# Science

## Properties of Materials Year 5

**Remember when**

Name and recognise different materials including wood, plastic, glass, metal, water and rock.
The physical properties of a variety of everyday materials and to compare and group materials on the basis of these properties. (Y2/Y4)
How materials are suitably used based on their properties. (Y2)
Magnets and electrical circuits work (Y4)
Change shape of solid squashing, bending, twisting and stretching. (Y2)
Materials that are solids, liquids and gases and their particle structure. (Y4)
Some materials change state when they are heated or cooled and the temperature at which this happens. (Y4)
Some rocks are permeable. (Y3)

**Sticky knowledge**

- Materials which are good thermal conductors allow heat to move through them easily.
- Thermal conductors are used to make items that require heat to travel through them easily, such as a saucepan which requires heat to travel through to cook food.
- Thermal insulators do not let heat travel through them easily. Examples of thermal insulators include woolen clothes and flasks for hot drinks.
- Electrical conductors allow electricity to pass through them easily while electrical insulators do not.
- Electrical insulators have a high resistance which means that it is hard for electricity to pass through these objects.
- different materials are suitable for different uses because of their hardness
- different materials are suitable for different purposes based on their transparency
- A metallurgist is a scientist who tests metals and develops new materials

**Key vocabulary**

conductivity
conductor
electrical
gas
liquid
magnetic
magnetism
insulator
material
particles
solid
hardness
thermal
transparency

**National Curriculum**

- 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

**Common Misconceptions**

Some children may think:
• thermal insulators keep cold in or out
• thermal insulators warm things up

**Enquiry Questions**

| LO | Knowledge and Skills | Lesson outline |
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| **Lesson 1**<br><br>**LO:** To compare and group materials based on hardness<br><br>**Enquiry type**<br>Comparative/ Fair testing | **Sticky Knowledge:** different materials are suitable for different uses because of their hardness<br><br>**Focus skill**<br>To plan different types of scientific enquiries to answer questions, including recognising and controlling variables where necessary. | Starter: recap materials and properties. Children to be given a selection of different materials to sort in different ways. Discuss the ways they have sorted them and why.<br><br>Children investigate whether 5 different materials can be scratched by 4 different objects of increasing hardness. They use their results to place the materials in order of hardness.<br><br>Results to be put into a table.<br><br>Write up: prediction, results, conclusion.<br><br>LA – Simple prediction/conclusion, template for results table.<br><br>ARE – As described<br><br>GD – Decide on materials to test. |
| **Lesson 2**<br><br>**LO:** To compare and group materials based on transparency<br><br>**Enquiry type**<br>Fair testing. | **Sticky Knowledge:**<br><br>Different materials are suitable for different purposes based on their transparency<br><br>**Focus skill**<br>Record data and results of increasing complexity using bar charts | Starter: Children are again given different materials and asked to sort them, linking back to Year 3 work on light.<br><br>We are going to test which materials would be suitable to create a window. What properties would a window need?<br><br>Children to make predictions about which material would be the most suitable, primarily considering transparency.<br><br>Children to test the transparency of particular objects by shining a torch through (as in year 3) and measuring the amount of lumens let through using a data logger. Discuss which materials would be the most suitable, taking into account the results of the enquiry, plus hardness (recap from last lesson). Why would a window need to be hard? |

