

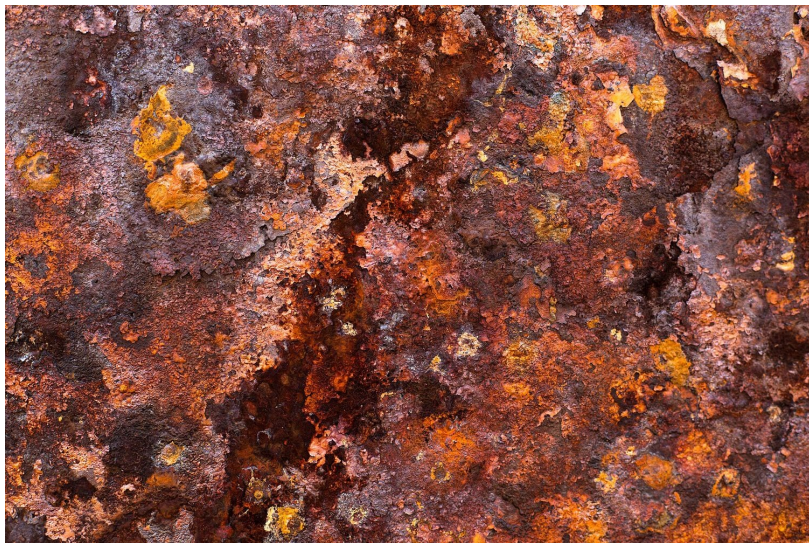
Exercise walk-through

6.1

Physical and chemical changes

IGCSE Chemistry

Physical vs chemical change



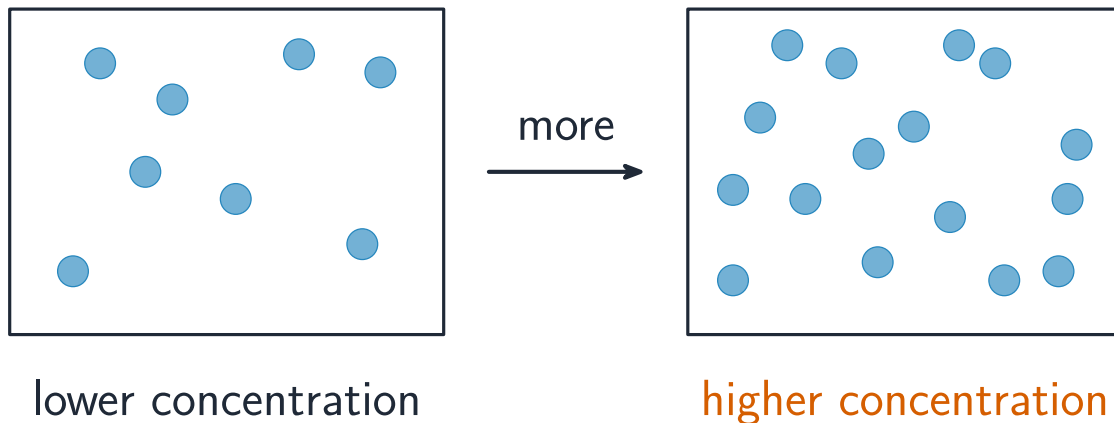
Iron rusting – a new substance forms

- A **physical change** makes **no new substance** – only the state or shape changes, and it usually reverses. Melting ice, dissolving sugar.
- A **chemical change** makes **one or more new substances** and is usually hard to reverse. Burning, rusting.
- Signs of a chemical change: a colour change, a gas given off, an energy change, or a **precipitate** forming.

Collision theory and rate

Collision theory : particles must collide with enough energy ($\geq E_a$). Faster when collisions are **more frequent** or **more energetic**:

- more **concentration** / pressure
- more **surface area**
- higher temperature



What a collision needs

Rate of reaction

The **rate of reaction** is how fast the **reactants** are used up, or the **products** formed.

Frequency

More collisions per second – higher concentration, higher pressure, larger surface area – means a faster rate.

Energy

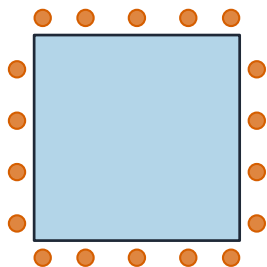
A collision only works if the particles have enough **kinetic energy** to react. Heating raises the average, so far more collisions succeed.

