



What? (key knowledge)

Materials

What does material mean?	All objects have a name like 'a door'. Material is the 'stuff' an object is made from.
Everyday materials you need to know	Wood Plastic Glass Metal Water Rock

Names of some common properties of materials

Hard	Not easily broken
Soft	Easy to cut, fold or change shape
Stretchy	Can be made longer or wider without breaking
Stiff	Doesn't change shape easily
Shiny	Reflects light easily
Dull	Not very bright or shiny
Rough	Has an uneven surface
Smooth	An even surface with no lumps or bumps
Bendy	Can be bent easily
Waterproof	Keeps out water
Absorbent	Soaks up liquid easily
Transparent	Easy to see through
Opaque	Not able to see through

Some common materials and their properties

Wood	Hard, strong, stiff
Plastic	Strong, shiny, bendy
Glass	Transparent, smooth, stiff
Metal	Hard, strong, shiny
Water	Runny, wet, clear
Rock	Hard, strong

Comparing and grouping materials

You can put materials into different groups by answering these questions about the material.	Hard or Soft? Stretchy or Stiff? Shiny or Dull? Rough or Smooth? Bendy or not Bendy? Waterproof or not waterproof? Absorbent or not absorbent? Transparent or opaque?
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What? (key vocabulary)

Spelling	Definition/Sentence
Properties	A way to describe something
Material	The 'stuff' an object is made out of.
Liquid	Liquids can flow or be poured easily.
Surface	An outside part or layer of something.
Object	A thing that can be seen and touched.
Reflect	If a surface reflects light, heat, sound, or an image, it sends the light, etc. back and does not absorb it





Diagrams and Symbols

	
Wood	Plastic
	
Glass	Metal
	
Water	Rock



What? (key knowledge)	
Materials	
Wood	Hard, strong, stiff
Plastic	Strong, shiny, bendy
Glass	Transparent, smooth, stiff
Metal	Hard, strong, shiny
Water	Runny, wet, clear
Rock	Hard, strong
Uses of common materials	
Wood can be used for:	Doors, tables
Plastic can be used for:	Pens, rulers
Glass can be used for:	Windows, glasses
Metal can be used for:	Cars, coins
Rock can be used for:	Garden walls, old buildings
Brick can be used for:	Houses, walls
Paper can be used for:	School books, wrapping paper
Card can be used for:	Folders, birthday cards
Different materials for the same thing	
Some objects can be made from various materials	For example, a spoon can be made from: plastic, wood or metal.
Changing the shape of materials	
Squashing	Crush something so that it becomes flat, soft, or out of shape
Bending	Changing a straight object so that it is curved.
Twisting	Change the shape of an object by turning it.
Stretching	Made longer or wider without tearing or breaking
People we need to know	
John Dunlop	Born in 1840 An expert in rubber Invented the first inflatable tyre
Charles Macintosh	Born in 1766 Invented the first waterproof fabric The 'mac' raincoat is named after him
John McAdam	Born in 1756 He invented building roads with a smooth, hard surface.

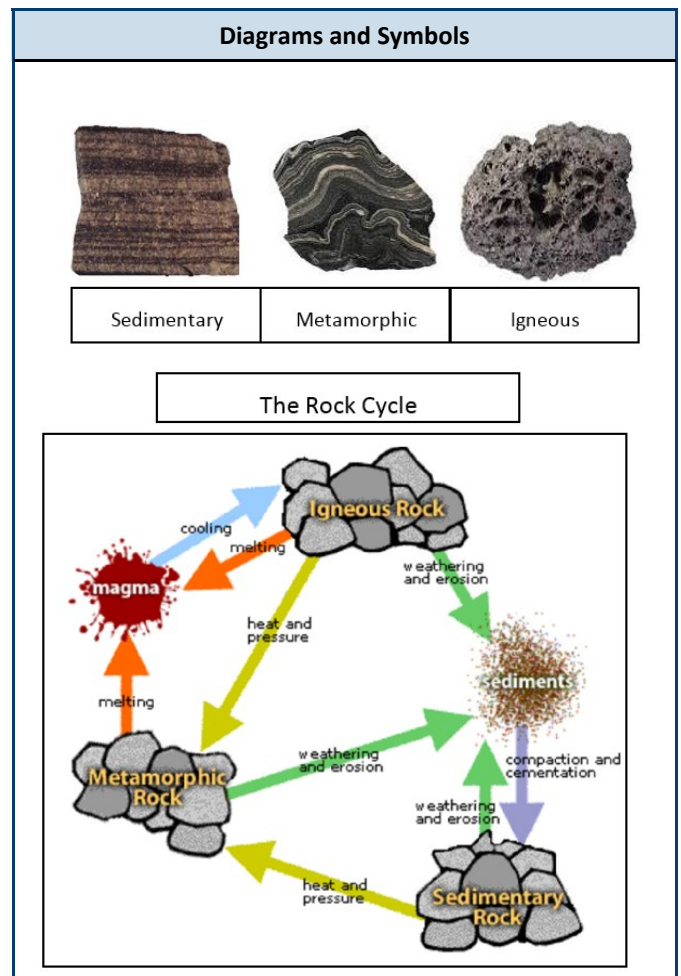
What? (key vocabulary)	
Spelling	Definition/Sentence
Various	Lots of different kinds
Rubber	A tough material that can be shaped
Inflatable	Can be filled with air
Fabric	Cloth produced by weaving or knitting
Transparent	A material that lets light pass through

