



States of Matter

Prior Knowledge

Distinguish between an object and the material from which it is made. (Y1 - Everyday materials)

Identify and name a variety of everyday materials, including wood, plastic, glass, metal, water, and rock. (Y1 - Everyday materials)

Describe the simple physical properties of a variety of everyday materials. (Y1 - Everyday materials)

Compare and group together a variety of everyday materials on the basis of their simple physical properties. (Y1 - Everyday materials)

Identify and compare the suitability of a variety of everyday materials, including wood, metal, plastic, glass, brick, rock, paper and cardboard for particular uses. (Y2 - Uses of everyday materials)

Find out how the shapes of solid objects made from some materials can be changed by squashing, bending, twisting and stretching. (Y2 - Uses of everyday materials)

Year: 4

Term: Spring

Grouping materials			
Materials fall into four main categories	<ul style="list-style-type: none"> solids liquids gases 		
Three key states of matter			
Solids	<p>Particles in a solid are close together and cannot move. They can only vibrate. Solids stay in one place and can be held.</p> <p>Most solids keep their shape unless force is applied to them.</p> <p>They can be hard, soft or even squashy. Some, like sand or salt can be poured. Solids always take up the same amount of space no matter what has happened to them.</p>		
Liquids	<p>Particles in a liquid are close together but can move around each other easily.</p> <p>Liquids change their shape depending on the container they are in. They can change shape but do not change the amount of space they take up. They can flow or be poured.</p>		
Gases	<p>Particles in a gas are spread out and can move around very quickly in all directions. They fill the container or room they are in.</p> <p>They do not have a fixed shape but they do have a mass.</p>		
Change of state			
What does changes of state mean?	Materials can be one of the three states of matter: solids, liquids or gases. Some materials can change from one state to another and back again.		
What are the changes of state?			
What	Explanation	Name of process	Example
Solid to liquid	A solid is heated to its melting point. Its particles start to move faster and faster until they are able to move over and around each other.	Melting	When an ice cube melts.
Liquid to solid	When a liquid freezes it turns into a solid. The particles in the liquid begin to slow down as they get colder and colder. They can then only move gently on the spot giving them a solid structure.	Freezing	When the water in a pond freezes, it turns to ice.
At what temperature does each happen?			
Boiling	When water is boiled it evaporates into water vapour (gas). Water boils at exactly 100°C. A hot bath is about 40°C.		
Melting	Different solids melt at different temperatures: ice melts at 0 degrees Celsius (0°C); chocolate melts at about 35°C		
Freezing	Water freezes at 0 degrees Celsius (0°C).		

Evaporation and Condensation

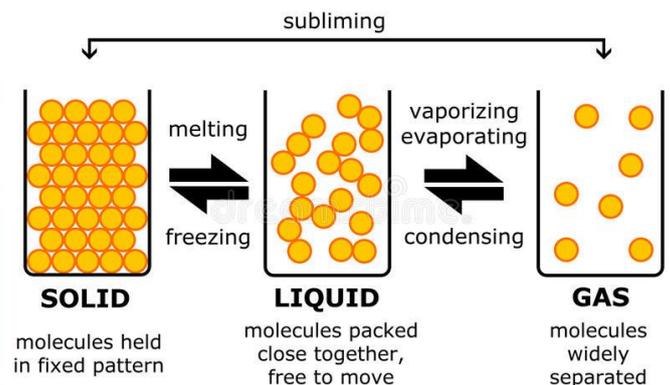
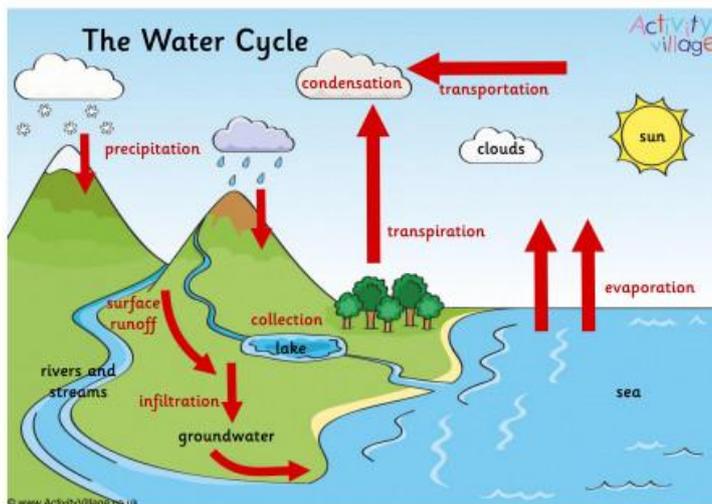
Evaporation occurs when water turns into water vapour. This happens very quickly when the water is hot, like a kettle, but it can also happen slowly, like a puddle evaporating in the warm air.

Condensation is when water vapour is cooled down and turns into water. You can see this when droplets of water form on a window. The water vapour in the air cools when it touches the cold surface.

The Water Cycle

1. Water from lakes and puddles, rivers and seas is evaporated by the sun's heat, turning it into water vapour.
2. This water vapour rises, then cools down to form water droplets in clouds (condensation).
3. When the droplets get too heavy they fall back to the earth as rain, sleet, hail or snow (precipitation).

