Changes in Materials

KS 1

Need to risk assess any contact with materials, use the CLEAPs folder to check on the health and safety recommendations for the activities.

- *Pupils distinguish between an object and the material from which it is made*
- *Pupils identify and name a variety of everyday materials, including wood, plastic, glass, metal, water, and rock*
- *Pupils describe and compare the simple physical properties (for example, roughness, hardness, shininess, ability to float, transparency) of a variety of everyday materials*

Pupils compare and group together a variety of everyday materials on the basis of their simple physical properties. (e.g. hardness, roughness, shininess, ability to float, flexibility)

The following is to be used to guide planning for both the **Hard Materials** and **Soft Materials** units at KS1. Although the the range of materials is different for each unit, the same planning sequence is used.

Pupils:
- Explore using senses, discuss, raise and answer questions about a wide range of everyday hard materials, such as wood, plastic, metal, glass, rock, brick, (or for soft materials, wool, fabric, plastic, sponge, mouldable and elastic materials) so that they begin to become familiar with the names of the common material groups.
- Explore the simple features of a variety of materials, such as: hard/soft; stretchy/stiff; shiny/dull; rough/smooth; bendy/not bendy; waterproof/not waterproof; absorbent/not absorbent; opaque/transparent, float/sink, magnetic/non-magnetic.
- Sort the materials in their own ways, explaining their reasons. Use this to establish the common material groups.
- Investigate simple properties of the materials, such as, Which material is shiniest? most see-through? most waterproof?

Explore everyday materials in and around the school. They might be 'material' detectives and make a map of the materials they find. They compare the materials with those found in other places, such as home, on the way to school.

Pupils identify and compare the suitability of a variety of everyday materials, including wood, metal, plastic, glass, brick, rock, paper and cardboard for particular uses

Pupils:
- Carry out simple fair tests to explore materials best suited to different purposes through questions, such as: 'What is ...for a bookshelf? (hard materials) the best material for an umbrella? ...for lining a dog basket? ...for curtains?...for a gymnast's leotard?' Which is the best paper for writing on? (soft materials) They might also think about how they make a material more suitable for a particular purpose eg How can we make wood waterproof for a fence post?
- Explore and identify the uses of different everyday materials. They think about the properties of materials that make them suitable or unsuitable for particular purposes.
- Explore how some materials are used for more than one purpose (eg metal can be used for coins, cans, cars and table legs; wood can be used for matches, floors, and telegraph poles) and, in simple terms, they explore how suitable the material is for each purpose.
- Explore how different materials are used for the same purpose (spoons can be made from plastic, wood, metal, but not normally from glass).They compare how good each material is for a particular use.
- Give their own ideas about unusual and creative uses for everyday materials.
- Find out, in simple terms, about people who have developed useful new materials, such as John Dunlop, Charles Macintosh, John McAdam.
- Visit or have visitors into school to talk about how they use materials in their work, such as a carpenter, joiner or blacksmith.

- *Pupils identify natural materials as those found in nature.*
- *Pupils recognise that some materials have been man-made.*

Pupils recognise that some materials can be recycled.

Pupils:
- Explore natural materials, perhaps through Forest School. They might make simple shelters using natural materials.
- Explore how a natural material, such as wood, is prepared for different uses. In simple ways, they compare this material with some materials which are man-made.
- Explore, in simple ways, how some materials are recycled, such as waste paper in school.

Key Vocabulary

Properties

Lower KS2

Pupils compare and group materials together, according to whether they are solids, liquids or gases.

Pupils:
- Carry out activities to explore the properties of solids, liquids and gases, such as exploring the same volume of water as they pour it into different shaped containers. They explore how the liquid takes on the shape of the container.
- Explore a range of materials (including additional solids, liquids and gases) and group according to whether they think they are solids, liquids or gases and explain why they think this.

Use their learning to make simple descriptions of states of matter, such as solids hold their shape: liquids form a pool not a pile: gases escape from an unsealed container. Use this work to establish related vocabulary.

- ***Use a range of thermometers to measure the change in materials as they are heated and cooled.***
- ***Pupils observe that some materials change state when they are heated or cooled.***

Recognise that changes of state are reversible.

Pupils:
- Explore different thermometers, such as digital, stick, forehead and room thermometer. Establish that temperature is a measure of how hot or cold something is. Pupils learn how the different thermometers are used to measure temperature and how to read the stick and room thermometers in 'C. Pupils take temperatures of various objects and in different places eg the classroom, by the radiator, their hands, and compare using different types of thermometer.
- Explore what happens to water when it is heated. Pupils might observe a boiling kettle or pan of water. NB Make sure pupils are at a safe distance from the boiling water. They observe the changes in the water as it heats up and boils.
- Explore what happens to water when it is cooled.
- They explore the properties of ice and compare with their descriptions of a solid. They might use ice cubes or make ice balloons.
- They observe what happens to ice as it melts, and compare the time taken for different sized pieces of ice to melt. They might also observe how quickly a snowman melts. Use the discussion to establish related vocabulary and to link the changes in water as it turns to ice and ice as it changes to water to weather conditions. Use to establish that melting and freezing are reversible changes.
- Investigate what happens to other liquids when they are put in the freezer.
- Investigate how the temperatures of warm and cold water change, by recording their temperatures over time when left at room temperature.