Diagrams and Symbols	
Squashing	
	
Bending	
	
Twisting	
	
Stretching	
	



What? (key knowledge)	
Types of rocks	
There are three main types of rock	Sedimentary Metamorphic Igneous
Sedimentary	Sedimentary rocks are formed from particles of sand, shells, pebbles, and other fragments of material. Together, all these particles are called sediment. Gradually, the sediment accumulates into layers and over a long period of time hardens into rock.
Metamorphic	Metamorphic rocks are formed under the surface of the earth from the metamorphosis (change) that occurs due to intense heat and pressure (squeezing).
Igneous	Igneous rock is formed when magma cools and solidifies, it may do this above or below the Earth's surface.
How to spot each type of rock	
Sedimentary	Usually crumbly and allow water through them Made of layers and stuck together with mineral crystals They can contain fossils within their layers
Metamorphic	Usually hard May contain tiny crystals or fossils
Igneous	Very hard Contain crystals
How fossils are formed	
How are fossils formed?	An animal dies, its skeleton settles on the sea floor and is buried by sediment. The sediment surrounding the skeleton thickens and begins to turn to stone. The skeleton dissolves and a mould is formed. Minerals crystallise inside the mould and a cast is formed. The fossil is exposed on the Earth's surface.
How is soil made?	
What is soil made from?	Minerals (small stone fragments: clay, silt or sand) Organic Matter (decaying plants and animals) Water (which the nutrients in the minerals and the organic matter dissolve into) Air (which fills the gaps between the mineral and organic matter parts).
Types of soil	Sandy soil is pale in colour with lots of small air gaps. Water drains through sandy soil easily so it usually feels quite dry. Clay soil is an orange or blue-ish sticky soil with very few air gaps. Water does not drain through it easily. When it rains, puddles stay on top of clay soil for a long time. Chalky soil is a light brown soil. Water drains through it quickly. Peat is different from other soils because it does not contain any rock particles. It is made from very old decayed plants and is dark, crumbly and rich in nutrients (chemicals plants need to grow).

What? (key vocabulary)	
Spelling	Definition/Sentence
Erosion	The gradual wearing away of something.
Magma	Hot fluid below or within the earth's crust from which lava and other igneous rock is formed on cooling.
Tectonic plates	A layer under the ground made up of large, moving pieces called plates. All of Earth's land and water sit on these plates.
Solidify	To become solid or hard.
Dissolve	To become part of a liquid



