

KS3 Big idea 5: Matter part 1a

Glossary:

- **Boil**

Change from liquid to a gas of all the liquid when the temperature reaches boiling point.

- **Condense**

Change of state from gas to liquid when the temperature drops to the boiling point.

- **Density**

How much matter there is in a particular volume, or how close the particles are.

- **Diffusion**

The process by which particles in liquids or gases spread out through random movement from a region where there are many particles to one where there are fewer.

- **Evaporate**

Change from liquid to gas at the surface of a liquid, at any temperature.

- **Freeze**

Change from liquid to a solid when the temperature drops to the melting point.

- **Gas pressure**

Caused by collisions of particles with the walls of a container.

- **Particle**

A very tiny object such as an atom or molecule, too small to be seen with a microscope.

- **Particle model**

A way to think about how substances behave in terms of small, moving particles.

- **Melt**

Change from solid to liquid when the temperature rises to the melting point.

- **Sublime**

Change from a solid directly into a gas.

Activities

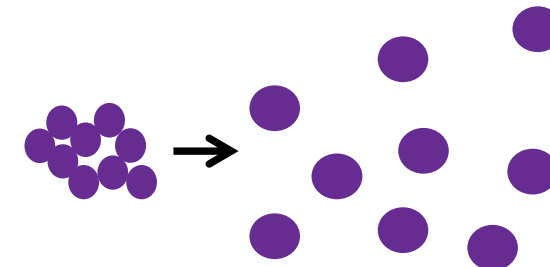
1. Explain how a solid melts in terms of **energy** and **forces between particles**.

2. Explain why ice and iron have different melting points. Your answer should consider the forces of attraction between the particles.

3. When a volcano erupts liquid rock (magma) is released along with hot gases. The magma cools and turns into solid rock.

- Describe the changes in the movement of the particles in the magma as it cools.
- Describe the arrangement of particles in the hot gases and explain how they are different to those in a liquid.

4. A pupil draws the following diagram to show the changes when water boils and becomes steam. They have made one mistake. What would you advise them to do differently to improve the work?



5. The melting point of oxygen is -218°C and its boiling point is -183°C .

Predict the state of matter of oxygen at:

- -200°C
- 20°C
- -219°C

6. Explain why diffusion cannot happen in a solid substance.

7. Explain why a fully inflated balloon could burst if it was kept in a hot room.

QUICK QUESTIONS:

- Draw diagrams representing the particles in a solid, liquid and gas.
- Describe how the particles move in a solid, liquid and gas.
- State the name of the process in each of the following changes:
 - Solid to liquid
 - Liquid to solid
 - Gas to liquid
 - Liquid to gas.

1. The particle model

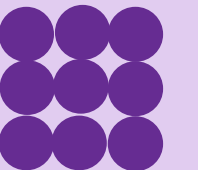
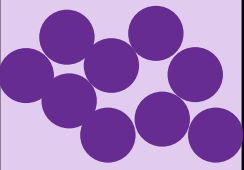
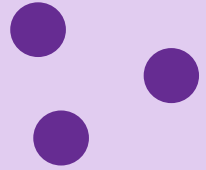
All substances (matter) are made up of tiny **particles**. We can represent these particles in **models** using **spheres**. Every particle in a **substance** is the same as the others, but particles of different substances are different to each other.

The properties of a substance depend on:

- What its particles are like
- How its particles are arranged
- How its particles move around

2. States of matter

The three states of matter are **solid**, **liquid** and **gas**.

Solid	Liquid	Gas
		

3. Differences in states of matter

- In **solids** the particles are **closely spaced** and **vibrating**.
- In **liquids** the particles are quite closely spaced (the particles are in **contact**) but there is **random motion**
- In **gases** there is **random motion** and the particles are **widely spaced**.

Particles of a substance usually become less closely packed from solid (most dense) to liquid to gas (least dense), but the particles themselves do not change.

4. Changes of state – melting and freezing

A solid **melts** when it is heated because the particles are **gaining energy** from the surroundings. This energy breaks the **forces of attraction** between the molecules.

The **more energy** a particle has, the **faster** it can move.

A liquid **freezes** when its particles **lose energy** to the surroundings.

The temperature at which a substance changes from solid to liquid **or** liquid to solid is called its **melting point**.



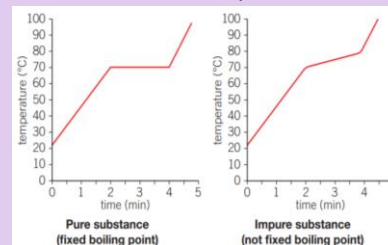
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5. Changes of state – boiling

Boiling changes a substance in the liquid state to the gas state. It only happens if enough **energy is gained** from the surroundings to make gas bubbles within the liquid. The temperature at which a substance changes from liquid to gas or gas to liquid is called its **boiling point**.

Pure substances have **fixed** (exact) melting and boiling points.



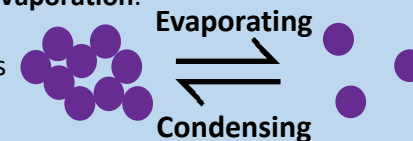
6. Changes of state – evaporating and condensing

Some particles in a liquid will have **more energy** than the others. They can leave the liquid's **surface** and move away as a gas. This is known as **evaporation**.

When gas particles **lose energy** to the surroundings they move **closer** to each other until they touch,

forming a liquid. This is known as **condensation**.

Neither process needs a specific temperature to happen.



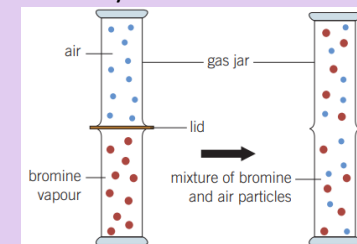
7. Diffusion

Substances in the liquid and gas states have particles which are **moving randomly** all the time. They are called **fluids**

because their particles can **flow**. This means that their particles can **diffuse**.

Diffusion happens faster:

- If the substance is a gas
- At higher temperatures
- With smaller particles

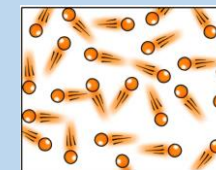


8. Gas pressure

Inside a container, randomly moving gas particles **collide** with (bump into) the inner surfaces of the container. The force from this is known as gas pressure.

You can increase gas pressure by:

- Increasing the number of particles
- Increasing the temperature
- Reducing the volume of the container



Gas is the only state of matter which can be **compressed**, because there are spaces between the particles.