SCIENCE

Lesson 7

Year 8

Topic: The particle model of matter

Introducing the particle model of matter

Today you will:

- understand and apply the particle model of matter.

Resources

Find and prepare

Sheet 6 — Applying the particle model of matter

Key terms

model, particle, evaporation, condensation, freezing, melting, sublimation, solidification

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

Science start-up

Models in science

1. Take a sheet of scrap A4 paper, and:
   a. tear the paper in half
   b. take one half and tear it in half again
   c. keep doing this until you can't tear it any more
   d. how many times were you able to tear the paper before you couldn't tear it in half anymore?

In this activity, when you kept tearing the paper to make it smaller, eventually you got to a point where you couldn't tear it any more. If you were able to continue tearing the paper into smaller and smaller pieces you would eventually end up with extremely small particles. All matter, living or non-living, is made up of extremely small particles.

A **particle** is a small, individual piece of matter that has mass and volume. All matter, living and non-living is made up of particles.

Earlier you learned that the properties of a material or substance depend on its state of matter; that is, whether it is a solid, liquid, or gas. For example, the substance water has different properties depending on its state — solid (ice), liquid (water) or gas (water vapour). The substance is the same, but the properties are different. How can this be?

Scientists use a **scientific model** to explain these differences in properties.

A **model** is a representation that describes, simplifies, clarifies or provides an explanation of the workings, structure or relationships within an object, system or idea.

Models are used to simplify concepts that are difficult to understand or to represent and explain things that are difficult to observe under normal circumstances. For example, a plastic human body model represents our internal body anatomy so that we can observe the structure of the body systems and the relationship between the organs within these systems. Sometimes models are used by scientists to make predictions. For example, climate scientists across the world use models to predict the effect of global temperature variations on climate.

The particle model of matter

Matter has mass and occupies space. It can be represented as tiny particles, which are arranged, move and combine in unique ways depending on the type of substance and its state. In this lesson, you will explore this model.

Lesson

The particle model of matter

2. Conduct an online video search using the terms ‘arrangement of particles in solids, liquids and gases Edukite Learning’.
   a. Watch a video comparing the arrangement and movement of particles in solid, liquid and gaseous matter.
   b. Use the information in the video and the following table to summarise the particle model of matter.

	State of matter		
Particles	**Solids**	**Liquids**	**Gases**
Arrangement			
Movement			
Space			
Forces of attraction			
Physical properties	fixed volume fixed shape not easily compressed	fixed volume flows not easily compressed	variable volume flows easily compressed

3. Justify how the physical properties of a state of matter — solid, liquid or gas — are related to the movement, spacing and attraction of particles.

Apply the particle model of matter to explain physical changes

A **change of state** occurs when a material changes from one state of matter to a different state, such as liquid to gas or gas to liquid. A change of state is a **physical change**, in which physical properties change, but the type of particles remain the same. Changes of state are caused by adding or removing heat energy.

4. The diagram below represents the arrangement of particles in solids, liquids and gases as a change of state diagram.

   a. Label each part of the diagram with the state of matter it represents:

   b. What is the effect on the movement, attraction and arrangement of particles in matter when heat energy is transferred to them?

   c. What happens when heat energy is transferred from the particles to the surroundings?

5. Conduct an online video search using the terms ‘sublimation and deposition of iodine’ and watch how iodine changes from a solid state to a gas state and back again.

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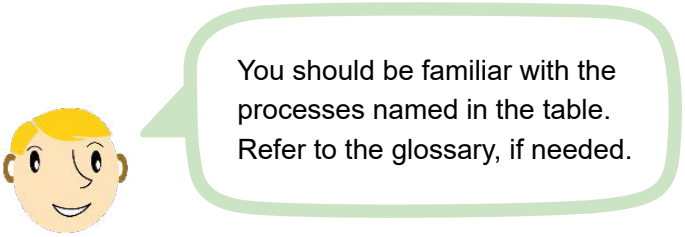
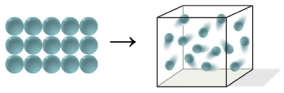
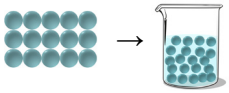
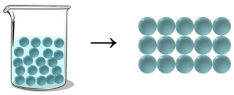
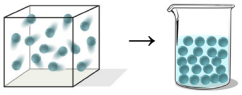
6. Kai completed the following table. Tick the row(s) of the table where you agree with Kai.

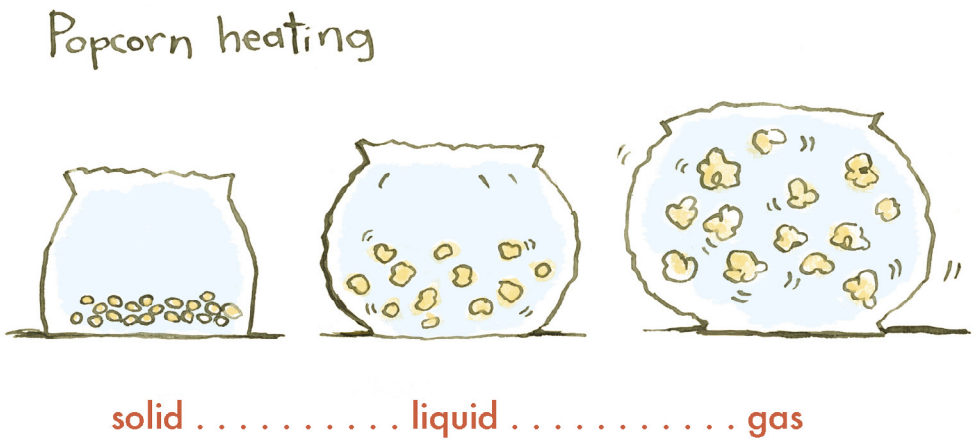


	Change of state	Particle model representation	Name of process	Example
☐	solid → gas		sublimation	iodine sublimates to form iodine gas
☐	solid → liquid		melting	ice block left out of the freezer
☐	liquid → solid		evaporation	water heated in a kettle
☐	gas → liquid		condensation	drops of water form on a cold mirror after a hot shower

7. Open and complete the questions on **Sheet 6 —** Applying the particle model of matter.

Reflection

8. The diagram below shows a representation of the states of matter using a popcorn model.



a. Describe how the popcorn model accurately represents states of matter.

b. What is the main problem with this model's representation of matter?

In the next lesson, you will review changes of states of matter and research everyday applications of a change of state. If you do not have access to the internet, contact your teacher to find out what other information resources you may be able to access.

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