

Properties and changes of Materials

The Big Questions

Which materials could we be best to protect our snowman from melting?

Are boiling and evaporation the same thing?

Core Knowledge

In Year 3, you learnt how different materials respond to magnets in the topic on **Forces and Magnets**. You also carried out hardness tests when investigating the **properties of rocks** and you learnt that materials can be opaque, translucent or transparent during the topic on **Light**. In Year 4, you grouped materials according to whether they were solids, liquids or gases and you learnt how the particles behaved in each **state of matter**. You also carried out electrical conductivity investigations during the topic on **Electricity**.

- Almost every material in the world is a solid, liquid or gas.
- Different materials are used for particular jobs based on their properties.
- The properties of different materials include: hard/soft; flexible/rigid; transparent/opaque; shiny/dull; conductor/insulator –(thermal and electrical); magnetic/non-magnetic; soluble; waterproof/absorbent; floats/sinks; flammable/inflammable.
- Changes of state – melting, evaporating, condensation and freezing are reversible. Although the substance has changed physically, it has not changed chemically and the process can be reversed.
- Reversible changes, such as mixing and dissolving solids and liquids together can be reversed by sieving, filtering or evaporating.
- Some changes of state are **irreversible**, for example burning or rusting, where a chemical change has taken place.

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Core Knowledge

- Irreversible changes often result in the formation of new materials—for example when toast is burnt, some of the substances within it have irreversibly changed and we cannot get the bread back.
- Mixing some substances together can be irreversible. For example, when you mix bicarbonate of soda with vinegar, they react and carbon dioxide (a new substance) is formed.
- Dissolving - when a substance dissolves in a liquid it forms a **solution**. The substance is said to be **soluble** in the liquid. It looks like the substance has disappeared but it has not, it has simply mixed with the liquid. For example, when sugar dissolves in water, it has intermingled with the water so that the sugar molecules fit into the spaces between the water molecules.
- Materials that won't dissolve are called **insoluble**. Sand is an example of an **insoluble** material. A **suspension** is when the particles do not dissolve.
- Dissolving is not the same as melting. When a solid dissolves in a liquid, tiny particles remain and spread throughout the solution, whereas a solid that melts changes state to become a liquid.

Sieving



Smaller materials fall through the holes in the sieve, separating them from the larger particles which are left behind.

Filtering



The liquid will pass through the filter paper but the solid particles will get caught.

Evaporating



As it heats up, the liquid changes into a gas leaving the solid particles behind.

- **Material**— The substance that something is made out of e.g. glass, plastic, wood.
- **Solid**—This state of matter cannot take the shape of its container. Solids have particles that are very close together and can only vibrate.
- **Liquid**— This state of matter can flow and can take the shape of its container. The particles in liquid are more loosely packed than a solid and can move around each other.
- **Gases**—Gas particles are further apart than in solids or liquids and they can move around freely. A gas can fill and take on the shape and volume of its container.
- **Melting**—The process of heating a solid until it changes into a liquid.
- **Freezing**—When a liquid cools and turns into a solid.
- **Evaporating**—When a liquid turns into a gas or vapour.
- **Condensing**—When a gas, such as water vapour, cools and turns into a liquid.
- **Soluble** –When a substance is able to dissolve in a liquid (especially water)
- **Solution**—A liquid mixture in which a solid has dissolved and become distributed in a liquid
- **Solute**—The smaller part of the solution that has dissolved in the liquid.
- **Conductor**—A conductor is a material that heat or electricity can easily travel through. Most metals are both thermal conductors (they conduct heat) and electrical conductors (they conduct electricity).
- **Insulator**—An insulator is a material that does not let heat or electricity travel through them. Wood and plastic are both thermal and electrical insulators.

As scientists we will

- 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
- know that some materials will dissolve in liquid to form a solution, and describe how to recover a substance from a solution
- use knowledge of solids, liquids and gases to decide how mixtures might be separated, including through filtering, sieving and evaporating
- give reasons, based on evidence from comparative and fair tests, for the particular uses of everyday materials, including metals, wood and plastic
- demonstrate that dissolving, mixing and changes of state are reversible changes
- 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
- Look at the work of chemists such as Spencer Silver or Ruth Benerito

