Science Progression - Chemistry

Year 1	Term 6: Moon Zoom Describe the simple physical properties of a variety of everyday materials. 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 Compare and group together a variety of everyday materials on the basis of their simple physical properties
Substantive Knowledge	**Exploring Properties** **What is a sample?** A sample is a small part of something larger. It helps us understand more about the whole thing. **Different types of samples we might find:** Metal pieces: These might come from the aircraft or other vehicles. Plastic fragments: Parts from the aircraft that are made of plastic. Glass shards: Broken pieces of glass that might come from windows. Soil or dirt: The ground beneath the crash site. Organic matter: Leaves, twigs, or other natural materials. **Endpoints** 1. Identify the properties of different materials. 2. Use descriptive language to express what they feel, see, and experience. 3. Understand that different materials have various uses based on their properties. **New Planets/ Welcome to Earth** Planet Wood Objects: Wooden toys, furniture, pencils Planet Plastic Objects: Plastic bottles, bags, toys Planet Glass Objects: Windows, jars, bottles Planet Smooth Objects: Glass, polished metal, some plastics Planet Bendy Objects: Rubber, certain plastics, fabric Planet Waterproof Objects: Raincoats, wellies, some plastics (like waterproof bags) **Endpoints** 1. Identify different materials and sort them based on their properties. 2. Explain why certain objects are suitable for certain tasks based on their materials. 3. Create their own planets and discuss the unique characteristics of each.
Disciplinary Knowledge	**Observe**: Use their senses to identify properties. **Classify:** Group materials based on their properties. **Record Data:** Write down their observations using simple adjectives on sticky notes or large sheets of paper. **Sorting and Grouping:** Understanding how to sort materials based on their properties. **Observation**: Noticing features of materials in everyday objects. **Communication**: Discussing findings with peers and sharing ideas about objects and materials. **Hands-on Learning:** Engaging with physical objects to enhance understanding of material properties.

Useful Websites	• BBC Bitesize - Materials • Science Kids - Properties of Materials • National Geographic Kids - Materials • BBC Bitesize - Materials • National Geographic Kids - Materials Science • Twinkl - Materials Sorting Activity

Year 2	Term 3: Land Ahoy! Identify and compare the suitability of a variety of everyday materials, including wood, metal, plastic, glass, brick, rock, paper and cardboard for particular uses.
Substantive Knowledge	**Investigating Materials** **What Are Boats?** Definition: A boat is a vehicle used for travelling on water. **Types of Boats:** Sailboats Rowboats Motorboats Barges **Materials Used to Make Boats** Wood: Strong and lightweight, often used in traditional boats. Plastic: Durable and waterproof, common in modern small boats. Metal: Used for large vessels; very strong and long-lasting. Glass: Sometimes used in windows or the hull of certain boats. Card/Paper: Used for model boats; not suitable for real watercraft. **Properties of Different Materials** Wood: Properties: Light, can float. Uses: Canoes, small sailing boats. Plastic: Properties: Light, can float, waterproof. Uses: Kayaks, dinghies. Metal: Properties: Heavy, can sink, very strong. Uses: Cargo ships, ferries. Glass: Properties: Heavy when thick, can sink, sometimes transparent, fragile. Uses: Windows in boats. Brick: Properties: Heavy, sinks. Uses: Not used in boats, but important for other constructions. Paper/Card: Properties: Lightweight, can float if treated. Uses: Model boats for experiments and projects. **Floating and Sinking** Float: If something stays on the surface of the water. Sink: If something goes to the bottom of the water. Buoyancy: The ability of an object to float. Density: The amount of mass in a given volume which affects floating or sinking. Material: The substance from which something is made. **Endpoints** 1. Identify and name various boats and the materials they are made from. 2. Describe the properties of materials (wood, plastic, metal, glass, brick, paper/card). 3. Conduct simple experiments to test which materials float or sink. 4. Discuss their findings with peers and explain their reasoning.