The other half

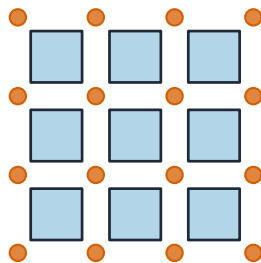
Temperature therefore acts twice, which is why it changes rate more sharply than concentration does.

Every rate factor is either *more collisions* or *more successful ones*. Say which, and the explanation is complete.

Surface area



one big lump
small surface
area $\rightarrow$ slower

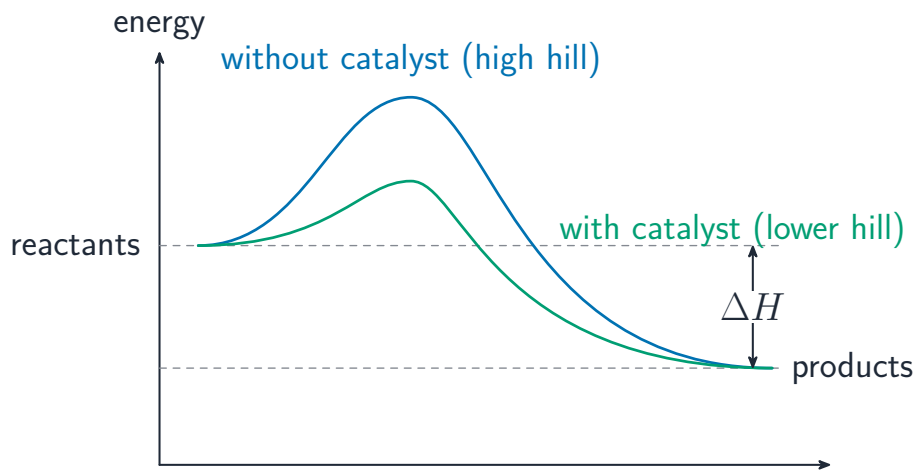


same mass
as powder
large surface
area $\rightarrow$ faster

A powder has far more surface than one lump, so acid touches **many more** particles.

More exposed particles $\Rightarrow$
more collisions $\Rightarrow$ a faster
rate.

Catalysts



a catalyst lowers the activation energy; ΔH is unchanged

A **catalyst** speeds a reaction but is **not used up**.

- it lowers the **activation energy**
- ΔH is unchanged
- **enzymes** are biological catalysts

Exercises 2.1·2.2

2.1 State one difference between a physical and a chemical change. [1]

2.2 Give two signs that a chemical reaction has happened. [2]

Exercises 2.1·2.2

2.1 State one difference between a physical and a chemical change. [1]

2.1

- a **chemical** change makes a **new substance**; a **physical** change does not
-

2.2 Give two signs that a chemical reaction has happened. [2]

2.2

- any **two** of: colour change / gas given off / energy or temperature change / a precipitate forms

Exercise 3.1

3.1 Which is a physical change?

[1]

☐

A burning magnesium

B rusting iron

C melting ice

D neutralising an acid

Exercise 3.1

3.1 Which is a physical change?

[1]

☐

A burning magnesium

B rusting iron

C melting ice

D neutralising an acid

3.1 C

- melting ice makes **no new substance** – a physical change
- A, B and D all make new substances

Exercise 3.2 (a)

3.2 Dissolving salt in water and burning a candle are both changes.

(a) State which is a physical change and which is a chemical change.

[2]

Exercise 3.2 (a)

3.2 Dissolving salt in water and burning a candle are both changes.

(a) State which is a physical change and which is a chemical change.

[2]

(a)

- dissolving salt: **physical**
- burning a candle: **chemical**

Exercise 3.2 (b)

3.2 Dissolving salt in water and burning a candle are both changes.

(b) Explain your choice for the candle.

[2]

Exercise 3.2 (b)

3.2 Dissolving salt in water and burning a candle are both changes.

(b) Explain your choice for the candle.

[2]

(b)

- burning makes **new substances** (e.g. CO_2 and water)
- and is **hard to reverse**