P2 Thermal Physics

P2.1 Kinetic particle model of matter

P2.1.1 States of matter

Kinetic Particle Model of Matter

All matter is made up of tiny particles (atoms or molecules) that are **in constant motion**. The **arrangement, movement, and energy** of the particles explain the **properties** of solids, liquids, and gases. **Temperature** affects the **kinetic energy** of the particles — higher temperature = faster particle movement.

Distinguishing Properties of Solids, Liquids, and Gases

Property	Solid	Liquid	Gas
Arrangement of particles	Closely packed in a fixed, regular pattern	Close together but not in a fixed arrangement	Far apart, random arrangement
Movement	Vibrate in fixed positions	Move slowly & slide past each other	Move quickly in all directions
Forces between particles	Very strong	Weaker than in solids	Very weak
Shape	Fixed shape	No fixed shape – takes the shape of the container	No fixed shape
Volume	Fixed volume	Fixed volume	No fixed volume – can be compressed easily
Compressibility	Not easily compressed	Not easily compressed	Easily compressed

Changes of State

Solid → liquid	Melting	E.g. ice → water
Liquid → solid	Freezing	E.g. water → ice
Liquid → Gas	Evaporating / boiling	E.g. water → steam
Gas → liquid	Condensation	E.g. steam → water

Heating gives particles **more kinetic energy**, making them move faster and overcome forces holding them together. Cooling removes kinetic energy, slowing particles and allowing forces to pull them closer together. The Kinetic Particle Model explains how **particle motion and energy** determine the **state of matter** and **changes between states**.