Observe the changes in some materials as they are heated eg butter, chocolate or wax as they melt. This might be done by using a bain-marie. (NB Use only hand-hot water.)

- ***Identify the part played by evaporation and condensation in the water cycle.***

Recognise that changes of state are reversible.

Pupils:
- Pupils investigate evaporation by observing changes in a puddle over a day or by investigating how different shaped containers affect how quickly water evaporates from them. They discuss their ideas about what happens to the water. Use this discussion to establish that the water turns into water vapour and that this process is called evaporation. Also, use this to establish related vocabulary.
- Explore condensation by observing steam from a kettle meeting a cold surface or by seeing their breath on a cold day or condensation on windows. Explore the changes and use to establish that all the changes (melting, freezing evaporation and condensation) are reversible.

Explore the part played by evaporation and condensation in the water cycle.

Upper KS2

- ***Pupils measure the temperature at which some materials change state in degrees Celsius ('C)***
- ***Pupils demonstrate that changes of state are reversible changes.***
- ***Pupils research the temperature at which some materials change state in degrees Celsius ('C)***
- ***Pupils associate the rate of evaporation with temperature.***

Pupils:
- Briefly revisit their learning about solids, liquids and gases. Help pupils to identify the properties of each group.
- Use data loggers to measure, in real time, the temperature of water as it heats up and boils. Pupils check the measurements against those taken using different thermometers. They look for signs of boiling as the water is heated. They interrogate the graph of temperature over time and discuss what they think is happening to the water at various points as it is heated. Using the graph, establish that the boiling point of water is 100C. Pupils discuss the properties of steam and compare with their descriptions of a gas.
- Discuss whether the steam can be changed back to water and talk about evidence they've seen which supports their ideas.
- Re-visit examples of water condensing on to cold surfaces eg metal, cold windows, glass. They discuss what they think is happening. Use to establish that when steam is cooled sufficiently it condenses into water, Re-establish that changes of state are reversible.
- Explore the changes that happen as water freezes, noticing the temperature at which water freezes into ice.
- They explore the changes in ice as it melts to become water, again noting the temperature at which it melts. They discuss the changes. Use to establish that changes of state are reversible.
- Research the temperatures at which other materials melt or freeze, such as when iron melts or when oxygen condenses.
- Explore the process of evaporation by investigating the factors that affect how quickly washing dries on a line. Discuss the outcomes and draw pupils' attention to the fact that the rate of evaporation is related to temperature.

Relate all these reversible changes to their learning about solids, liquids and gases.

- ***Pupils 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.***

Pupils:
- Experience changes that result in new materials being formed, such as rusting, burning and baking.
- Investigate the factors involved in iron rusting, such as oxygen/no oxygen (cover in Vaseline), water/no water, water/salty water, warm/cold conditions. They make observations/take pictures over time to capture the rusting process.
- Explore what happens when different materials are burned. NB Health &Safety - Risks and dangers of fire. They might also try burning the wick of a candle. Pupils examine new materials formed and compare with original ones. They discuss what they think happens and whether they think the change can be reversed. This work might also be supported by a visit from a Fire Officer.
- Explore the effect of adding acid (eg vinegar or lemon juice) to bicarbonate of soda. Pupils might also log temperature during the reaction using a data logger. They compare the original materials with those formed. They explain their ideas about what happens.

Explore the role of yeast in bread-making. They investigate factors that affect the activation of the yeast. Use this and the above changes to establish that when a change results in the formation of new materials, it is not usually reversible,

Pupils explore the work of scientists in creating new and useful materials.

Pupils:
- Find out about how chemists create new materials e.g. Spencer Silver, who invented the glue for Sticky notes or Ruth Benerito, who invented wrinkle-free cotton.

Research and discuss how chemical changes have an impact on our lives. They discuss the creative use of new materials, such as Tefal in non-stick pans,

Materials Hard/soft stretchy/stiff shiny/dull rough/smooth bendy/not bendy waterproof/not waterproof absorbent/not absorbent opaque/transparent wood, metal, plastic, glass, brick, rock, paper and cardboard **Opportunities for scientific investigation** Identifying, classifying and grouping materials Pattern seeking Observing closely Researching **Opportunities for Data Handling/Maths** Sorting objects. Simple Venn diagrams (e.g. wooden, metal) Carroll diagrams (e.g. transparent/not transparent; waterproof/not waterproof) **Resources** Magnifying lenses Samples of the materials Digital microscopes		