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| | | Results will be recorded as a bar graph.<br><br>Write up: prediction, results (bar graph)<br><br>LA – supported<br><br>ARE – As described<br><br>GD – Children to also consider whether a material will allow heat to escape. Why is this important when considering the most suitable material for a window? |
| **Lesson 3**<br><br>**LO:** To group materials based on magnetism and electrical conductivity<br><br>**Enquiry type**<br>Grouping, sorting and classifying | **Sticky Knowledge:** Electrical conductors allow electricity to pass through them easily while electrical insulators do not. Electrical insulators have a high resistance which means that it is hard for electricity to pass through these objects. Some electrical conductors are also magnetic<br><br>**Focus skill**<br>To plan different types of scientific enquiries to answer questions, including recognising and controlling variables where necessary. | Recap year 4: electrical conductors. Which of these materials are electrical conductors? How could we test this?<br><br>Explain SK: Electrical conductors allow electricity to pass through them easily while electrical insulators do not.<br>Electrical insulators have a high resistance which means that it is hard for electricity to pass through these objects.<br><br>Mini activity – place the materials into the circuits and see which are conductors.<br><br>What do you notice about the conductive materials?<br><br>What do you remember about magnets from Year 3? Do you think all of the electrical conductors will also be magnetic? How could we test this?<br><br>Children to test the materials and compare using a venn diagram.<br><br>Write up: prediction (what will electrical conductors and magnetic materials have in common?), results (venn diagram)<br><br>LA – Pictures, simplified prediction<br><br>ARE – What do you notice about the materials in the centre of the Venn diagram?<br><br>GD – What do you notice about the materials in both the centre and the outside of the Venn diagram? |
| **Lesson 4**<br><br>**LO:** To compare and group materials based on thermal conductivity<br><br>**Enquiry type**<br>Comparative/ Fair testing | **Sticky Knowledge:** Thermal conductors are used to make items that require heat to travel through them easily, such as a saucepan which requires heat to travel through to cook food.<br><br>Thermal insulators do not let heat travel through them easily. Examples of thermal insulators include woolen clothes and flasks for hot drinks.<br><br>**Focus skill**<br>Record data and results of increasing complexity using line graphs<br>(Pupils will need to have covered line graphs in maths before doing this. If not this could be presented as a bar chart) | Investigate how penguins keep warm in a cold climate. Show what happens to the temperature of hot water in a stand alone bottle compared to one that is surrounded by other bottles.<br><br>Discuss SK: Thermal conductors are used to make items that require heat to travel through them easily, such as a saucepan which requires heat to travel through to cook food.<br>Thermal insulators do not let heat travel through them easily. Examples of thermal insulators include woolen clothes and flasks for hot drinks.<br><br>(Teacher) has a problem. No matter when I make a hot drink, it is cold by the time I get to drink it.<br><br>Enquiry to test which materials keep a hot drink warm for the longest amount of time. Children will wrap paper cups in different materials, pour in a set amount of a hot drink and leave for an hour. Test the temperature regularly (every 10minutes) and record (line graph).<br><br>(H&S: hot drinks should not be scalding)<br><br>Does it matter which type of drink we test? Why? (discuss milk lowering the temperature of the liquid to begin with)<br><br>LA – Results presented as a bar chart.<br><br>ARE – As described<br><br>GD - Which material will be the best to keep ice cream from melting? Design their own investigation (TA support) |
| **Lesson 5**<br><br>**LO:** To investigate materials suitable for space investigation (STEM).<br><br>**Enquiry type**<br>Fair testing. | **Sticky Knowledge:** A metallurgist is a scientist who tests metals and develops new materials<br><br>**Skill:** Take measurements, using a range of scientific equipment, with increasing accuracy and precision, taking repeat readings where appropriate | Using the STEM space case, children will carry out different enquiries to ascertain the properties of different materials.<br><br>Activities will be carried out in groups (carousel – needs a full afternoon per class).<br><br>Investigate properties of materials and decide which would be suitable for use on a spacecraft, including an introduction from a space scientist, setting the real world context for their challenge. Children will investigate eleven materials looking at mass, magnetic attraction, impact tests, electrical and thermal conductivity. They plan tests, record their findings and draw their own conclusions. |

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| | | Finally they will report back on which materials they think are most suitable for the satellite and why.<br><br>Create a table to show the results from the individual tests..<br><br>Lesson to be tweeted.<br><br>Mixed ability groups to investigate. |
| **Lesson 6**<br><br>**LO:** To draw conclusions about the suitability of materials (STEM)<br><br>**Enquiry type**<br>Fair testing. | **Sticky Knowledge:** A metallurgist is a scientist who tests metals and develops new materials<br><br>**Skill**: To report and present findings from enquiries, including conclusions, causal relationships and explanations of results, in oral and written forms such as displays and other presentations | Lead on from previous lesson.<br><br>Generate a class discussion and guide children into thinking about the different parts of the spacecraft and what kinds of materials would best be suited for which purpose. Each group will be given a different part, and write down the reasons for their choices and present findings to the rest of the class.<br><br>Presentation in mixed ability groups. |

| | **End of unit assessment** | |
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| Working towards | Working at Age related expectations | Working at a greater depth |