

## Year 1 Materials



### National Curriculum Objectives:

- distinguish between an object and the material from which it is made
- identify and name a variety of everyday materials, including wood, plastic, glass, metal, water, and rock
- describe the simple physical properties of a variety of everyday materials
- compare and group together a variety of everyday materials on the basis of their simple physical properties

### Killer Facts:

- The things around us are made of many different materials.
- You can describe an object by describing its material properties.
- Different materials have different properties.
- Some materials have similarities and can be grouped together.
- We can use lots of language to describe materials, including: hard, soft, stretchy, stiff, rough, smooth, bendy, waterproof

Pupils should explore, name, discuss and raise and answer questions about everyday materials so that they become familiar with the names of materials and properties such as: hard/soft; stretchy/stiff; shiny/dull; rough/smooth; bendy/not bendy; waterproof/not waterproof; absorbent/not absorbent; opaque/transparent. Pupils should explore and experiment with a wide variety of materials, not only those listed in the programme of study, but including for example: brick, paper, fabrics, elastic, foil.

Pupils might work scientifically by: performing simple tests to explore questions, for example: 'What is the best material for an umbrella? ...for lining a dog basket? ...for curtains? ...for a bookshelf? ...for a gymnast's leotard?'

Prior EYFS Learning	What materials can we find?	Which is the best material?	Key Vocabulary
<ul style="list-style-type: none"> <li>- Explore characteristics of everyday objects and use mathematical language to describe them.</li> <li>- Use everyday language to describe size, weight and capacity.</li> <li>- Talk about the observable features of their everyday environment.</li> <li>- Safely use and explore a range of materials and tools.</li> <li>- Experiment with colour, texture and form.</li> <li>- Question the use and purpose of objects and materials.</li> <li>- Ask questions about the place they live.</li> <li>- Manipulate materials to create a desired effect.</li> </ul>	<p>Identify, label and record materials which they can see within the classroom using scientific vocabulary. Identify the name of the object and the materials that create them.</p> <p>Consider the questions: What would the classroom be like if the tables were made of jelly or the chairs were chocolate?</p> <p>Using a range of materials, children to group according to their properties. Which are similar/different. Use hoops to allow children to separate their groupings – beginning to introduce Venn diagrams.</p> <p>Play 'odd one out' with a range of materials, allowing children to explain their choices using scientific vocabulary.</p>	<p><b>Investigate a few throughout the year/key stage.</b></p> <p><u>Building</u> Discuss the story of the Three Little Pigs and make predictions about which house will make the most successful house. Give children alternative materials to create houses. Which alternative will be most successful and why? Which would be the best material to build a bookshelf using?</p> <p><u>Toys</u> Which material is best to wrap a present/toy? Which fabric would make the best blanket for a teddy/baby?</p> <p><u>Material/Fabrics</u> Which would be the best material to fix a torn umbrella? Discuss designs and make predictions before testing. Which material would produce the best curtains? What would be the best filling for a cushion?</p> <p>How do puddles change over time? Mark puddles on the playground with chalk. Children should identify that water is a material – ensure children know that the object has a different name from the material that it is made of.</p>	<p>hard soft stretchy stiff shiny dull rough smooth bendy waterproof absorbent opaque transparent material compare</p>

### In Year 2:

- identify and compare the suitability of a variety of everyday materials, including wood, metal, plastic, glass, brick, rock, paper and cardboard for particular uses
- find out how the shapes of solid objects made from some materials can be changed by squashing, bending, twisting and stretching

## Year 2 Materials



### National Curriculum Objectives:

- identify and compare the suitability of a variety of everyday materials, including wood, metal, plastic, glass, brick, rock, paper and cardboard for particular uses
- find out how the shapes of solid objects made from some materials can be changed by squashing, bending, twisting and stretching

### Killer Facts:

- Different materials are more suitable than others for different tasks.
- Some materials can be change by squashing, bending, twisting and stretching them.
- Materials can be used for more than one purpose.

Pupils should identify and discuss the uses of different everyday materials so that they become familiar with how some materials are used for more than one thing (metal can be used for coins, cans, cars and table legs; wood can be used for matches, floors, and telegraph poles) or different materials are used for the same thing (spoons can be made from plastic, wood, metal, but not normally from glass). They should think about the properties of materials that make them suitable or unsuitable for particular purposes and they should be encouraged to think about unusual and creative uses for everyday materials. Pupils might find out about people who have developed useful new materials, for example John Dunlop, Charles Macintosh or John McAdam.

