SCIENCE

Lesson 6

Year 8

Topic: The particle model of matter

Exploring states of matter

Today you will:

- understand that different states of matter have different physical properties.

Resources

Find and prepare

Sheet 5 — Investigating physical properties

Key terms

states of matter, solid, liquid, gas, evaporation, condensation, freezing, melting, dissolving, solidification

For definitions and explanations of terms, please see the Glossary.

Science start-up

Revise states of matter

matter: any living or non-living object, material or substance that has mass and volume (occupies space).

1. Recall what you already know about the states of matter listed below, and give at least two everyday examples for the different states.

	States of matter			
	Solid	**Liquid**	**Gas**	**Plasma**
Everyday examples				

2. Look at the image below.

https://pixabay.com/photos/objects-equipment-assortment-neat-731426/

a. Describe three different ways you could split the objects into at least two groups based on a different property each time. Identify the properties used.

b. If the objects were grouped based on the senses of sight, hearing and touch, consider which items you would put in each group. Would there be only one possible way to divide the items? Explain your response.

Lesson

Explore and describe physical properties of states of matter

The way matter — object, material or substance — is used or changed to suit a purpose is determined by its properties. There are two categories of properties: physical and chemical. The focus of this lesson is the physical properties of matter.

physical properties: properties of a substance that can be observed or examined without changing the composition of particles, for example melting/boiling points, hardness, strength, conductivity

physical change: a physical change is a change in the physical properties of a substance without changing its chemical composition; some examples include cutting a sheet of paper or melting an ice cube

3. Open **Sheet 5 —** Investigating physical properties, to investigate the physical properties of three of the states of matter: solid, liquid and gas. Read through the investigation and complete the *Background* and *Risk assessment* sections on the sheet.

STOP

Assemble your materials and equipment. Ensure you wear Personal Protective Equipment (PPE), such as safety goggles, during the investigation.

Complete the investigation and **Sheet 5**. If you don't have all the resources, complete the sheet as much as possible, include predictions if you do not conduct the investigation. Make any necessary changes to the sheet to show if you are only predicting and not using observations from conducting the investigation.

Physical changes

4. When materials go through a physical change, the physical properties of the material change. For example: if you cut a piece of paper, the size and shape of the original piece of paper changes.

Terminology

evaporation, condensation, freezing, melting, solidification, dissolving

a. Read the descriptions below of some physical changes. Choose a term from the list on the previous page to correspond with each physical change.

Physical change	
Description	**Term**
In winter, in some countries, water in lakes becomes solid ice.	freezing
On a hot, windy day the water level in Jenny's fish pond drops.	
When Tara puts butter in the warm pan, it becomes runny.	
Matthew has a hot shower and the bathroom mirror 'fogs up'.	
Ben mixes jelly crystals with hot water.	
Talei makes candles by using heated wax in different shaped moulds.	

Reflection

Summarise physical properties of matter

5. The table below summarises the physical properties of water in each of its three states.

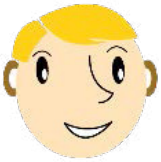
   a. Label each column with the state of matter — solid, liquid or gas — that corresponds to the list of physical properties.

	Physical properties of states of matter		
Shape	Assumes the shape of its container	Has a fixed shape	Assumes the shape of part of the container it occupies
Volume	Fills the volume of its container	Has a fixed volume	Has a fixed volume
Compressibility	Easily compressed	Not easily compressed	Not easily compressed
Flow	Flows easily	Does not flow	Flows easily

Scientists use these physical properties as a convenient method of classifying or grouping matter. However, there are many materials and substances that don't fit neatly into this classification scheme.

Plasma is considered to be a fourth state of matter due to its unique properties, such as its ability to emit coloured light. Some materials have properties that are not distinctly one state or another, such as stir-thinning or stir-thickening fluids (non-Newtonian fluids). Cornflour slime, for example, is a fluid, but becomes thicker and not easily compressed when a force is applied to it.

Some objects we consider to be solids appear to be compressible (for example: sponge, eraser, rubber ball) because of air-filled spaces in their structure. Gels, foams and creams also have unique properties that make them harder to classify as either solid or liquid.



Can you think of other examples? Look in your pantry or fridge for possibilities.

In the next lesson, you will learn about a scientific model which can be used to explain states of matter and changes of state.