

| TOPIC                                          | NATIONAL CURRICULUM                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | KEY VOCABULARY                                                                                                                                                                                                                                                                                                             | POSSIBLE TRIP                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
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| <b>PROPERTIES AND CHANGES OF MATERIALS (1)</b> | <ul style="list-style-type: none"> <li>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.</li> <li>Know that some materials will dissolve in liquid to form a solution and describe how to recover a substance from a solution.</li> <li>Use knowledge of solids, liquids and gases to decide how mixtures might be separated, including through filtering, sieving and evaporating.</li> <li>Give reasons, based on evidence from comparative and fair tests, for the particular uses of everyday materials, including metals, wood and plastic.</li> </ul> | <p><b>TIER 2 (Academic):</b> Compare, group, measure, investigate, analyse, determine, separate, recover.</p> <p><b>TIER 3 (Topic Specific):</b> Hardness, transparency, conductivity (electrical, thermal), solubility, solution, solute, solvent, dissolve, filter, evaporate, sieve, mixture, reversible, material.</p> | <p><b>Royal Institution (Mayfair):</b><br/>Hosts full-day primary laboratory workshops (e.g., Cosmetic Chemistry) where pupils investigate solubility, state changes, neutralisation, and physical properties in professional lab settings.</p> <p><b>Sublime Science / Mad Science London</b> (In-School Provider): Delivers classroom science shows covering reversible and irreversible changes, including gas-releasing acid-base reactions, slime chemistry, and thermal insulation experiments</p> |
| <b>PRIOR LEARNING</b>                          | <b>Y4:</b><br>States of Matter (solids, liquids, gases), melting, freezing, boiling, evaporation, and condensation.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                                                                                                                                                                                                                                                                                                                            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |

|                                                         | WEEK 1                                                                                                      | WEEK 2                                                                                                   | WEEK 3                                                                                         | WEEK 4                                                                                                                              | WEEK 5                                                                                                           | WEEK 6                                                                                                     |
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| <b>ENQUIRY QUESTION</b>                                 | Which materials are the best conductors of heat and electricity?                                            | How can we test materials for hardness, transparency, and magnetism?                                     | What factors affect how fast a solid dissolves in a liquid?                                    | How can we separate a mixture of solids of different sizes?                                                                         | How can we recover a dissolved solid from a liquid solution?                                                     | How can we select the best materials to design a everyday product?                                         |
| <b>LEARNING OBJECTIVES</b>                              | To test and rank materials based on thermal and electrical conductivity.                                    | To investigate physical properties (hardness, transparency, magnetism).                                  | To investigate solubility and the effect of temperature on dissolving rates.                   | To select and apply sieving and filtering techniques to separate mixtures.                                                          | To recover solutes from solutions using evaporation techniques.                                                  | To justify material choices based on evidence from fair testing.                                           |
| <b>ACTIVITY</b><br><b>WORKING SCIENTIFICALLY SKILLS</b> | <b>COMPARATIVE TESTING:</b><br>Test metal, wood, plastic, and glass spoons in hot water with butter timers; | <b>CLASSIFYING:</b><br>Perform scratch tests on solids; test light transmission using light meters; test | <b>COMPARATIVE TESTING:</b><br>Measure time taken for equal sugar mass to dissolve in water at | <b>PROBLEM SOLVING:</b><br>Separate a multi-part mixture (sand, gravel, paperclips, water) using magnets, sieves, and filter paper. | <b>OBSERVING OVER TIME:</b><br>Evaporate saltwater solutions over heat sources to observe salt crystal recovery; | <b>RESEARCHING &amp; TESTING:</b><br>Test fabrics and membranes for thermal insulation, waterproofing, and |

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|                                                             | insert materials into test circuits to test conductivity.                                                                                                                                                                                                                          | magnetic attraction using magnets.                                                   | 20°C, 40°C, and 60°C with repeated trials.                                              |                                                                                              | record liquid volume loss.                                                                    | transparency to design an optimal tent or teabag.                                           |
| <b>ASSESSMENT</b>                                           | Identify metals as high thermal/electrical conductors and plastics/wood as insulators.                                                                                                                                                                                             | Classify materials into matrices based on hardness scale, opacity, and magnetism.    | State pattern: higher solvent temperature increases the rate of solid dissolving.       | Demonstrate that sieving separates large particles while filtering removes insoluble solids. | Explain that evaporation leaves the solid solute behind as liquid solvent turns to gas.       | Provide evidence-based reasoning for selecting materials for specific functions.            |
| <b>END POINT ASSESSMENT</b>                                 | Pupils can compare materials by thermal/electrical conductivity, hardness, solubility, and transparency; distinguish dissolving from melting; select appropriate separation methods (filtering, sieving, evaporating); and justify material selection for specific practical uses. |                                                                                      |                                                                                         |                                                                                              |                                                                                               |                                                                                             |
| <b>HIGHER ORDER QUESTIONS</b>                               | Why do electrical wires require copper interiors but plastic outer sheaths?                                                                                                                                                                                                        | Why is a diamond rated as hard while chalk is soft, even though both are solids?     | What is the difference between a solid melting and a solid dissolving into a solvent?   | Why cannot filter paper separate dissolved salt from water?                                  | If a sugar solution evaporates, will the recovered sugar taste the same as before dissolving? | Why would metal be a poor choice of material for making a teabag?                           |
| <b>FURTHER OPTIONAL QUESTIONS/BIG QUESTIONS FOR DISPLAY</b> | Why does sugar seem to disappear in hot tea, and where does it actually go?<br>How can we turn salty ocean water into pure drinking water?<br>Why are wooden spoons used for stirring hot soup instead of metal spoons?                                                            |                                                                                      |                                                                                         |                                                                                              |                                                                                               |                                                                                             |
| <b>INCLUSION &amp; ADAPTATION</b>                           | Pre-assembled circuit kits with visual conductivity indicators (Bulb Lights = Conductor).                                                                                                                                                                                          | Dual sorting circles labelled "Scratches Easily" vs "Hard Surface" with touch cards. | Stopwatch visual timers with color-coded temperature beaker stands.                     | Step-by-step pictorial funnel and sieve assembly guide cards.                                | Direct visual observation of salt crystal formation under magnifying loupes.                  | Visual matrix choice board (Waterproof, Warm, Clear) for product building.                  |
| <b>GREATER DEPTH</b>                                        | Quantify thermal transfer rates by measuring temperature drops over time in varied flasks.                                                                                                                                                                                         | Research Mohs Scale of Mineral Hardness and order unknown mineral specimens.         | Graph dissolving rates across saturation points to determine maximum solubility limits. | Design a multi-stage industrial filtration process for contaminated muddy river water.       | Calculate percentage yield recovery of solutes post-evaporation.                              | Write a design specification report defending material choices against cost and durability. |