Pupils might work scientifically by: comparing the uses of everyday materials in and around the school with materials found in other places (at home, the journey to school, on visits, and in stories, rhymes and songs); observing closely, identifying and classifying the uses of different materials, and recording their observations.

### Prior Year 1 Learning

- distinguish between an object and the material from which it is made
- identify and name a variety of everyday materials, including wood, plastic, glass, metal, water, and rock
- describe the simple physical properties of a variety of everyday materials
- compare and group together a variety of everyday materials on the basis of their simple physical properties

### Which is the best material?

Materials hunt – **building on Year 1 learning, can they identify the material and what it is made of** before discussing why it is suitable – using scientific adjectives e.g. opaque, transparent, flexible, ridged, and rough.

Give children pairings of objects and materials: a jumper of glass, a wall of paper, a window of wood, a car of metal, a table of fabric. Which are suitable and which are not? Is it a good choice? Why?

Which would be the best material to make a tent? Record data and test materials based on a set of pre-agreed properties. E.g. flexibility, absorbent/waterproof, stretchy.

Design an experiment to test how stretchy different fabrics are – which fabrics would be best to create an Olympic swimming costume? How could we test elasticity? Measure length of material at the start vs after stretching.

Which is the strongest paper? Test a range of papers' durability using weights. Make predictions prior to testing.

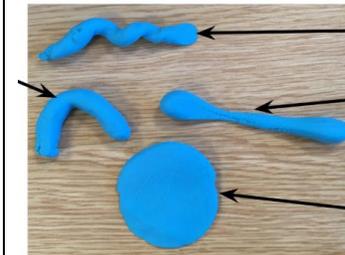
Build bridges that are strong enough to hold a toy car. What is the best way to twist/bend/manipulate the papers to make the bridge? Which is the best type of material to use to create the bridge? – DT link.

Which objects float and which sink? What are the best materials/dimensions to make a boat that will float?

### How can materials change?

Investigate how waterproof different fabrics are using samples and pipettes of water. Consider how we can change how absorbent a fabric is – changing its properties. Children could add wax crayon coating to some materials or observe teacher dipping into hot wax.

- Link to art and wax resists in art.



Allow children to experiment with changing the shape of different materials. Can they explain the difference between how these materials have been manipulated?

Give children a range of materials – scarf, paper, elastic band, rock. Children to test these, recording

results in a table. Does it bend? Does it stretch? Is it flexible? Does it twist?

Which ball is the bounciest? Show slow motion ball bouncing videos – can they describe what happens it the ball? Record heights or number of bounces in a chart.

If everything I touched became bendy/flexible, how would my life change? Children could write/discuss simple stories to answer these questions.

Consider how materials can change when heated. Chop up wax crayons and add to moulds – change them into new shapes and observe – Take care with Year 4 = changing states.

### Key Vocabulary

hard\*  
soft\*  
stretchy\*  
stiff\*  
shiny\*  
dull\*  
rough\*  
smooth\*  
bendy\*  
waterproof\*  
absorbent\*  
opaque\*  
transparent\*  
material\*  
compare\*  
bendy  
float  
sink  
fabric  
flexible  
elasticity  
inflexible  
stretching  
squashing  
rigid

\*prior learning

### In Year 3:

- compare and group together different kinds of rocks on the basis of their appearance and simple physical properties
- describe in simple terms how fossils are formed when things that have lived are trapped within rock
- recognise that soils are made from rocks and organic matter

## Year 3 Rocks



### National Curriculum Objectives:

- compare and group together different kinds of rocks on the basis of their appearance and simple physical properties
- describe in simple terms how fossils are formed when things that have lived are trapped within rock
- recognise that soils are made from rocks and organic matter

### Killer Facts:

- Rock is a naturally occurring material.
- There are different rocks, e.g. limestone, sandstone, slate, which have different properties.
- Soils are made up of pieces of ground down rock, which may be mixed with plant and animal material (organic matter).
- Some rocks (mainly sedimentary) contain fossils.
- Fossils were formed millions of years ago. When plants and animals died, they fell to the seabed. They became covered and squashed by other materials. Over time, the dissolving animal and plant matter is replaced by minerals from water.