Disciplinary Knowledge	**Observation:** Look closely at images of boats and materials. **Hypothesis:** Make educated guesses about which materials will float/sink. **Experimentation:** Test different materials to see what floats and what sinks in water. **Data Collection:** Record observations of which materials float and which sink.
Useful Websites	• BBC Bitesize - Floating and Sinking • National Geographic Kids - Boats • Science4Us - Materials and Their Properties • Primary Resources - Science Worksheets

Year 4	Term 6: Tribal Tales 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.
Substantive Knowledge	**Investigating Rocks** **Types of Rocks** **Igneous Rocks** Formed from cooled magma or lava. Appear shiny and can be coarse or fine-grained. Examples: Granite, Basalt. **Sedimentary Rocks** Formed from particles of other rocks and organic materials. Often have a layered appearance and can contain fossils. Examples: Sandstone, Limestone. **Metamorphic Rocks** Formed under heat and pressure from other rocks. Can have a banded or foliation structure. Examples: Marble, Slate. **Properties of Rocks** Texture: Coarse, fine, smooth, rough. Colour: Can vary widely based on minerals. Hardness: Some rocks are very hard (like diamonds), while others (like chalk) are much softer. Porosity: Some rocks can absorb water, while others cannot (like granite). **End Points** 1. Identify and name different types of rocks. 2. Describe and compare the appearance and properties of various rocks. 3. Explain the uses of certain rocks in everyday life. **Changes** **What are Fossils?** Definition: Fossils are the remains or traces of plants and animals that existed a long time ago. They can be bones, shells, imprints, or other evidence of past life. Types of Fossils: Body Fossils: These are the actual remains of the organism (e.g., bones, shells). Trace Fossils: These show evidence of the organism's activity (e.g., footprints, burrows). **The Fossilisation Process** Fossilisation is a complex process that involves several steps: Death: The process begins when an organism dies. Decay: The soft parts of the organism decay or are eaten by scavengers, leaving only hard parts like bones or shells. Burial: Over time, sediment such as mud and sand covers the remains. This can happen in rivers, lakes, or oceans. Pressure: Layers of sediment accumulate over time, and the weight of the layers compresses the buried remains. Mineral Replacement: Minerals from water can seep into the bones or shells, replacing the original material and turning it into stone. Erosion and Discovery: Over millions of years, the layers of rock may erode, exposing the fossil for discovery. **Endpoints** 1. Describe the stages of fossil formation in simple terms. 2. Identify different types of fossils. 3. Explain why some organisms are more likely to become fossilised than others. 4. Create a model or diagram that illustrates the fossilisation process.

Disciplinary Knowledge	**Scientific Skills** Observation: Carefully look at rocks to note their texture, colour, and other physical properties. Classification: Group rocks based on identified characteristics. Investigation: Conduct experiments to test the hardness or porosity of different rocks (using a scratch test or water absorption). **Inquiry Process** Ask Questions: What differences can we see between types of rocks? Collect Data: Gather rock samples and record observations. Analyse Results: Compare findings with peers. **Scientific Skills** Observation: Students should learn to observe fossils and recognise their types. Categorisation: Students can categorise different fossils based on whether they are body or trace fossils. Model Creation: Encourage students to create a simple model showing the fossilisation process using clay or other materials. **Inquiry Skills** Questioning: Encourage students to ask questions about fossils, such as "What types of environments are best for fossilisation?" Research: Guide students in conducting research using books and websites to find out more about specific fossils.
Useful Websites	• British Geological Survey • National Geographic Kids - Rocks and Minerals • Rock Cycle for Kids - Ducksters • BBC Bitesize - What is a Fossil? • National Geographic Kids - Fossils • The Natural History Museum - Fossil Facts • Earth Learning Ideas - The Fossilisation Process