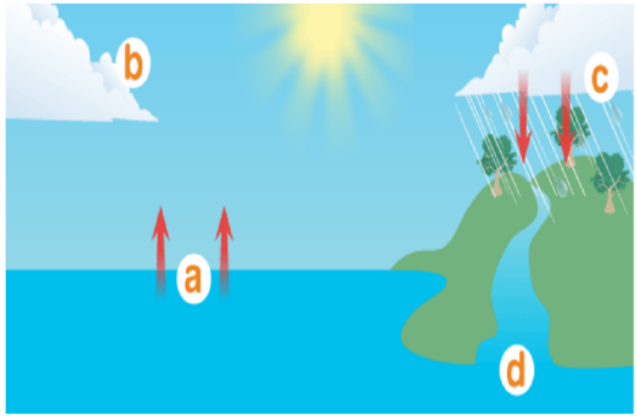


What? (key knowledge)			
Grouping materials			
Materials fall into three main categories	Solids Liquids Gases		
How to spot each type of material			
Solids	Solids stay in one place and can be held. Most solids keep their shape. They do not flow like liquids. (Some solids like sand or salt can be poured) Solids always take up the same amount of space. They do not spread out like gases.		
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.		
Gases	Gases are often invisible. Gases do not keep their shape. They spread out and change their shape and volume to fill up whatever container they are in.		
Changes of state			
What does changes of state mean?	What a material changes from one material type to another, we say 'it has changed state.'		
What are the changes of states?			
What	Explanation	Name of process	Example
Solid to Liquid	When a solid melts it changes to a liquid.	Melting	When an ice cube melts.
Liquid to Gas	A liquid evaporates into a gas when it is heated.	Evaporation	When water on a roof is warmed up and turns to steam.
Gas to Liquid	When a gas it cooled it condenses into a liquid.	Condensation	When steam from the shower cools on the mirror it turns to water.
Liquid to Solid	When a liquid freezes it turns into a solid.	Freezing	When the water in a pond freezes, it turns to ice.
At what temperature does each happen?			
Boiling	Water boils at exactly 100°C (A hot bath is about 40°C)		
Melting	Different solids melt at different temperatures: Ice melts at 0 degrees Celcius (0°C). (Chocolate melts at about 35°C)		
Freezing	Water freezes at 0 degrees Celcius (0°C).		

What? (key vocabulary)	
Spelling	Definition/Sentence
Temperature	The measure of warmth or coldness of an object.
Celsius	The common scale in the UK for measuring temperature.
Boils	To become so hot (100°C) that water bubbles and then turns into a gas.
Container	Something which holds things inside, like a box, jar or tub.

The Water Cycle

Water on the earth is constantly moving. It is recycled over and over again. This recycling process is called the **water cycle**.



a. Water evaporates into the air
The sun heats up water on land, and in rivers, lakes and seas and turns it into water vapour. The water vapour rises into the air.

b. Water vapour condenses into clouds
Water vapour in the air cools down and changes back into tiny drops of liquid water, forming clouds.

c. Water falls as rain
The clouds get heavy and water falls back to the earth in the form of rain or snow.

d. Water returns to the sea
Rain water runs over the land and collects in lakes or rivers, which take it back to the sea. The cycle starts all over again.

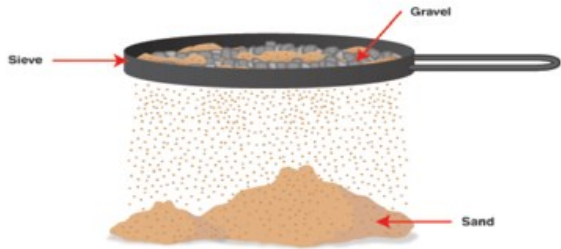


What? (key knowledge)	
Comparing and grouping materials	
Materials can be grouped by their properties (is it hard or soft?) or by more than one of their properties (is it hard and magnetic?).	
Properties of materials we can compare	
Hard	Difficult to scratch, like the head of a hammer.
Soft	Easy to shape, like fabric.
Soluble	Can be dissolved, like coffee granules.
Insoluble	Cannot be dissolved, like pebbles.
Transparent	See through, like glass.
Opaque	Not see through, like a wooden door.
Electrical conductor	Lets electricity pass through easily, like copper wire.
Electrical insulator	Do not let electricity flow through easily, like plastic or rubber.
Thermal conductor	Lets heat pass through easily, like a metal kettle.
Thermal insulator	Does not let heat pass through easily, like a wood pan handle.
Magnetic	Is attracted to a magnet, like a steel spoon. Note: Not all metals attract to magnets.
Not magnetic	Is not attracted to a magnet, like a wooden spoon.
Mixtures and solutions	
A mixture	Where substances are mixed together, but dissolving hasn't taken place. For example, mixing, cucumber slices, egg slices and tomato slices to make a salad.
A solution	Some substances dissolve in a liquid. When this happens the liquid is called a solution. For example, when gravy granules dissolve in water, this is a solution.
Separating a mixture	
We can separate a mixture by sieving and/or filtering	Sieving - sorting out the big bits from the small bits, e.g. stones from soil. Filtering - separating solid bits from a liquid, e.g. sand from sand and water.
Separating a solution	
We can separate a solution by evaporation	Because the soluble substance is too mixed into the water, it can't be removed by sieving or filtering. Evaporation - A liquid evaporates into a gas when it is heated. This removes the liquid and leaves the substance behind.
Reversible changes	
What is a reversible change?	A change that doesn't last forever. For example, water can turn to ice when frozen, but can be turned back to water by heating it.
Irreversible changes	
What is an irreversible change?	Lasts forever Usually caused by heat. E.g. Eggs, flour, butter and sugar heated to make a cake. The original ingredients can't be recovered.