Linked with work in geography, pupils should explore different kinds of rocks and soils, including those in the local environment. Pupils might work scientifically by: observing rocks, including those used in buildings and gravestones, and exploring how and why they might have changed over time; using a hand lens or microscope to help them to identify and classify rocks according to whether they have grains or crystals, and whether they have fossils in them. Pupils might research and discuss the different kinds of living things whose fossils are found in sedimentary rock and explore how fossils are formed. Pupils could explore different soils and identify similarities and differences between them and investigate what happens when rocks are rubbed together or what changes occur when they are in water. They can raise and answer questions about the way soils are formed.

Prior Year 2 Learning:	Classifying Rocks	What is soil?	How are fossils formed?	Key Vocabulary
<ul style="list-style-type: none"> <li>- identify and compare the suitability of a variety of everyday materials, including wood, metal, plastic, glass, brick, rock, paper and cardboard for particular uses</li> <li>- find out how the shapes of solid objects made from some materials can be changed by squashing, bending, twisting and stretching</li> </ul>	<p>Make chocolate rocks when introducing the different rock types. Sedimentary – layers of different chocolate/biscuit, metamorphic – warm the sedimentary rock up to create a new rock, igneous – melted chocolate poured onto something cold.</p> <p>Rock detectives – locate a range of rocks around the school grounds and describe their features. Classify the using what they know about rock types. Could be done outside of the school grounds looking at a range of rocks that have weather and aged – a church/graveyard. Take photographs and describe observable features of the differing rocks.</p> <p>Rock sorts within the classroom. Children could sort rocks into groups using hoops/tables. E.g., which ones have crystals, which do not?</p> <p>Scientifically record results to investigate whether different types of rocks are durable (can be marked/scratched) or permeable (allows water to sink in).</p> <p>Is there a pattern to where we find volcanoes in the world?</p>	<p>Collect soil samples from different locations. Add water and observe how it all settles into layers – what can they observe within the layers? What can they see that is organic and what can they see that is non-organic in the different soils?</p> <p>Different plants grow in different soil types. Investigate which soil type is the best for growing plants.</p> <p>Observe soil through hand lenses.</p> <p>Give children a range of soil samples and allow them to classify/order in different ways. Children could talk about most → least crumbly. Which are driest? Which have more organic matter? Which are lightest/darkest in colour?</p> <p>Design a test to investigate which soils will hold water for the longest. Consider adding different amounts of sand – how does this affect how quickly water drains through? How would we keep in fair? What would we need to change?</p>	<p>Give children to opportunity to practically make fossils within the classroom and describe the different processes afterwards. (Plasticine as seabed, add shape, add salted water with blue colouring, add shredded tissue as sediment and push to show force. Dig down through the sediment layers to find a fossil underneath). Can also be created using plaster of paris.</p> <p>Can children match the imprint fossil with the bone/creature that created it?</p>	<p>hard* soft* rough* smooth* waterproof* absorbent* opaque* transparent* material* compare* flexible* elasticity* inflexible* rigid* rock stone boulder grain crystal igneous metamorphic sedimentary classify fossils permeable impermeable porous soil organic matter *prior learning</p>

### In Year 4:

- compare and group materials together, according to whether they are solids, liquids or gases
- observe that some materials change state when they are heated or cooled, and measure or research the temperature at which this happens in degrees Celsius (°C)
- identify the part played by evaporation and condensation in the water cycle and associate the rate of evaporation with temperature

**Year 4 Materials**



**National Curriculum Objectives:**

- compare and group materials together, according to whether they are solids, liquids or gases
- observe that some materials change state when they are heated or cooled, and measure or research the temperature at which this happens in degrees Celsius (°C)
- identify the part played by evaporation and condensation in the water cycle and associate the rate of evaporation with temperature

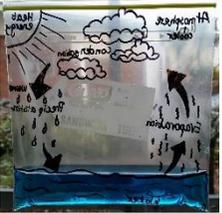
Pupils should explore a variety of everyday materials and develop simple descriptions of the states of matter (solids hold their shape; liquids form a pool not a pile; gases escape from an unsealed container). Pupils should observe water as a solid, a liquid and a gas and should note the changes to water when it is heated or cooled.