Year 6	Term 3: Alchemy Island Record data and results of increasing complexity using scientific diagrams and labels, classification keys, tables, scatter graphs, bar and line graphs. 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. Plan different types of scientific enquiries to answer questions, including recognising and controlling variables where necessary. Use knowledge of solids, liquids and gases to decide how mixtures might be separated, including through filtering, sieving and evaporating. Take measurements, using a range of scientific equipment, with increasing accuracy and precision, taking repeat readings when appropriate 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. Use test results to make predictions to set up further comparative and fair tests. Report and present findings from enquiries, including conclusions, causal relationships and explanations of and degree of trust in results, in oral and written forms such as displays and other presentations. Identify scientific evidence that has been used to support or refute ideas or arguments. Know that some materials will dissolve in liquid to form a solution, and describe how to recover a substance from a solution.
Substantive Knowledge	**Examining Samples from Alchemy Island** **Materials:** Understand the materials that may be found on Alchemy Island. **Properties of Materials:** Focus on characteristics such as: State (solid, liquid, gas) Transparency (transparent, translucent, opaque) Hardness (soft, hard) Electrical Conductivity (conductors, insulators) Thermal Conductivity (good conductors, poor conductors) Magnetism (magnetic, non-magnetic) **Endpoints** 1. Describe the properties of different materials found on Alchemy Island. 2. Classify materials based on their observable characteristics. 3. Accurately record information using a spreadsheet. 4. Reason scientifically about the potential origins of samples from Alchemy Island. **Separating Mixtures** **Key Concepts** **Mixtures:** Combinations of two or more substances that can be physically separated. Examples include sand and salt mixed with water, or oil mixed with water. **Filtration:** A method used to separate solids from liquids. It involves passing a mixture through a filter paper or porous material to trap solid particles. **Sieving:** A technique used to separate larger particles from smaller ones. This is often done using a sieve, which is a device with holes of a specific size. **Evaporation:** The process of turning a liquid into vapour. This method is used to separate a dissolved solid from a liquid. **Real-World Applications** Water purification systems use filtration to remove impurities. Cooking uses sieving to separate flour from lumps. Salt production involves evaporating seawater to extract salt. **Endpoints** 1. Understand how to use filtration, sieving, and evaporation to clean mixtures. 2. Evaluate and communicate the effectiveness of each method. **Fountain of Gold** **What is a Chemical Reaction?** A chemical reaction is a process where substances (reactants) are transformed into new substances (products). Common signs of a chemical reaction include: Colour change Gas production (bubbling or fizzing) Temperature change (exothermic or endothermic reactions)

Formation of a precipitate (solid that forms from a liquid solution)

Reversible Reactions: These can be undone. An example is the crystallisation of substances.

Irreversible Reactions: These create new substances that cannot be returned to their original form (e.g., burning wood**).**

Endpoints

1. Understand the differences between mixtures and chemical reactions.
2. Describe and explain the process taking place at the Fountain of Gold, using scientific terminology.
3. Evaluate whether the chemical reaction observed is reversible or irreversible based on evidence gathered during the exploration.

Gold Crystals

Changes in State

Physical Change: The process observed is a physical change, not a chemical one. The jelly marbles swell when water is absorbed but remain the same substance.

Reversibility: Discuss the reversibility of changes—how the marbles can return to their original size when dehydrated.

Measuring Growth

Weight Measurement: Weight is measured in grams (g). Use digital scales for precision.

Size Measurement: Use a ruler or measuring tape to gauge the diameter of the marbles.

Drawing the Line Graph

X-Axis: Time intervals (minutes).

Y-Axis: Weight of the marbles (grams).

Plotting Points: Each recorded weight at the respective time interval.

Connecting Points: Draw a line to show the growth trend over time.

Endpoints

1. Effectively measure and record data.
2. Analyse and interpret scientific data through graphs.
3. Communicate findings about physical changes and the reversibility of these changes using appropriate scientific language**.**

Into the Lab/Alchemist's Challenge

Soluble: A term used to describe a substance that can dissolve in a solvent.

Insoluble: A term used to describe a substance that cannot dissolve in a solvent.

Solution: A homogeneous mixture formed when a solute dissolves in a solvent.