Diagrams and symbols



Key skills

- **Use** my results to draw a conclusion and make predictions or suggest improvements for answering a different question or repeating my test.
- **Identify** differences, similarities or changes when making comparisons in my experiments or scientific learning.
- **Support** my answers or conclusions by pointing out the scientific evidence.
- **Report** my conclusion from the data I have measured.
- **Gather** the data I need to answer a scientific question and then present them in an appropriate way
- **Record** my findings in labelled diagrams, keys, bar charts or tables.
- **Set up** a practical fair test experiment to answer a scientific question.
- **Make** careful observations and record accurate measurements using equipment or a data logger.
- **Ask** relevant questions and use different types of scientific enquiries to answer them

Vocabulary

Working scientifically vocabulary - observe, test, object, record, equipment, prediction, measurement, enquiry, dependent variable, independent variable, fair test, similar, theory, hypothesis

Solid – Something that is hard and firm where all particles are packed together tightly	Liquid – Something that flows and can be poured, the particles move around more freely when compared to a solid
Gas – Something where the particles move around very freely e.g. oxygen	Particle – an extremely small piece of matter
Melting – when something changes from a solid to a liquid	Freezing – when something changes from a liquid to a solid
Boiling point – The point when a liquid boils and turns into a gas.	Celsius – the unit in which temperature is measured
Evaporation – a liquid being heated up and turning into a gas	Condensation – the cooling of a gas so that it turns into a liquid
State of matter – A solid, a liquid or a gas	

Boils	to reach, or cause something to reach, the temperature at which a liquid starts to turn into a gas
Celsius	a measurement of temperature on a standard in which 0° is the temperature at which water freezes, and 100° the temperature at which it boils
Condense	to change or make something change from a gas to a liquid or solid state
Container	a hollow object, such as a box or a bottle, that can be used for holding something, especially to carry or store it
Decrease	to become less, or to make something become less
Evaporate	to cause a liquid to change to a gas, especially by heating
Gas	a substance in a form like air that is neither solid nor liquid
Increase	to (make something) become larger in amount or size
Liquid	a substance, such as water, that is not solid or a gas and that can be poured easily
Material	a type of physical thing, such as wood, stone, or plastic, having qualities that allow it to be used to make other things
Particle	an extremely small piece of matter
Solid	hard or firm, keeping a clear shape
State of matter	A liquid, solid or gas
Temperature	the measured amount of heat in a place or in the body

Additional vocabulary to discuss across the unit – vibrate, water cycle, precipitation, container, temperature, ice, water, reversible, thermometer, transpiration

Future Learning:	<p>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. (Y5 - Properties and changes of materials)</p> <p>Know that some materials will dissolve in liquid to form a solution, and describe how to recover a substance from a solution. (Y5 - Properties and changes of materials)</p> <p>Use knowledge of solids, liquids and gases to decide how mixtures might be separated, including through filtering, sieving and evaporating. (Y5 - Properties and changes of materials)</p> <p>Give reasons, based on evidence from comparative and fair tests, for the particular uses of everyday materials, including metals, wood and plastic. (Y5 - Properties and changes of materials)</p> <p>Demonstrate that dissolving, mixing and changes of state are reversible changes. (Y5 - Properties and changes of materials)</p> <p>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. (Y5 - Properties and changes of materials)</p>
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Key Outcomes

1. What are solids, liquids and gases and how are they different?

Children will compare and group materials together according to whether they think they are solids, liquids or gases. Children will understand the properties of solids, liquids and gases through role play. Children will create labelled diagrams, including scientific vocabulary to represent and describe each state of matter.

2. What happens when solid materials are heated?

Children will observe a teacher demonstration of heating plastic then make predictions about which items will melt the fastest (ice, chocolate, butter, ice cream, sweets e.g. starburst) Children will understand the process of melting and that it is a state change from solid to liquid.

3. What happens when liquids are cooled?

Children will investigate which liquids can be frozen by cooling through making predictions. Children will understand that freezing is a state change from liquid to solid and will research freezing points of liquids. They will understand that not all liquids freeze e.g. oil.

4. How can we change the state of water using what we already know?

Children will understand that boiling is a change of state from liquid to gas that happens at 100 degrees Celsius. Evaporation is the same state change as boiling (liquid to gas), but it happens slowly at lower temperatures. Condensation is the change back from a gas to a liquid caused by cooling.

5. Can we identify where evaporation and condensation take place in the water cycle?

Children will learn the process of the water cycle and create labelled diagrams demonstrating the processes of evaporation and condensation.

6. How does temperature influence the speed of evaporation?

Children will observe and record the rate of evaporation over a period of time such as puddles, wet paper towels, washing on a line and investigate the effect of temperature on drying washing.

Deepening and broadening the knowledge and understanding for GDS learners:

- knows that materials are made up of particles and explains (in simple terms) how the particles are arranged differently in each
- observes, compares and sorts more complex materials as solids, liquids or gases, e.g. shaving foam, sponge, talcum powder, jelly
- knows that temperature can affect the state in which a material exists
- describes the effect of temperature on a range of different materials
- recognises that some changes of state are reversible and some are not
- knows that the water we drink today is the same water that people drank in the past

- uses correct terminology to explain concepts, *e.g. the 'steam' on the windows is condensation*
- knows that evaporation and condensation are reversible changes