**Note:** Teachers should avoid using materials where heating is associated with chemical change, for example, through baking or burning.

Pupils might work scientifically by grouping and classifying a variety of different materials; exploring the effect of temperature on substances such as chocolate, butter, cream (for example, to make food such as chocolate crispy cakes and ice-cream for a party). They could research the temperature at which materials change state, for example, when iron melts or when oxygen condenses into a liquid. They might observe and record evaporation over a period of time, for example, a puddle in the playground or washing on a line, and investigate the effect of temperature on washing drying or snowmen melting.

**Killer Facts:**

- Materials can be grouped and classified according to whether they are a solid, liquid or a gas.
- Solids stay in one place and hold their shape. They take up the same amount of space and do not spread out like a liquid.
- A liquid can flow or be poured and change depending on the container they are in.
- Gases are often invisible and do not have a fixed shape. They spread out and fill whatever container they are in.
- Some materials can change state when heated and cooled
- Temperature has an impact on the water cycle, where water evaporates and condenses.

Prior Year 3 Learning:	Solids, Liquids and Gases	Heating and Cooling	The Water Cycle	Key Vocabulary
<ul style="list-style-type: none"> <li>- identify and compare and group together different kinds of rocks on the basis of their appearance and simple physical properties</li> <li>- describe in simple terms how fossils are formed when things that have lived are trapped within rock</li> <li>- recognise that soils are made from rocks and organic matter</li> </ul>	<p>Dancing raisins experiment – children to observe and explain their observations using scientific vocabulary of solids, liquids and gas. Afterwards, complete card sort of properties of solids, liquids and gases.</p> <p>We can pour grains of rice – does that mean it is a liquid?</p> <p>Children to investigate the differences between solids and liquids: water, sand, rice, sugar, stones, wood, milk, honey, washing up liquid, shaving foam etc. This should support the understanding that some solids have very small particles so can be poured, but this does not make them a liquid.</p> <p>Make observations of how unusual materials act/change, for example foam burst shower gel, shaving foam or toothpaste. Use vocabulary to describe the observations made.</p> <p>Explore making gases visible – trees in the wind, balloons, squeezing sponges underwater, blowing bubbles with straws.</p>	<p>Chocolate chairs – would they be a good invention? Discuss using scientific vocabulary.</p> <p>Make predictions about which type of chocolate will melt fastest and carry out a fair test.</p> <p>Consider a range of liquids and freezing – which will freeze fastest/slowest? Explore what happens to different liquids when they are frozen.</p>  <p>Role play what occurs when changing from a solid to a liquid to a gas – children to show particles moving/densely packed in.</p> <p>When ice cubes melt in glass, will the volume of water increase, decrease or stay the same? Consider question and plan an investigation.</p>	<p>Children to add a wet handprint to a tissue prior to lunch – what happened to it over lunchtime? Can children identify that the water has evaporated?</p>  <p>Look at the image - what do they notice? Does it have to be raining for the window to be wet?</p> <p>Place hot water in a cup with cling film over the top and add an ice cube. Observe what occurs</p>  <p>Create a water cycle in a bag/jar to demonstrate the different stages before labelling a diagram.</p>	<p>waterproof*</p> <p>absorbent*</p> <p>opaque*</p> <p>transparent*</p> <p>material*</p> <p>compare*</p> <p>flexible*</p> <p>elasticity*</p> <p>inflexible*</p> <p>rigid*</p> <p>classify</p> <p>solid</p> <p>liquid</p> <p>gas</p> <p>state</p> <p>particles</p> <p>boil</p> <p>freeze</p> <p>substance</p> <p>condensation</p> <p>evaporation</p> <p>precipitation</p> <p>water cycle</p> <p>water vapour</p> <p>*prior learning</p>

**In Year 5:**

- 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



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Pupils should build a more systematic understanding of materials by exploring and comparing the properties of a broad range of materials, including relating these to what they learnt about magnetism in year 3 and about electricity in year 4. They should explore reversible changes, including, evaporating, filtering, sieving, melting and dissolving, recognising that melting and dissolving are different processes. Pupils should explore changes that are difficult to reverse, for example, burning, rusting and other reactions, for example, vinegar with bicarbonate of soda. They should find out about how chemists create new materials, for example, Spencer Silver, who invented the glue for sticky notes or Ruth Benerito, who invented wrinkle-free cotton.

