Science Year 4 Autumn 2 In a State

Key Facts

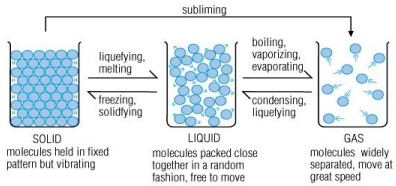
States of Matter

There are 3 states of matter. These are: Solids, Liquids and Gases. Each has characteristic properties:

- **Solids:** the shape of a solid does not change on its own – it is rigid.
  They also have a fixed volume. E.g. Clay is solid unless its moulded to any shape.
- **Liquids**: like water can flow because the particles are arranged randomly. Liquids can flow and take on the shape of the container in which they are placed—characteristics not found in solids.
- **Gases:** vapor is used to describe gases that are usually liquids at room temperature. Some gases actually are visible (nitrogen dioxide for instance). Carbon dioxide, is present in all kinds of fizzy beverages, and in fire extinguishers.

Changes of States:

Some are reversible processes; for example, when ice is heated it melts but the resulting water will become ice again if sufficiently cooled. Those are irreversible are frying an egg or baking a cake.



Vocabulary

Word	Definition
Solids	Solids retain their shape unless a force is applied to them, for example to cut or shape them.
Liquids	Liquids when transferred from place to place take the shape of the container they are in but do not change in volume.
Gases	Gasses change in shape and volume to fill the space they are in. The particles in a gas are wide apart and move freely so, under pressure, the gas will take up less space.
Melting	The change from solid to liquid caused by heating.
Particles	Tiny bits of matter that make up everything in the universe.
Freezing	The change from liquid to solid caused by cooling.
Evaporation	The change from liquid to gas.
Boiling	A change from liquid to gas when the liquid is heated to a specific temperature known as its boiling point.
Condensation	The change from gas to liquid at temperatures between its boiling and freezing points.

Common misconceptions:

Children may be confused by solids such as sponge which can apparently be compressed. They need to understand that the actual solid material does not change in volume but that it contains spaces filled with air which is pushed out when the sponge (object) is squashed.

They may also have difficulty with malleable solids such as clay which can be shaped. They need to recognise that a force has been applied to change the shape of the material.

Granular solids and powders, which seem to behave like liquids in some respects, can be difficult to classify. Children need to focus on the properties of the individual grains.

Gases are less familiar to children than liquids and solids. They do not always realise that an 'empty' container has air in it or that gases have substance and weight. They may

Knowledge and Understanding:

Children will learn: This module introduces the concept of states of matter. Children will learn the characteristic properties of solids, liquids and gases, first through physically exploring typical materials and then by classifying examples, such as powders and very viscous liquids, which are harder to classify. Using first-hand experience and secondary sources they will learn about changes of state and begin to understand freezing and boiling points as identifying characteristics of a material. They will learn the names of some common gases. They will have the opportunity to explore the expansion of liquids and gases when they are heated, using this to make a simple thermometer and explain how it works. They will also learn about the water cycle, modelling it in different ways and further developing their understanding of changes of state. This module focuses on reversible changes; reversibility will be covered in more detail in Year 5, along with other types of change.

Key skills and concepts:

Children will be able to:

When working scientifically children will make careful observations and explain what they show. They will also observe and measure changes over time, first-hand and using secondary sources. They will classify materials and record their sorting using Venn diagrams. They will plan and carry out fair tests, learning to identify and control variables and drawing up tables to record their data. This will then be presented as bar or bar line graphs. Children will identify patterns in the data and use these to answer their investigation questions and to make further predictions. When investigating changes of state they will use thermometers and data loggers, applying their mathematical knowledge of the measurement of temperature in degrees Celsius and learning to interpret a line graph (data logger trace) of temperature and time.

Key Questions

- How can we distinguish between solids and liquids?
- What is air?
- What are differences between solids, liquids and gases?
- How can we plan an investigation to test ideas about ice?
- What affects how fast ice melts?
- What are melting and freezing?
- How do materials change state—evaporation?
- How do materials change state—Boiling?
- How do materials change state—Condensation?
- Why do we put salt on icy roads?
- Where does rain come from?
- What have we learnt about changes of state?