

NATIONAL CURRICULUM OBJECTIVE:

PROPERTIES AND CHANGES OF MATERIALS

Pupils should be taught to:

- 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

WORKING SCIENTIFICALLY:

- recording data and results of increasing complexity using scientific diagrams and labels, classification keys, tables, scatter graphs, bar and line graphs using test results to make predictions to set up further comparative and fair tests
- reporting 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 identifying scientific evidence that has been used to support or refute ideas or arguments

CONTEXT

BUILDINGS AND CONSTRUCTION

Building materials in ancient Rome were varied and used with great knowledge of how to achieve the best result from their qualities. The use of materials evolved in accordance with access to the materials as well as wealth and skills to process them.



FASHION

Much of Roman clothing was designed to reveal the social status of its wearer, particularly for freeborn men. In typical Roman fashion, the more distinguished the wearer, the more his dress was distinctively marked, while the dress of the lowest classes was often not marked at all.

The most common fabrics found in ancient Roman clothing were **wool, linen, and silk**. Leather was only used for shoes and sandals, with the exception of military uniforms. Wool was produced in Italy, but linen and silk often came from the eastern parts of the empire.



LESSON 1 PROPERTIES OF MATERIALS

LO: I can compare materials according to their properties.

KEY/NEW WORDS:

- Material
- Property
- Magnetic
- Hard
- Transparent
- Flexible
- Permeable.

LESSON PLAN:

Starter 1-

Complete the Preassessment KWL grid (Activity 1a)

Starter 2-

Complete the matching activity (Activity 2a)

Main- Explore the different materials (that were used by the Ancient Romans) and test the properties: Linen, silk, leather, wool, wax, gold, copper, zinc, silver, lead- choose 5 materials to explore.

Activity 1a

Science: Properties and Changes of Materials

K	W	L
What I know	What I want to know	What I have learnt



Activity 1b- Match the definitions

Magnetic	
Reflective	
Absorbent	
Permeable	
Translucent	
Flexible	
Hard	
Flammable	
Insulating	
Transparent	

Objects are attracted to magnets.

Will bounce off its surface.

Is able to soak up liquid easily.

Will allow liquids and gases to pass through it.

Will let light, but not detailed shapes, pass through them.

Easy to bend.

Will easily catch fire and burn quickly.

Difficult to scratch.

Will stop energy such as electricity or heat from transferring through.

Light passes through easily and objects are seen clearly.

Activity 1c- exploring the materials

Follow these instructions to test the properties of different materials.

<p>Magnetism test. Touch a magnet to each material. If it is attracted to the magnet, it is a magnetic material. If it is not attracted to the magnet, it is not magnetic. Cross or tick to show whether each material is magnetic.</p>	<p>Hardness test. Using the pointed end of a nail, carefully try to scratch the surface of each material. Number the materials from 1 to 5, with 1 being the softest material and easiest to scratch with the nail, and 5 being the hardest material and hardest to scratch with the nail. Wear goggles for this test.</p>
<p>Transparency test. Hold each material in front of your eyes. If you can completely see through it, it is transparent. If you can see through it a bit, it is translucent. If you can't see through it at all, it is opaque. Cross or tick to show whether each material is transparent.</p>	<p>Flexibility test. Flexibility means how much a material will bend without breaking. Try to gently bend each material over the edge of the table. Number the materials from 1 to 5, with 1 being the least flexible material and hardest to bend, and 5 being the most flexible material and easiest to bend.</p>
<p>Permeability test. If a material is permeable, it allows liquids to go through it. Impermeable materials do not allow liquids through, so they are waterproof. Place each material over a jar that is in an empty tray, using an elastic band to hold it in place if necessary. Pour 20ml of water onto the material. If the material is permeable, some or all of the water will go through it into the jar. If it is impermeable, the water will stay on the material or run off it into the tray. Cross or tick to show whether each material is permeable.</p>	

Record your results below.

Material	Properties				
	Magnetic Y or N	Hardness 1 - 5	Transparent Y or N	Flexibility 1 - 5	Permeable Y or N

LESSON 2 THERMAL CONDUCTORS AND INSULATORS

LO: I can investigate thermal conductors and insulators.