Pupils might work scientifically by: carrying out tests to answer questions, for example, 'Which materials would be the most effective for making a warm jacket, for wrapping ice cream to stop it melting, or for making blackout curtains?' They might compare materials in order to make a switch in a circuit. They could observe and compare the changes that take place, for example, when burning different materials or baking bread or cakes. They might research and discuss how chemical changes have an impact on our lives, for example, cooking, and discuss the creative use of new materials such as polymers, super-sticky and super-thin materials.

**Killer Facts:**

- When two or more substances are mixed, the elements can be separated.
- Mixtures can often be separated using sieving or filtering.
- Some changes can be reversed and some are irreversible.
- A solution involves substances being combined chemically.
- A substance can often be recovered from a solution.
- A solution can be separated again by evaporating.

**Prior Year 4 Learning**

- compare and group materials together, according to whether they are solids, liquids or gases
- observe that some materials change state when they are heated or cooled, and measure or research the temperature at which this happens in degrees Celsius (°C)
- identify the part played by evaporation and condensation in the water cycle and associate the rate of evaporation with temperature

**Purpose of Materials**

We need to keep ice-creams cold and hot chocolates warm – what are the best materials to do this? Test a range of materials – how well will different cups keep a drink warm? How well will different containers slow down melting ice-cream?

Give children a range of objects. Can they identify the material and consider why those materials were chosen? E.g. saucepans, plug sockets, plastic covered wires, thermos flasks.

Set up circuits – which materials will conduct electricity and which will not?

**Mixtures and Separating**

Add sugar to water and observe closely – what do children notice? Discuss what might change the speed of sugar dissolving. Record and interpret a groups results. E.g. Temperature of water, amount of sugar, amount of water.



Vocabulary to support.

Which will dissolve in cold water – coffee granules, oil, salt, sugar sprinkles.

Will granulated sugar, castor sugar, icing sugar and a sugar cube dissolve at the same rate? What difference does stirring make – only some groups to use stirring as a variable.

Investigate a range of techniques for separating:

Filtering	Water/sand vs water/sugar or salt
Evaporation	What will affect the speed of evaporation of a salt solution? What evaporates – water or salt?
Sieving Floating/Sinking Magnets	Use a mixture of pasta, lentils, paperclips/iron filings, salt, small cork pieces.
Evaporation	Which techniques could children use to separate this mixture? E.g., Sieve out larger edible pieces, use magnets to separate clip/iron filings, add water to separate cork, and then evaporate to isolate the salt.

Link to Earth – why are microplastics ruining the planet?

**Reversible and Irreversible Changes**

Some changes result in the formation of new materials and this is usually not reversible. If we have made a new substance, we have created a chemical change that is irreversible. Make links with cooking – toast, eggs, jelly, making bread. Discuss why these are all irreversible changes.

Carry out oxidation experiments – will it rust? Try different types of nails, e.g. copper, iron, stainless steel, coated, galvanised, partially submerged in tap water or rainwater. Consider variations – will other liquids make nails go rusty? Which liquid causes the most rust? Does the temperature of the water affect the amount of rust?

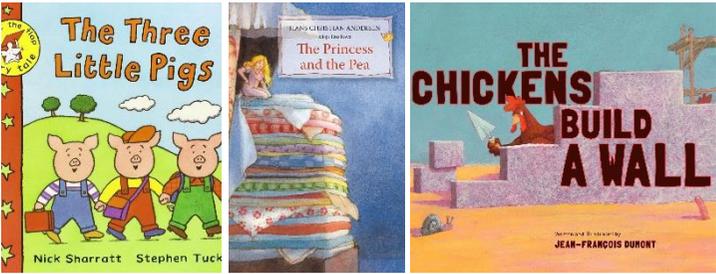
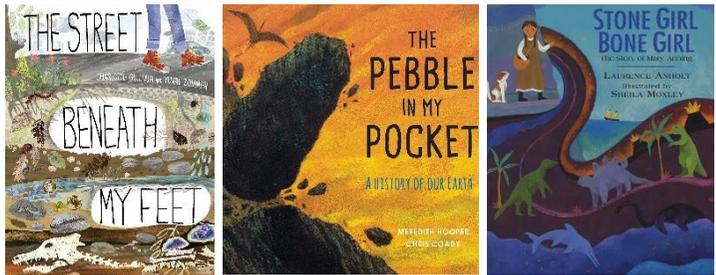
Reversible or irreversible changes:  
Add baking powder to vinegar – it froths/fizzes, has a new substance been made? (Yes, gas has reacted with the vinegar, before they were separate). Make slime, melting chocolate, water and ice cubes



