Year 4 – States of Matter



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| National Curriculum Outcomes: Knowledge   * Compare and group materials together, according to whether they are solids, liquids or gases * 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 * Identify the part played by evaporation and condensation in the water cycle and associate the rate of evaporation with temperature | | | | | | National Curriculum Outcomes: Working Scientifically   * Asking relevant questions and using different types of scientific enquiries to answer them * Setting up simple practical enquiries, comparative and fair tests * Making systematic and careful observations and, where appropriate, taking accurate measurements using standard units, using a range of equipment, including thermometers and data loggers * Gathering, recording, classifying and presenting data in a variety of ways to help in answering questions * Recording findings using simple scientific language, drawings, labelled diagrams, keys, bar charts, and tables * Reporting on findings from enquiries, including oral and written explanations, displays or presentations of results and conclusions * Using results to draw simple conclusions, make predictions for new values, suggest improvements and raise further questions * Identifying differences, similarities or changes related to simple scientific ideas and processes * Using straightforward scientific evidence to answer questions or to support their findings | | | | | |
| Children 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. (*Taken from the National Curriculum*) | | | | | |
| Links to prior learning  **Year 1 -** 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.  **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 the shapes of solid objects made from some materials can be changed by squashing, bending, twisting and stretching. | | | | | | | | Links to future learning  **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 metals, wood 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 that this kind of change is not usually reversible, including changes associated with burning and the action of acid on bicarbonate of soda. | | | |
| Key Vocabulary  Material, matter, compare, sort, group, temperature, degrees celsuis, thermometer, heated, cooled, evaporation, condensation, melting, solidifying, freezing, solid, liquid, gas, water cycle, rain, precipitation, cloud, particles | | | Common Misconceptions  Children may think:   * ‘solid’ is another word for hard or opaque * solids are hard and cannot break or change shape easily and are often in one piece * substances made of very small particles like sugar or sand cannot be solids * particles in liquids are further apart than in solids and they take up more space * when air is pumped into balloons, they become lighter * water in different forms – steam, water, ice – are all different substances * all liquids boil at the same temperature as water (100 degrees) * melting, as a change of state, is the same as dissolving * steam is visible water vapour (only the condensing water droplets can be seen) * clouds are made of water vapour or steam * the substance on windows etc. is condensation rather than water * the changing states of water (illustrated by the water cycle) are irreversible * evaporating or boiling water makes it vanish * evaporation is when the Sun sucks up the water, or when water is absorbed into a surface/material. | | | | | | | | |
| Important knowledge/facts that the children need to know   * Materials can either be a solid, liquid or gas. * Solids retain their shape and can be held. Sometimes solids can behave like liquids if they are made up of lots of small parts, for example sand or sugar. Children should learn that these are still solids as the individual grains of each retain their shape. * Liquids take on the shape of the container they are in and can be poured. * Gases are often invisible. They spread out to fill the space or container they are in. * Solids can become liquids through heating. This process is called melting * Liquids can become gases through heating. This process is called evaporation. * Gases can become liquids through cooling. This process is called condensation. * Liquids can become solids through cooling. This process is called solidification or freezing (it is helpful to use *solidification* rather than *freezing* with children as the term *freezing* can lead them to think things have to be very very cold to solidify) * Water freezes at 0oC and boils at 100oC. * The water cycle is the compete journey that water makes from one place to another and from one state to another. | | | | | | | | | | | |
| Important scientists  **Anders Celsius** – Created the Celsius temperature scale  **Carol Kirkwood** – Scottish weather presenter | STEM Career Links  **Chemist** (studies chemistry)  **Materials scientist** (researches structures and properties of materials)  **Meteorologist** (studies the atmosphere and weather) | | | | Links to real life   * Where do we see melting in our everyday lives? (Ice in drinks, ice lollies, chocolate that gets warm etc.) * Where do we see evaporation in our everyday lives? (Clothes drying, water vapour above a cup of tea, puddles drying up etc.) * Where do we see condensation in our everyday lives? (Our breath on a window, our breath when it is cold, clouds in the sky etc.) | | | | | | |
| Suggested Enquiry Activities | | | | | | | | | | | |
| Identifying and Classifying   * At what temperature do different materials melt (butter, chocolate, ice etc.) * Group materials into solids, liquids and gases | | Comparative and Fair Testing   * Which kind of chocolate (white, milk, dark) is best for making crispy cakes that won’t melt in warm weather? * Where is the best place in school to dry out our wet clothes? | | Observation over Time   * Which ice lolly melts the slowest? * How do the clouds in the sky change over the course of a day/hour? * How does a wet handprint on a paper towel dry? | | | | | Pattern Seeking   * Do bigger ice cubes melt more slowly? | | Research using Secondary Sources   * Research the water cycle. * At what temperature do metals change state? |
| Wow Factor Experiences   * Create a water cycle in a bag (see weblinks below) * Investigate melting ice lollies or chocolate | | | | | | | | | | | |
| Maths Links   * Measure the perimeter of a puddle as it dries over time. This data can then be turned into a line graph. * Measure the size (height/width/circumference) of different ice lollies as they melt over time | | | | | | | Literacy Links  Create a piece of drama and/or diary entry of a drop of water going through the water cycle | | | Broader Curriculum Links  **Geography:** Explore weather conditions around the world | |
| Story Links  Charlie and the Chocolate Factory – Roald Dahl | | | | | | | | | | | |
| Helpful Weblinks  Water cycle in a bag activity - <https://www.mobileedproductions.com/blog/how-to-make-a-water-cycle-in-a-bag>  Teacher CPD for this unit (free) – <https://www.reachoutcpd.com/courses/upper-primary/states-of-matter/>  Assessment exemplification (could also be useful with planning ideas) – <https://www.planassessment.com/product-page/examples-of-work-states-of-matter-y4-chaya>  BBC Class Clips (useful videos) – <https://www.bbc.co.uk/bitesize/topics/zkgg87h>  STEM Learning’s online resource library for this unit - <https://www.stem.org.uk/resources/community/collection/12345/year-4-states-matter> | | | | | | | | | | | |