The Cathedral School Of St Peter and St John R.C Primary School — Materials

Year One – Material Properties – Everyday Materials

National Curriculum Objectives:

- Distinguish between and object and the material from which it is made.
- Identify and name a variety of everyday materials, including wood, metal, plastic, glass, 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 properties.

Non Statutory: 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?'

Inspiring science key ideas:

- **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.**

Working scientifically

- *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 learning	Key Learning – What the pupils need to know	Vocabulary
In Early Years: Practical investigations in this unit should focus on 'Which is the best material for…?' It is not essential *what* the children test but the most appropriate properties for this age range would be waterproofing, absorbency or strength. **It is essential that teachers discuss opportunities provided in the Foundation Stage and try to extend these and avoid repetition. Foundation stage focuses more on experiencing the different properties whereas KS1 is more concerned with being able to *measure* how waterproof, absorbent or strong a material is.**	▫ Children need experiences to explore a variety of objects made from different materials and with different properties. ▫ Testing materials is an ideal opportunity to model and practice designing a comparative test/fair test investigation. ▫ Encourage the children to sort a selection of materials or objects into sorting circles by the property of the item. Let the children decide the criteria for sorting for themselves first but then encourage them to sort by opposites (e.g. put 'rough' in one circle and ask them to decide what would be in the other – can they discover the opposites each time. ▫ Children should be able to identify and choose an 'odd one out' from a group of three materials. They should be able to justify their ideas using natural, man-made and property words (rough, smooth, stretchy, shiny, ect.) to explain their odd one out.	Common materials: e.g. metal, plastic, wood, paper, glass, clay, rock, brick, fabric, sand, papers, cork, shell, water, elastic, foil Words used to describe materials and their properties e.g. hard/soft, rough/smooth, shiny/dull, bendy/not bendy, stretchy/stiff, waterproof/not waterproof, absorbent/not absorbent, magnetic, transparent, opaque, float, wet, squashy, strong. Words and phrases for making comparisons e.g. the same as, different from, harder, smoother, scratchiest, roughest, etc. Group, sort, sorting rings, describe, compare, because

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 shapes of solid objects made from some materials can be changed by squashing, bending, twisting and stretching.

The Cathedral School Of St Peter and St John R.C Primary School — Materials

Year Two – Material Properties – Everyday 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 shapes of solid objects made from some materials can be changed by squashing, bending, twisting and stretching.
-

Non statutory: 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.

Inspiring science key ideas:

- 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.
- Some materials can be found naturally; others have to be made.

Working scientifically

- *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.*
- *Thinking about unusual and creative uses for everyday materials.*

Prior learning	Key Learning – What the pupils need to know	Vocabulary
In Year One: Distinguish between and object and the material from which it is made. • Identify and name a variety of everyday materials, including wood, metal, plastic, glass, 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 properties.	Exploring materials and their properties These ideas are explored through testing materials to see if they are appropriate for particular jobs. Topics need to be arranged so that all the main groups of materials are explored and important properties are investigated (strength, flexibility, waterproofness, absorbency, softness, slippiness, stretchiness, brittleness)	Common materials: e.g. metal, plastic, wood, paper, glass, clay, rock, brick, fabric, sand, papers, cork, shell, water, elastic, foil Words used to describe materials and their properties recapped from Y1 unit e.g. hard/soft, rough/smooth, shiny/dull, bendy/not bendy, stretchy/stiff, waterproof/not waterproof, absorbent/not absorbent, magnetic, transparent, opaque, float, wet, squashy, strong/breaks easily, wobbly, sticky, uncomfortable Uses of materials, properties of materials Words and phrases for making comparisons

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.

The Cathedral School Of St Peter and St John R.C Primary School **Materials**

Year Three – Material Properties – Materials and their uses.

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. Linked with work in geography, pupils should explore different kinds of rocks and soils, including those in the local environment.

Non statutory: 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.

Inspiring science key ideas:

- 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.
- Rocks and soils can feel and look different.
- Rocks and soils can be different in different places/environments.