Which is the odd one out – ice melting, sugar cube in water or antacid tablet in water? 3 = only irreversible one.

**Key Vocabulary**

- waterproof\*
- absorbent\*
- permeable\*
- impermeable\*
- inflexible\*
- classify\*
- solid\*
- liquid\*
- gas\*
- state\*
- substance\*
- condensation\*
- evaporation\*
- substance
- solution
- filtering
- sieving
- dissolving
- reaction
- soluble
- solute
- insoluble
- saturated
- thermal conductor
- insulator
- reversible changes
- irreversible changes
- \*prior learning

Year Group	Common Misconceptions	Recommended Linked Texts for Materials
Year 1	<ul style="list-style-type: none"> <li>- only fabrics are materials</li> <li>- only building materials are materials</li> <li>- the word 'rock' describes an object rather than a material</li> <li>- 'solid' is another word for hard</li> </ul>	<p><b>The Three Little Pigs</b> by many authors</p> <p><b>The Princess and the Pea</b> by Hans Christian Anderson</p> <p><b>The Chickens Build a Wall</b> by Jean-Francois Dumont</p> 
Year 2	<ul style="list-style-type: none"> <li>- only fabrics are materials</li> <li>- only building materials are materials</li> <li>- the word 'rock' describes an object rather than a material</li> <li>- 'solid' is another word for hard</li> </ul>	<p><b>Traction Man</b> by Mini Grey</p> <p><b>The True Story of the Three Little Pigs</b> by Jon Scieszka</p> <p><b>The Dragon Machine</b> by Helen Ward</p> 
Year 3	<ul style="list-style-type: none"> <li>- rocks are all hard in nature</li> <li>- rock-like, man-made substances such as concrete or brick are rocks</li> <li>- materials which have been polished or shaped for use, such as a granite worktop, are not rocks as they are no longer 'natural'</li> <li>- certain found artefacts, like old bits of pottery or coins, are fossils</li> <li>- a fossil is an actual piece of the extinct animal or plant</li> <li>- soil and compost are the same thing</li> </ul>	<p><b>The Street Beneath my Feet</b> by Charlotte Guillain</p> <p><b>The Pebble in my Pocket</b> by Meredith Hooper</p> <p><b>Stone Girl Bone Girl</b> by Laurence Anholt</p> 
Year 4	<ul style="list-style-type: none"> <li>- 'solid' is another word for hard or opaque</li> <li>- substances made of very small particles like sugar cannot be solids</li> <li>- particles in liquids are further apart than in solids and they take up more space</li> <li>- when air is pumped into balloons, they become lighter</li> <li>- water in different forms – steam, water, ice – are all different substances</li> <li>- clouds are made of water vapour or steam</li> <li>- evaporation is when the Sun sucks up the water and it vanishes</li> </ul>	<p><b>Charlie and the Chocolate Factory</b> by Roald Dahl</p> <p><b>Once Upon a Raindrop</b> by James Carter</p> <p><b>The Rhythm of Rain</b> by Grahame Baker-Smith</p> 
Year 5	<ul style="list-style-type: none"> <li>- Many misconceptions exist around reversible and irreversible changes, including around the permanence or impermanence of the change. There is confusion between physical/chemical changes and reversible and irreversible changes.</li> <li>- thermal insulators keep cold in or out and warm things up</li> <li>- solids dissolved in liquids have vanished and you cannot get them back</li> <li>- lit candles <u>only</u> melt, which is a reversible change</li> </ul>	<p><b>Kensuke's Kingdom</b> by Michael Morpurgo</p> <p><b>Itch</b> by Simon Mayo</p> <p><b>The Witches</b> by Roald Dahl</p> <p><b>The BFG</b> by Roald Dahl</p> 