

Chemistry

Particles · elements and compounds · reactions

Everything is made of tiny particles. The rest follows from that.

This belongs to **Henry**.

Skills

Biology

Chemistry

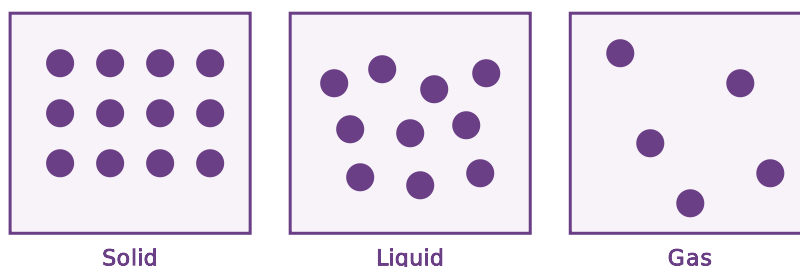
Physics

The thread through Chemistry

Start with particles. How they are arranged gives solids, liquids and gases. What kind they are gives elements and compounds. When they swap partners, you get a reaction.

The particle model

Big idea: Everything is made of tiny particles. How close together they are decides if it is a solid, liquid or gas.



Solid: packed in a regular pattern. Liquid: close but jumbled. Gas: far apart with lots of space.

Solid particles close, in rows, vibrating on the spot. Fixed shape.

Liquid particles close but jumbled, sliding past. Takes the shape of its container.

Gas particles far apart, moving fast in all directions. Fills the space.

MUST KNOW

The arrangement and movement in each state.

SHOULD KNOW

Why a gas can be squashed but a solid cannot.

NICE TO KNOW

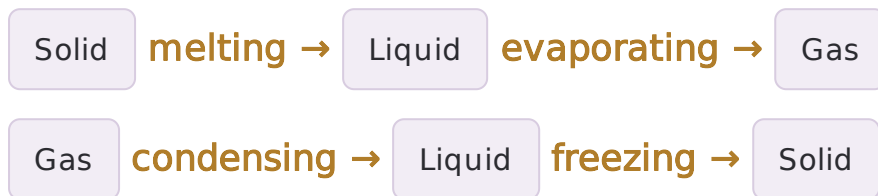
Particles in a gas cause pressure.

Common mistakes

- Particles do not melt or change size. The **arrangement** changes, not the particle.
- In a gas, the space between particles is empty. Nothing is in the gaps.

Changing state

Heating gives particles energy to move more and break apart. Cooling does the opposite.



Key vocabulary

Melting	solid to liquid
Freezing	liquid to solid
Evaporating	liquid to gas
Condensing	gas to liquid

QUICK CHECK

1. In which state are particles far apart?

2. What is the change from liquid to gas called?

EXPLAIN WHY

3. Why can a gas be squashed into a smaller space, but a solid cannot?

WORKED EXAMPLE ANSWER

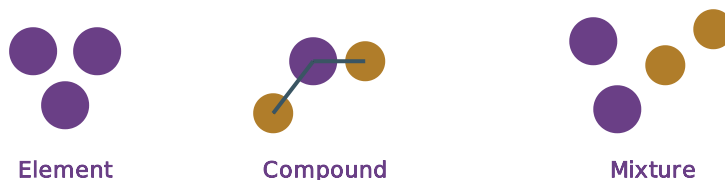
In a gas, the particles are far apart with lots of empty space between them, so they can be pushed closer together. In a solid, the particles are already packed tightly together with no space, so there is no room to squash them.

EXAM STYLE

4. Describe the arrangement and movement of particles in a liquid. [2 marks]

Atoms, elements and compounds

Big idea: Atoms are the building blocks. One kind on its own is an element. Different kinds joined make a compound.



Element: one kind of atom. Compound: different atoms joined together.

Mixture: different atoms, not joined.

Atom the smallest particle of an element.

Element made of only one kind of atom (e.g. oxygen, gold).

Compound different elements chemically joined (e.g. water).

Mixture substances together but not joined. Easy to separate.

Each element has a symbol: O for oxygen, H for hydrogen, Na for sodium. Water is written H_2O , two hydrogen atoms joined to one oxygen.

MUST KNOW

Element vs compound vs mixture.

SHOULD KNOW

What an atom and a symbol are.

NICE TO KNOW

Reading a simple formula like CO_2 .

Common mistakes

- A compound is **joined** and hard to separate. A mixture is **not joined** and easy to separate.
- The first letter of a symbol is a capital, the second is small. Co and CO mean different things.

Elements and compounds: questions

QUICK CHECK

1. What is an element?

2. What is the symbol for oxygen?

3. Is water an element or a compound?

EXPLAIN WHY

4. Explain the difference between a compound and a mixture.

WORKED EXAMPLE ANSWER

In a compound, different elements are chemically joined together, so it is hard to separate them and the compound behaves as a new substance. In a mixture, the substances are just mixed and not joined, so they can be separated easily, for example by filtering. So the key difference is whether the parts are joined.

5. Sort these into elements and compounds: oxygen, water, gold, carbon dioxide. [2 marks]

Chemical reactions

Big idea: In a chemical reaction, substances change into new substances.

Reactants → Products

The substances you start with are the reactants. The new substances you make are the products.

Signs a reaction has happened

- Bubbles of gas are given off.
- A colour change.
- A change in temperature.
- A new substance forms that you cannot easily change back.

Word equations

magnesium + oxygen → magnesium oxide

Mass is not lost in a reaction. The atoms are just rearranged, so the total mass stays the same.

MUST KNOW

Reactants → products.
Signs of a reaction.

SHOULD KNOW

Write a simple word equation.

NICE TO KNOW

Acid + metal → salt + hydrogen.

Common mistakes

- Melting or boiling is a change of state, not a chemical reaction. No new substance is made.
- Mass is not destroyed. If it seems to drop, a gas has escaped.

Reactions: questions

QUICK CHECK

1. What do we call the substances we start with?

2. Give two signs that a chemical reaction has happened.

EXPLAIN WHY

3. Why is melting ice not a chemical reaction?

WORKED EXAMPLE ANSWER

When ice melts, it turns from solid water into liquid water. It is still water, so no new substance has been made. It is only a change of state, which can be reversed by freezing. A chemical reaction makes a new substance, so melting ice does not count.

EXAM STYLE

4. A candle burns. Wax reacts with oxygen. (a) Name the reactants. (b) Explain why this is a chemical reaction. [3 marks]

Answers

Topic 4: Particles

1. A gas.
2. Evaporating (or boiling).
3. Particles are close together but jumbled, and they slide past each other.

Topic 5: Elements and compounds

1. A substance made of only one kind of atom.
2. O.
3. A compound.
4. A compound is chemically joined and hard to separate; a mixture is not joined and easy to separate.
5. Elements: oxygen, gold. Compounds: water, carbon dioxide.

Topic 6: Reactions

1. The reactants.
2. Any two: bubbles of gas, colour change, temperature change, a new substance.
3. It only changes state and stays as water, so no new substance is made.
4. (a) Wax and oxygen. (b) A new substance is made and it cannot easily be changed back, so it is a chemical reaction.