Working scientifically

- *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 identify and classify rocks according to whether they have grains or crystals, and whether they have fossils in them.*
- *Research and discuss the different kinds of living things whose fossils are found in sedimentary rock and explore how fossils are formed*
- *Explore different soils and identify similarities and differences between them and investigate what happens when rocks are rubbed together [hardness test] or what changes occur when they are in water [permeability test].*
- *Raise and answer questions about the way soils are formed.*

Prior learning	Key Learning – What the pupils need to know	Vocabulary
In Year Two: • 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 shapes of solid objects made from some materials can be changed by squashing, bending, twisting and stretching. • May have some understanding of a variety of different rocks in the natural world. • Some understanding of what soil is. (how to identify soil etc) • May have some knowledge of what a fossil is.	I. There are different types of rock. II. There are different types of soil. III. Soils change over time. IV. Different plants grow in different soils. V. Fossils tell us what has happened before. VI. Fossils provide evidence. VII. Palaeontologists use Fossils to find out about the past.	Words describing rocks e.g. rock, stone, pebble, slate, marble, chalk, granite, sand, sandstone, hard, texture, grains, crystals, contain fossils, bits pressed together, sedimentary. Words describing soils e.g. darker, lighter, organic matter, leaf litter, grains, clay, sandy, grains. Rub together, break apart/break up, permeable, non-permeable, acid rain, weathering, erosion. Comparison/compare, description/describe.

In Year Four:

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

The Cathedral School Of St Peter and St John R.C Primary School **Materials**

Year Four – Material Properties - States of Matter –Material changes

National Curriculum Objectives:

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

Non statutory: 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.

Inspiring science key ideas:

- **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.**

Working scientifically

- *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).*
- *Researching the temperature at which materials change state, for example, when iron melts or when oxygen condenses into a liquid.*
- *Observing and recording evaporation over a period of time, such as a puddle in the playground or washing on a line, and investigating the effect of temperature on washing drying or snowmen melting.*

Additional suggestion for working scientifically opportunities which enhance learning and support using ICT across the curriculum.

- This unit provides an ideal opportunity for using data logging equipment to detect/measure and compare temperatures.

Prior learning	Key Learning – What the pupils need to know	Vocabulary
In KS1: • 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. • 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 change by squashing, bending, twisting and stretching.	***Material properties - state of matter*** ▫ Compare and group materials together, according to whether they are solids, liquids or gases. ▫ Solids, liquids and gases can be identified by their observable properties. ▫ Solids have a fixed size and shape (the size and shape can be changed but it remains the same after the action). ▫ Liquids can pour and take the shape of the container in which they are put. ▫ Liquids form a pool not a pile. ▫ Solids in the form of powders can pour as if they were liquids but make a pile not a pool. ▫ Gases fill the container in which they are put. ▫ Gases escape from an unsealed container. ▫ Gases can be made smaller by squeezing/pressure. ▫ Liquids and gases can flow. ***Material changes*** ▫ Measuring temperature tells us how hot or cold something is. ▫ Heating causes solids to melt to liquids and liquids to evaporate into gases. Cooling causes gases to condense to liquids and liquids to freeze to solids. ▫ Evaporation happens when water is heated/warmed and changed into a gas. ▫ Condensation happens when water vapour in the air turns into a visible liquid. ▫ Evaporation and condensation are changes that can be reversed ▫ The water we use has been used before.	Solid, liquid, gas, property, change, temperature, change state, heated, cooled, temperature, degrees Celsius, water cycle condensation/condense, evaporation/evaporate, melting/melt, freezing/freeze, solidification/solidity, boiling temperature particle, air, carbon dioxide, oxygen, helium, natural gas, viscosity, States of matter Measure, compare, group, research, observe

	▫ Evaporation and condensation are an important part in the water cycle. ▫ Changes to materials can happen at different rates (factors affecting evaporation –temperature only – see yr5).	

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 wood, metals 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 this kind of change is usually not reversible, including changes associated with burning and the action of acid on bicarbonate of soda.

The Cathedral School Of St Peter and St John R.C Primary School — Materials

Year Five – Material properties – Testing material properties - Mixing and Separating Insoluble & Soluble Materials - Reversible and irreversible changes

National Curriculum 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 wood, metals 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 this kind of change is usually not reversible, including changes associated with burning and the action of acid on bicarbonate of soda.

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 wrinklefree cotton. Note: Pupils are not required to make quantitative measurements about conductivity and insulation at this stage. It is sufficient for them to observe that some conductors will produce a brighter bulb in a circuit than others and that some materials will feel hotter than others when a heat source is placed against them. Safety guidelines should be followed when burning materials. 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.

Inspiring science key ideas:

Material properties

- 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
- Give reasons, based on evidence from comparative and fair tests, for the particular uses of everyday materials, including metals, wood and plastic
- Compare a variety of materials and measure their effectiveness (e.g. hardness, strength, flexibility, solubility, transparency, thermal conductivity, electrical conductivity)

Temperature and Thermal Insulation

- Heat always moves from hot to cold.
- Some materials (insulators) are better at slowing down the movement of heat than others.
- Objects/liquids will warm up or cool down until they reach the temperature of their surroundings.