Solute: The substance that is dissolved in a solution (e.g., gold dust).

Solvent: The liquid in which the solute dissolves (e.g., water).

The Science of Solutions

Dissolving Process: When a solute (like gold dust) is added to a solvent (like water), the solute particles break apart and are surrounded by solvent molecules. If enough solute is added, the solution becomes saturated, meaning no more solute can dissolve.

Temperature Effect on Solubility: Generally, the solubility of solids increases with temperature. This means that more solute can dissolve in a solvent when it is warm or hot compared to when it is cold.

Saturated Solutions

A saturated solution is achieved when no more solute can dissolve in the solvent at a given temperature. Any additional solute will settle at the bottom of the beaker.

Endpoints

1. Define and describe key terms related to solubility.
2. Conduct a fair test and record results systematically.
3. Explain the relationship between temperature and solubility of solids.
4. Make observations and infer conclusions based on collected data.

Disciplinary Knowledge	**Observation:** Carefully observe each sample's physical properties. **Classification:** Use a systematic approach to group samples based on their characteristics. **Recording Data:** Create and maintain a detailed spreadsheet to record your observations and groupings. **Planning and Conducting Investigations**: Design a fair test to explore which method is most effective for cleaning a mixture. **Making Observations and Collecting Data:** Record data systematically using tables or charts. Capture photos at various stages. **Evaluating Results**: Analyse the outcomes of your cleaning process to determine the success rate and understand why certain methods worked better than others. **Ask a Question:** How can we decontaminate our sample mixture effectively? **Make Predictions:** Which method will work best for cleaning different kinds of mixtures? **Experiment:** Conduct the experiment using filtration, sieving, and evaporation. **Observe and Record:** Use diagrams and photographs to document changes. **Analyse and Conclude:** Discuss the effectiveness of each method. **Observations and Data Collection** As scientists, we must be careful observers. Keep a record of all physical changes during the reaction. Have a notebook ready to jot down observations about colour changes, gas production, and temperature changes. **Design a Simple Experiment** Experiment Idea: Create a 'Fountain of Gold' at your classroom's table. Materials: Vinegar, baking soda, gold spray paint (to mimic gold), food colouring. Procedure: Mix baking soda and vinegar in a container; observe the reaction and discuss changes. **Discussion and Reflection** After observing the experiment, discuss: What did you see? Were there any surprises? Was the reaction reversible? Why or why not? **Hypothesis Formation:** Expect students to predict whether the marbles will grow in size and weight. **Observation:** Describe changes visually, noting differences in weight and size over time. **Data Collection:** Record weight and size at regular intervals (e.g., every 5 minutes). **Analysis:** Compare initial measurements to final results to assess growth and whether changes are reversible. **Planning an Investigation** Formulate a hypothesis (e.g., "More gold dust will dissolve in warm water than in cold water"). Identify variables: Independent: Temperature of the water (cold vs warm/hot). Dependent: Amount of gold dust that dissolves. Controlled: Volume of water, type of solute, number of spoons. **Conducting the Experiment** Prepare two beakers with 50ml of cold water and 50ml of warm/hot water. Add level spoons of gold dust, one at a time, stirring gently. Stop adding when no more gold dust dissolves (saturated solution). **Recording Results** Create a table to document the number of spoons of gold dust added for both the cold and warm solutions.
Useful Websites	• BBC Bitesize - Properties of Materials • Primary Science - Understanding Materials • Science Buddies - Conductivity and Resistance • BBC Bitesize Science • Primary Science Teaching Trust • Royal Society of Chemistry - Learn Chemistry • BBC Bitesize - Chemical Reactions • Science Museum - What is a Chemical Reaction? • PhET Interactive Simulations - Reactants, Products and Leftovers • BBC Bitesize - Properties of Materials • Science Buddies - Absorbent Polymers • The Royal Society of Chemistry - Experiments • BBC Bitesize: Solubility • Primary Science: Understanding Solutions • American Chemical Society – Solubility: Classroom Resources