What? (key vocabulary)	
Spelling	Definition/Sentence
Dissolved	To become incorporated into a liquid so as to form a solution.
Separating	The action of moving things apart.
Evaporation	When a liquid turns to a gas due to an increase in temperature.
Properties	A specific quality of something.


Diagrams and Symbols

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 dissolves (seems to disappear) into the water. We can separate the salt from the water by boiling a solution. The water will evaporate until it is all gone. The salt will be left behind.





What? (key knowledge)	
Evolution	
What is evolution?	Evolution is the way that living things change over time.
Do things evolve?	We know that living things used to look a lot different to how they do now. We know this because fossils have been found that show creatures that look a lot different to how they do today. Fossils show us that living things have changed over time.
So how do things evolve?	A famous scientist, Charles Darwin observed that although individuals in a species shared similarities, they were not exact copies of each other. He noticed that there were small differences or variations between them. He also noticed that everything in the natural world was in competition. The winners were those that had characteristics which made them better adapted for survival. For example, they were stronger, faster, cleverer or more attractive than others in their species. These living things were more likely to reproduce and pass on their useful characteristics to their offspring. Individuals that were poorly adapted were less likely to survive and their characteristics were not as likely to be inherited. Over time, the characteristics that help survival become more common and a species gradually changes. Given enough time, these small changes can add up to the extent that a new species altogether can evolve.
Variation	
What's the important thing to know?	Living things produce offspring of the same kind. For example, owls produce baby owls and humans produce baby humans... BUT ... Normally offspring vary and are not identical to their parents.
So what?	Natural variation like this can lead to offspring being more likely or less likely to survive in their environment. If the variant makes them more likely to survive, they are more likely to be alive to pass this variant to their offspring. As a result, this variant is more likely to become more common in this species.
Adaptation	
What is adaptation?	Adaptation is when things evolve to overcome challenges in their environment. For example by adapting their behaviour.
Examples of adaptation	Migration Birds have adapted to move around the world to find weather and food sources to suit them. Birds that didn't do this may have run out of food and died.
	Sticking together in packs Animals that learned to live in packs were more likely to be safer and more successful when hunting, leading them to be more likely to survive.

What? (key vocabulary)	
Spelling	Definition/Sentence
Fossils	A fossil is naturally preserved remains or traces of animals or plants that lived in the geologic past
Variations	Small differences
Reproduce (revisit)	To produce again/ give birth
Offspring	Children or young
Migration	Seasonal movement of animals from one location to another

Diagrams and Symbols

How variation can impact on evolution

Because the hawks can see and catch the tan mice more easily, a relatively large fraction of the tan mice are eaten, while a much smaller fraction of the black mice are eaten. If we look at the ratio of black mice to tan mice in the surviving ("not-eaten") group, it will be higher than in the starting population.

Panel 1: A population of mice has moved into a new area where the rocks are very dark. Due to natural genetic variation, some mice are black, while others are tan.

Panel 2: Some mice are eaten by birds.

Panel 3: Tan mice are more visible to predatory birds than black mice. Thus, tan mice are eaten at higher frequency than black mice. Only the surviving mice reach reproductive age and leave offspring.

Panel 4: Mice reproduce, giving next generation. Because black mice had a higher chance of leaving offspring than tan mice, the next generation contains a higher fraction of black mice than the previous generation.

Panel 1: reproduction

Panel 2: Growth

Panel 3: reproduction

Panel 4: Growth

Panel 5: reproduction

Some individuals born happen to have longer necks.

Over many generations, longer-necked individuals are more successful, perhaps because they can feed on taller trees. These successful individuals have more offspring and pass the long-neck trait on to them.