Before the invention of the refrigerator, **Romans stored their food in underground chambers filled with ice and snow**, scientists say. The Romans used cellars in their houses to store cool beverages like wine.

Key/New Words:

Thermal, conductor, insulator, heat, material, variable

Outcome:

To test what material would keep your Roman food cool. What would be the best material for a Roman storage unit?



Starter-

What is a conductor and what is an insulator? Watch the video and get the children to organize the images below.

<https://www.bbc.co.uk/bitesize/articles/zb6mt39> (Activity 2a)

Main Activity 1-

Complete the investigation plan (Activity 2b)

Main Activity 2-

Complete the investigation grid (Activity 2c)

Plenary- Share and discuss results.

Activity 2a

Look at the pictures below. Write 'insulator' or 'conductor' in the space provided for the materials in the pictures:

Activity 2b

What materials will you test?

What material do you predict will be the best choice for your food storage?
Why?

What is the independent variable of your investigation? (Tip: This is the thing you will change in the investigation).

What is the dependent variable? (Tip: This is the thing that you observe or measure in your investigation).

What are the controlled variables? (Tip: These are the things that you keep the same in the investigation).

LESSON 3 MAGNETIC MATERIALS

LO: I can compare and group together materials based on their response to magnets.

KEY/NEW WORDS:

Magnetic, magnets, attract, repel, magnetic field, metal, material, iron, steel, copper, aluminium, gold, silver, nickel, cobalt, Earth's magnetic pole, compass

- **Starter-**

Put a 5-minute timer on the board. Chn to think of a material that has this property- for example: Raincoat- waterproof elastic band- stretchy (Activity 3a)

- **Main activity-**

Discuss that Roman soldiers wore armor. Would it be good to have a material that was magnetic? Why would that be useful? Not useful at times? **Roman soldiers wore armor made of iron and bronze alloys.** A preferred armor of the legions was lorica segmentate, a type of armor that was easy to move in as well as easy to put on, take off and store. The Roman scutum (or large shield) was also a kind of Roman armor.

- **Activity-**

Test different materials (Activity 3b) Complete the table.

- **Plenary-**

Share your results

Activity 3a

Word to describe properties of materials	Definition
durable	
flexible	
absorbent	
waterproof	
magnetic	
permeable	
conductive	
transparent	
stretchy	

Activity 3b

Material	Do you think it will be magnetic?	Is it magnetic?
wood		
iron		
tin foil		
copper		
plastic		
glass		

LESSON 4 DISSOLVING

LO: I know that some materials dissolve in a liquid to make a solution.

Key Question- Which materials are soluble and which are insoluble?

KEY/NEW WORDS:

- Soluble
- Insoluble
- Dissolve
- Material
- saturated
- solution
- evaporation

Starter-

Watch the videos and take notes.

<https://www.bbc.co.uk/bitesize/articles/zpbdpbk>

<https://www.bbc.co.uk/programmes/p011811q>

Then complete the matching activity in pairs. (Activity 4a)

Main-

Look at the following items: Salt, sugar, honey, flower petals, sand, pepper, rice and flour (These items were often mixed into medicines or used in the Ancient Roman times).

Complete the investigation-

Which items will dissolve? (Activity 4b)

Plenary-

Share the results

Activity 4a

insoluble

when nothing more can be
dissolved into the solution

soluble

cannot dissolve in a liquid

solution

the result of two materials being
mixed together

saturated

when a material can be dissolved
into a liquid

Activity 4b

Material	Soluble or insoluble?	Time taken to dissolve in warm water

LESSON 5

LO: I can predict how mixtures could be separated.

NEW/KEY WORDS:

separate/separation, materials, soluble/insoluble, magnetic, filter/filtering, sieve/sieving, evaporation, solids/liquids/gases, reversible/irreversible

Starter-

<https://www.youtube.com/watch?v=JJeY-mulqhw> recap and take notes.

What do these words mean? (Activity 5a) match the key words

Main-

Pre-mix the materials for the separation or let the children mix two materials and then plan how to separate them. (Activity 5b)

Plenary-

After the children have investigated separating a variety of mixtures, ask them to find a partner (not in their investigation group) and explain their findings using scientific vocabulary

Activity 5a

Draw a line from the process to its correct description.

