

5.1.1 The States of Matter

All matter exists in one of three STATES, these states are ...

1. **SOLID** STATE
2. **LIQUID** STATE
3. **GASEOUS** STATE

Many substances can occur in all 3 states.

For Example **H₂O** exists as ...

- ICE (solid)
- WATER (liquid)
- WATER VAPOUR (gas)

Iron can also exist in all three states (depends on the temperature)

- A Solid below 1535 °C
- A Liquid between 1535 °C and 3000 °C
- A Gas above 3000 °C

THE SOLID STATE of MATTER

Many objects around you exist in the SOLID state (rocks, metals wood).

To describe a solid object you would use the following characteristics ...

1) SHAPE:

A solid has a definite shape. The shape is usually described as rigid (stiff) and is not easily twisted out of shape at normal conditions. (But this changes under conditions of high heat or high pressure).

2) VOLUME:

All solids have a definite volume (they are not easily compressed or pulled apart under normal temperatures/pressures). Most solids EXPAND (increase volume) slightly when heated and CONTRACT (decrease volume) slightly when cooled. Because of this fact, many construction projects must allow for this change (when constructing a house, the foundation must leave room for expansion and contracting during the seasons).

3) MASS: The mass of a solid object NEVER CHANGES.

THE LIQUID STATE of MATTER

Many substances exist in the LIQUID state (water, oil, Koolaid).

To describe a liquid object you would use the following characteristics ...

1) SHAPE:

Liquids are all FLUIDS, they flow and can be poured. The shape of a liquid is not definite and therefore you can make it take almost any shape by placing the liquid into a container.

2) VOLUME:

All liquids have a definite volume (they are not easily compressed under normal temperatures/pressures). We take advantage of this fact in industrial uses (hydraulics). Most liquids expand (increase volume) slightly when heated (we use this fact to make thermometers) and contract (decrease volume) slightly when cooled.

3) MASS:

The mass of a liquid NEVER CHANGES.

THE GASEOUS STATE of MATTER

Many substances exist in the GASEOUS state (Oxygen, Propane ...).

To describe a gaseous object you would use the following characteristics:

1) SHAPE:

Gases do not have a definite shape. They expand to fill whatever space they can (it takes the full shape of its container). Like liquids, gases are fluid (they can be poured).

2) VOLUME:

Gases do not have a definite volume. They are easily compressed using pressure and temperature. An example of gases changing volumes is an explosion (the volume of gas expands rapidly).

3) MASS:

The mass of a gaseous substance NEVER CHANGES.

What is the difference between a GAS and a VAPOUR ?

A vapour is the gaseous state of a substance that is solid or liquid at room temperature.

This is why we say "water vapour" instead of water gas. A GAS is in the gaseous state at room temperature (25 °C).

SUMMARY CHART of States of Matter

Property	Solid	Liquid	Gas
Shape	definite	shape of container	fills entire container
Volume	definite	definite	indefinite
Compression (effect on Volume)	little effect	little effect	large effect
Heat (effect on Volume)	little effect	little effect	large effect
Mass	<i>never changes</i>	<i>never changes</i>	<i>never changes</i>

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