



Material world



About this topic

Curriculum link: Year 5, Properties and changes of materials

SUMMARY:

In this topic, the children learn about materials and how they change. First they test properties of materials before looking at how materials dissolve, what a solution is and evaporation. Finally, children compare reversible and irreversible changes.

UNITS:

2.1: Sorting and grouping materials

2.2: Solutions and mixtures

ACTIVITY RESOURCES

- 2.1: Why that material?
- 2.2: Investigation planning board
- 2.3: Graphing materials
- 2.4: Growing salt crystals

ONLINE RESOURCES:

Teaching slides (PowerPoint): Material world

Interactive activity: Material world

CPD video: Material world

Pupil video: Material world

Word mat: Material world

Editable Planning: Material world

Topic Test: Material world

Learning objectives

This topic covers the following learning objectives:

- 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.

Working scientifically skills

This topic develops the following working scientifically skills:

- Plan different types of scientific enquiries to answer questions, including recognising and controlling variables where necessary.
- Take measurements, using a range of scientific equipment, with increasing accuracy and precision, taking repeat readings when appropriate.
- Record data and results of increasing complexity using scientific diagrams and labels, classification keys, tables, scatter graphs, bar and line graphs.
- Use test results to make predictions to set up further comparative and fair tests.
- Report and presenting findings from enquiries, including conclusions, causal relationships and explanations of and degree of trust in results, in oral and written forms such as displays and other presentations.
- Identify scientific evidence that has been used to support or refute ideas or arguments.



CROSS-CURRICULAR LINKS

This topic offers the following cross-curricular opportunities:

English

- Create a 'Wordle' using scientific language relating to materials.

- Use recipes for cooking.
- Evaluate each other's writing.
- Write poetry using different genre, e.g. a Haiku about materials.
- Ask the children to write an explanation about how they made jelly dissolve quickly or produce a recipe card for one of the separation experiments.
- Write explanation texts using headings and subheadings.

Numeracy and mathematics

- Use appropriate measurements, e.g. volume, weight.
- Improve the accuracy of volume measurements by taking account of the meniscus.
- Take repeat readings, calculate the mean.
- Represent data from tables as a bar or line graph.

Computing / ICT

- Know how to use the Internet safely.
- Research discoveries and inventions, e.g. Play-doh, Post-It notes, microwave ovens.
- Use dataloggers to take measurements of temperature, e.g. when finding the best thermal insulator.
- Use search engines effectively when looking for secondary sources to help plan investigations.

Design technology

- Research smart materials.
- Observe changes in cookery.
- Read Michael Rosen's *Centrally Heated Knickers* – design and evaluate a pair using materials and technology.

History

- Create timelines of discoveries of materials.
- Compare materials that were used in a previous age and new materials that we now have, e.g. what were toys made of in Victorian times?

Art

- Use materials to create sculptures.
- Re-use materials to make new objects.
- Design clothes using, e.g. ring pulls, newspaper, plastic bags.



Teacher subject knowledge

There are many ways to group materials from their colours to their textures, but there are also standard groupings such as metal and plastic. Standard groupings are based on properties and origins, which are not always easy to grasp, e.g. plastics have a huge range of properties.

It is important that children experience how materials behave in their natural state and when changed, e.g. clay or a sheet of newspaper rolled up. This helps them appreciate why things are made from specific materials.



STEAM (SCIENCE TECHNOLOGY ENGINEERING ART AND MATHS) OPPORTUNITIES

Invite into class

- Artist / sculptor who uses different materials.
- A poet to help develop poems, e.g. Haikus.
- Local recycling firm, or local authority environmental officer.
- Crafts person, e.g. to make stained glass, carpenter.
- Food technician or a chef.
- Someone from a local university to talk about smart materials.
- A science ambassador to set challenges.
- A primary engineer to use materials for construction.
- Local industry to share how they use materials, e.g. from a packaging firm, wind turbines.

Visit

- A local quarry.
- Local industry using different materials.

The choice of a material for a particular job is often a compromise. For instance, silver is a better electrical conductor than copper, but it would be too expensive to use in electrical wires.

Material chosen depends on the appearance, comfort, cost or all of these. For instance, wood, steel and plastic are all strong enough to make chairs and can all be manufactured into suitable shapes. Sometimes the properties of materials may be combined to produce a material that ends up with the properties of none of them. For example, copper is a soft metal and zinc is rather brittle, but together they make brass, which is hard and tough.

Solutions and mixtures

A mixture contains more than one substance. These are not chemically joined, which means they are easy to separate using their properties, e.g. size, magnetism and solubility. Mixtures can be:

- Gas in solid (e.g. pumice stone); solid in solid (e.g. muesli).
- Solid in gas (e.g. smoke); gas in gas (e.g. air); liquid in gas (e.g. clouds, mist and aerosol).
- Gas in liquid (e.g. fizzy drinks); liquid in liquid (emulsion, e.g. milk); insoluble solid in liquid

(suspension, e.g. muddy water); soluble solid in liquid (solution, e.g. salt water).

This unit mainly covers soluble solids.

A substance may dissolve in one liquid but not in another. For instance, nail varnish dissolves in acetone but not in water.

A solution is usually transparent, even if it's coloured. Substances like instant coffee do not really dissolve; instead, small solid particles remain in suspension and

the liquid is murky. Focus on the 'disappearance' of the solid granules as evidence of dissolving.

When a solid is added to water, the water particles surround the solid edges. If the attraction between the water and solid particles, is greater than that between the solid particles then it will dissolve. This process is affected by things like temperature and the amount of solid. There is always a limit to how much solid can dissolve in a given amount of water.



CHILDREN'S MISCONCEPTIONS

Children might think...

- That 'material' just means 'fabric'. In fact, a 'science material' means any kind of matter in the world around us.
- That 'everyday materials' are single substances. Actually, they can be mixtures or compounds, e.g. brick, glass.
- They are comparing properties when they are comparing objects.
- That dissolving means that the substance has disappeared. If the liquid is evaporated the substance is still there but just cannot be seen.

Sometimes children confuse the following properties:

- Tough and hard: a diamond is very hard, but if hit with a hammer it will shatter because it is brittle.
- Tough and strong: polythene does not break when dropped but is not strong because it is easy to tear apart.

Children already know...

- About everyday materials and their properties and uses (Years 1 and 2).
- About magnetic materials (Year 3).
- About rocks (Year 3).
- About temperature and heating and cooling (Year 4).
- The states of matter and change of state (Year 4).
- About evaporation and condensation in the water cycle and the factors that affect evaporation (Year 4).



SCIENTIFIC VOCABULARY

You can download a Word mat of essential vocabulary from *My Rising Stars*.

dissolve: when a solid mixes with liquid to make a solution

elastic: returns to original shape when force removed

electrical conductor: material that allows electricity to flow through it

evaporate: heat liquid until it turns into gas

filter: use porous material to separate solid and liquid

flexible: easily bends; opposite of rigid and stiff

hard: resistant to scratching or pressure

insoluble: when something can't dissolve

mixture: two or more substances that can be separated

plastic: retains new shape when force removed

rigid: hard and fixed; not flexible

soluble: when something can dissolve

solute: the material that dissolves.

solution: mixture of solid and liquid (you might not be able to see the solid)

solvent: usually (liquid) that does the dissolving

strong: resistant to tearing

thermal conductor: heat travels quickly through thermal conductors, e.g. metals

thermal insulator: does not let heat travel through easily, e.g. wood and plastic

tough: resists cracking; opposite to brittle