Reversible changes - Mixing and Separating Insoluble & Soluble Materials

- **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**
- **Demonstrate that dissolving, mixing and changes of state are reversible changes.**
- Changes can occur when different materials are mixed
- Some material changes can be reversed and some cannot.
- Recognise that dissolving is a reversible change.
- Distinguish between melting and dissolving.
- Mixtures of solids (of different particle size) can be separated by sieving.
- Mixtures of solids and liquids can be separated by filtering if the solid is insoluble (un-dissolved).
- Evaporation helps us separate soluble materials from water.
- Changes to materials can happen at different rates (factors affecting dissolving, factors affecting evaporation – amount of liquid, temperature, wind speed).

Freezing, melting and boiling changes can be reversed (revision from yr4).

Irreversible changes - Changes that form new materials

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

- Carry out tests to answer questions such as '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?'
- Compare materials in order to make a switch in a circuit.
- *Observing and comparing the changes that take place, for example, when burning different materials or baking bread or cakes.*
- *Researching and discussing how chemical changes have an impact on our lives, for example cooking, and discuss [research] the creative use of new materials such as polymers, super-sticky and super-thin materials.*

The Cathedral School Of St Peter and St John R.C Primary School Materials

Material properties - Pupils should build a more systematic understanding of materials by exploring and comparing the properties of a broad range of materials and relating these to what they learnt about magnetism in Year 3 and about electricity in Year 4.	**Reversible/Irreversible changes -**By the end of this unit children should be able to categorize material changes into reversible or irreversible. Reversible changes: freezing, melting, boiling, evaporating, condensing and dissolving. Irreversible changes: cooking, reactions caused when some materials are mixed and new materials are created plus burning, rusting.

Prior learning	**Key Learning – What the pupils need to know**	**Vocabulary**
In Year 4: • Compare and group materials together, according to whether they are solids, liquids or gases . • Observe that some materials change state when heated or cooled, and measure and research the temperature at which this happens in degrees Celsius. • Identify the part played by evaporation and condensation in the water cycle and associate the rate of evaporation with temperature.	Pupils should build a more systematic understanding of materials by exploring and comparing the properties of a broad range of materials and relating these to what they learnt about magnetism in Year 3 and about electricity in Year 4. The big idea It is possible to change materials into completely different ones. This is very important because new substances might have different properties to materials we currently have. For example plastics can be moulded into intricate shapes, are waterproof, strong and electrical insulators. When materials are heated or mixed with other materials they sometimes can be made to turn into new materials. The question is how would we know if it was a new material or the same material mixed differently? Indicators that something new has been made are: 1. The properties of the material are different (colour, state, texture, hardness, smell, temperature) If it is not possible to get the material back easily it is likely that it is not there anymore and something new has been made (irreversible change) The key question we want children to interrogate is “have we made a new substance?” • Wet clay ◊ air-dried clay ◊ fired clay. • Flour and water ◊ dough ◊ bread • Add sugar to fizzy water; it fizzes up. Has a new substance been made? (No, the gas was dissolved in the water and adding sugar made it become un dissolved) • Add baking powder to vinegar, it fizzes up. Has a new substance been made? (Yes the gas was not in the vinegar as it wasn’t fizzy, so it must have been made) • Add water to instant snow. • Use lemon juice as an invisible ink, heating gently makes the ink visible. Is this a new substance? • When water is added to jelly and it is set, is it a new substance.	Words describing the characteristics of materials e.g. strong, hard, flexible, absorbent, transparent, thermal conductor, thermal insulator Words and phrases related to warmth and cold e.g. temperature, thermometer, degrees Celsius Words related to the investigation of these properties e.g. investigate, test, describe, explain, comparison, fair, conclude, evidence Comparison/compare, description/describe Words which have different meanings in other contexts e.g. test, fair, conclude Words associated with rocks: slate, marble, chalk, granite, sand, sandstone, clay, rock, stone, pebble, texture, absorbent, particles, permeable, non-permeable, acid rain Dissolved, undissolved, solution, mixture, filter, sieve, evaporate, condense, melting, separate, reversible, irreversible, reaction, product, material, powder, substance, acid, change, burning, rusting Words and phrases related to data handling e.g. bar line graph, line graph, average, accurate
In KS3: • the concept of a pure substance • mixtures, including dissolving • diffusion in terms of the particle model • simple techniques for separating mixtures: filtration, evaporation, distillation and chromatography • the identification of pure substances		