States of matter

Printable revision sheet — Galaxscia

LEVEL 1

Discovering the three states

The world we live in is made up of many objects and materials. All these materials can exist in different forms called the states of matter:

The solid state

The liquid state

The gaseous state

A simple example is water, which we all know well:

In the solid state: ice or snow

In the liquid state: rain, rivers, oceans

In the gaseous state: the invisible water vapour in the air

These three states can be observed for many other materials such as glass, iron, copper, carbon dioxide, and so on. There are also other, rarer states, but we will look at them later.

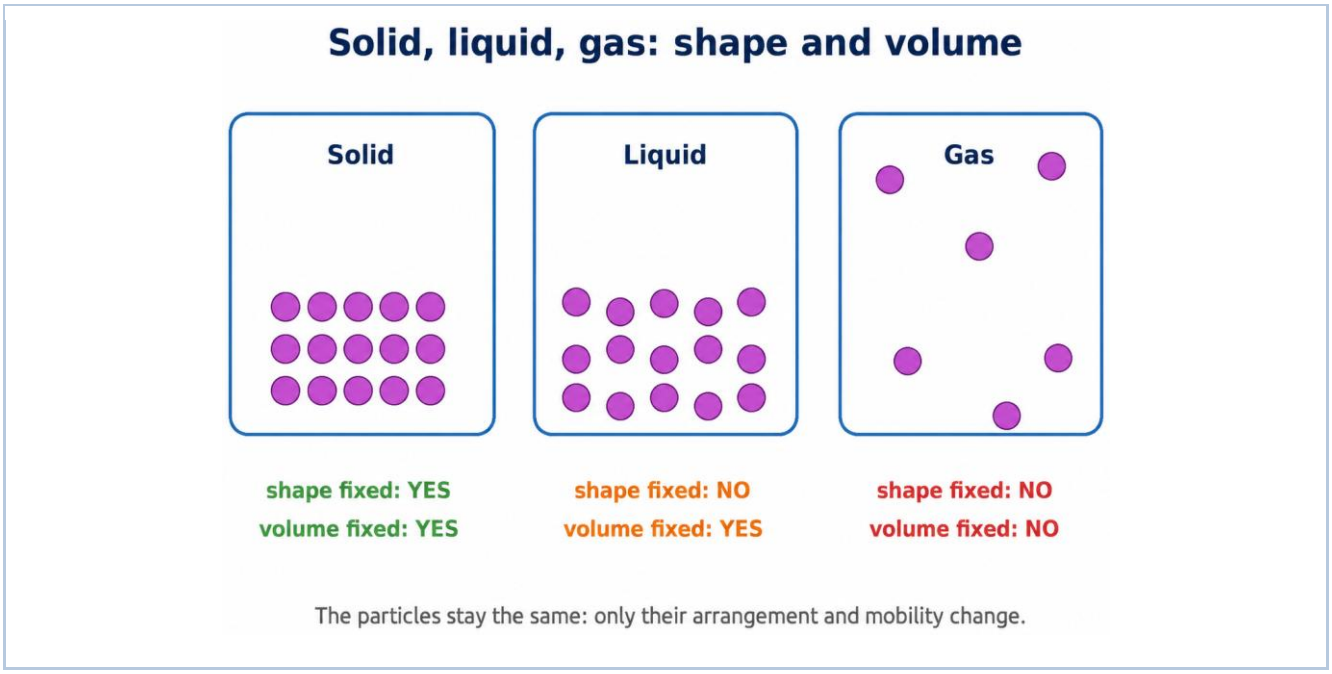
Key points — revision questions

- What are the three main states of matter?
- Give an example of water in each state.

LEVEL 2

Understanding the properties of each state

Each state of matter (true for water, metal, glass, air, and so on) has properties you can observe:



Key points — revision questions

- Does a liquid have a fixed volume? a fixed shape?
- Why do we say that a gas has no fixed volume?
- Compare an ice cube and liquid water: what changes and what stays the same?

LEVEL 3

The explanation at the level of the molecules

To understand why the states are different, we have to look at matter on the microscopic scale. All matter is made of molecules. Their arrangement and their movement determine the state of the matter.

1. The solid state

The molecules are very close to one another.

They are strongly bonded together, which blocks any movement.

They form crystal structures, very organised and regular.

They vibrate slightly but do not change place.

2. The liquid state

The molecules are close together but weakly bonded.

They are disordered.

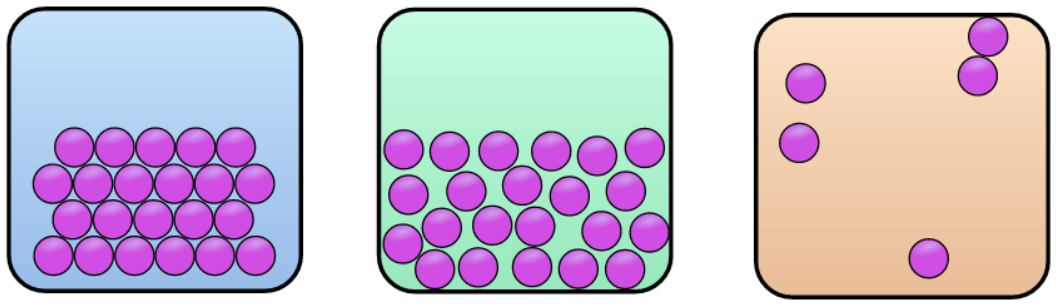
They can slide over one another.

3. The gaseous state

The molecules are very far apart.

There is no bond between them.

They move quickly in all directions.



State	Distance between molecules	Strength of the bonds	Arrangement	Movement
Solid	Close together	Very strong	Organised	Vibration on the spot
Liquid	Close together	Weak	Disordered	Sliding
Gas	Spread out	None	Disordered	Fast movement

Key points — revision questions

- What are the arrangement and packing properties of the molecules in the three states?
- Why does a liquid keep its volume but change its shape?
- Why does a gas fill all the space available?
- Why can a gas be compressed but not a liquid?

LEVEL 4

Going further: the rare states of matter

Besides the three common states, there are rarer ones:

Plasma: a gas whose molecules are so agitated that they split into charged particles (e.g. the Sun, lightning)

Bose-Einstein condensate: a state obtained at temperatures close to absolute zero, where the molecules become almost motionless