Evaporating
and Condensing

Separates insoluble
solids from liquids

Decanting

Separates two
liquids which have
different weights

Magnetism

Separates different
sized solids

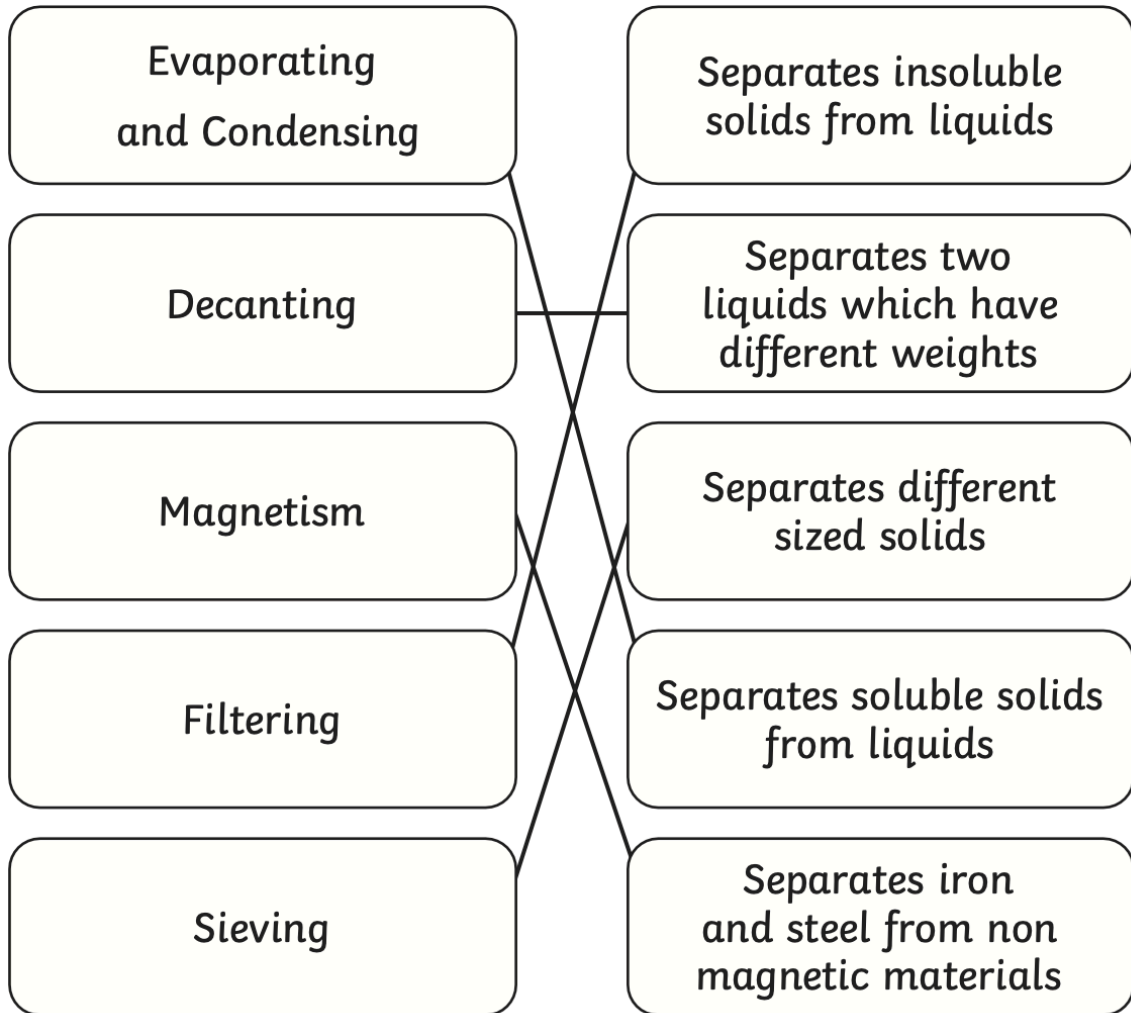
Filtering

Separates soluble solids
from liquids

Sieving

Separates iron and
steel from non
magnetic materials

Draw a line from the process to its correct description.



Activity 5b

The materials I am trying to separate are...

How did you separate the different materials?
