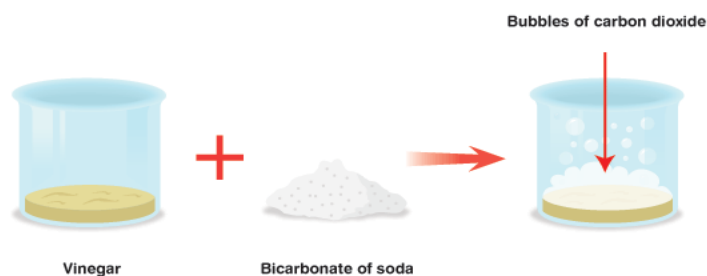
### Heating

Heating can cause an irreversible change. For example you heat a raw egg to cook it. The cooked egg cannot be changed back to a raw egg again.



### Mixing

Mixing substances together can cause an irreversible change. For example, when vinegar and bicarbonate of soda are mixed, the mixture changes and lots of bubbles of carbon dioxide are made. These bubbles, and the liquid mixture left behind cannot be turned back into vinegar and bicarbonate of soda again.



### Burning

Burning is an example of an irreversible change. When you burn wood you get ash and smoke. You cannot change the ash and smoke back to wood again.

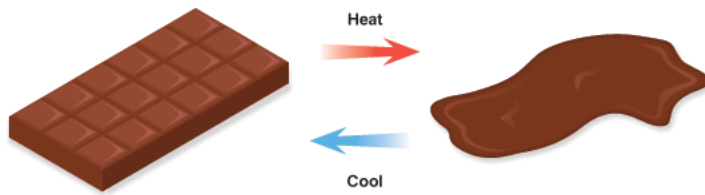
## Reversible changes

A reversible change is a change that **can** be undone or reversed.

A reversible change might change how a material looks or feels, but it doesn't create new materials.

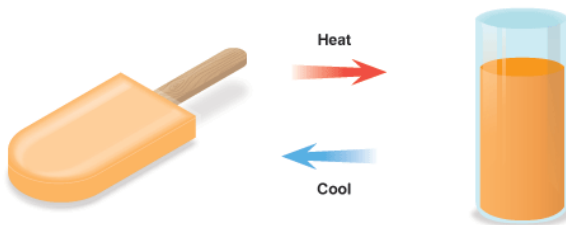
## Melting

Melting is an example of a reversible change. For example melted chocolate can be changed back into solid chocolate by cooling.



## Freezing

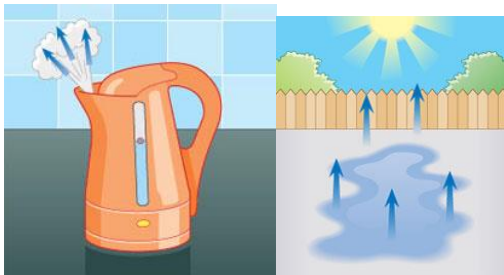
Freezing is an example of a reversible change. For example we can freeze orange juice to make ice lollies. The ice lollies can be changed back into orange juice by heating.



## Boiling, evaporating and condensing

Boiling, evaporating and condensing are all examples of reversible changes. For example, if you could capture all the steam that is made when a kettle boils, you could turn it back to water by cooling it.

A puddle will evaporate using heat from the Sun on a hot day.



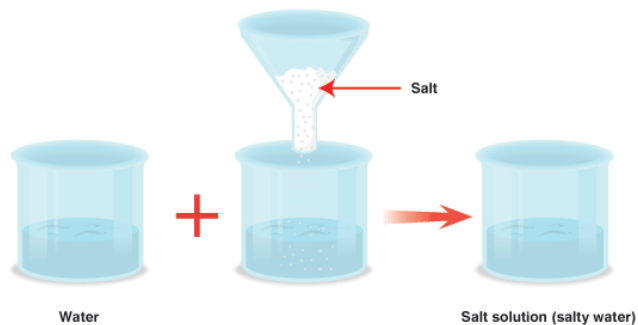
## Dissolving

Dissolving is an example of a reversible change. For example, when salt is mixed with water it disappears because it **dissolves** in the water to make salty water. But we can get the salt back again by boiling off the water. That leaves the salt behind.

Some substances dissolve when you mix them with **water**. When a substance dissolves, it looks like it disappears. But in fact it has just mixed with the water to make a transparent (see-through) liquid called a **solution**.

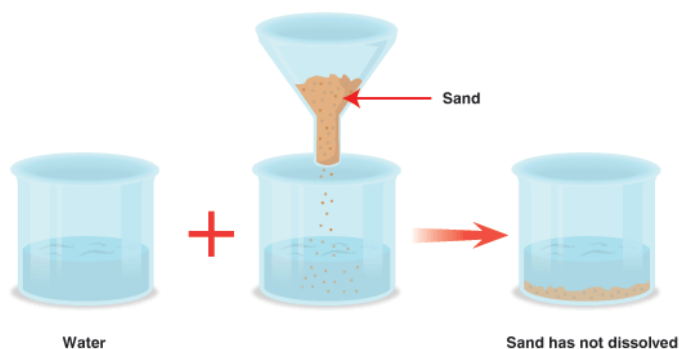
When you mix sugar with water, the sugar dissolves to make a transparent solution. Salt dissolves in water too.

Heat can help some substances dissolve faster in water. Salt, for example, will dissolve quicker in hot water than in cold water.



- Substances that dissolve in water are called **soluble** substances.
- Substances that do not dissolve in water are called **insoluble** substances.

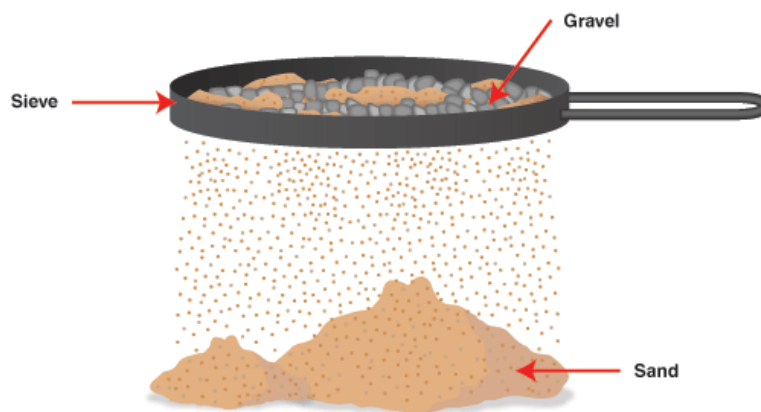
When you mix sand or flour with water, they do **not** dissolve.



## Separating mixtures

### Sieving

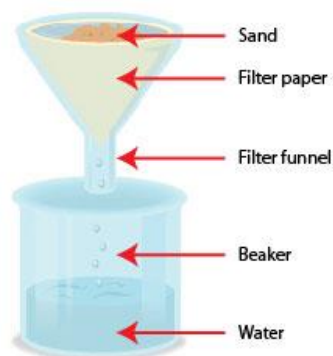
A mixture made of solid particles of different sizes, for example sand and gravel, can be separated by sieving.



## Filtering

A mixture of water and an insoluble substance like sand can be separated by filtering.

The mixture of sand and water is poured into the filter funnel, which is lined with filter paper. The water can pass through the paper to collect in the beaker. The sand particles cannot pass through the filter paper and collect in the filter funnel.



## Evaporating

By dissolving salt in water we make a solution. The salt disappears into the water. We can separate the salt from the water by boiling the solution. The water will evaporate until it is all gone. The salt will be left behind.

If we collect the water vapour that evaporates we can cool it to form water again.

