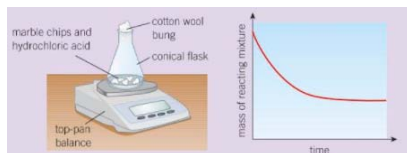


Measuring Rate

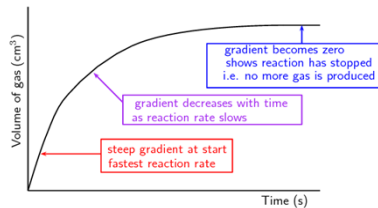
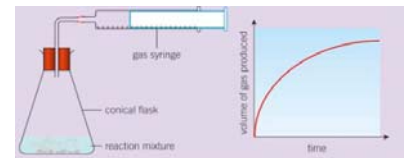
To measure the rate of a reaction you can:

- Measure how fast the reactants are used up
- Measure how fast the products are made

e.g. Measure mass lost due to gas formed



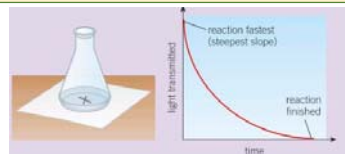
e.g. Measure volume of gas made



Rate = volume of gas ÷ time

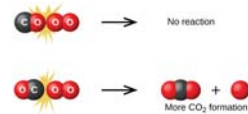
cm³/s

e.g. Measure time for insoluble product to form



Collision theory

For a reaction to happen reactants must: **collide with enough energy** (activation energy)



A successful collision is one that leads to a reaction

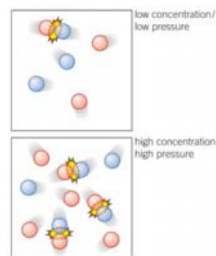
So to increase the rate of a reaction you must either

- Increase the frequency of collisions
- Increase the energy of the collisions
- Decrease the energy needed for a collision to be successful

Factors affecting rate

Concentration and Pressure

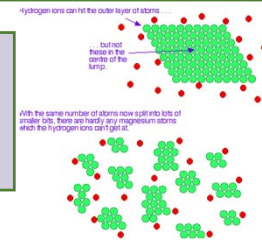
More particles in the same space.
More frequent collisions



L42 – 51 Rates and Equilibrium

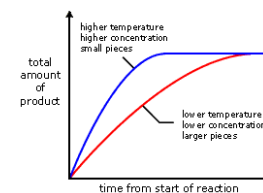
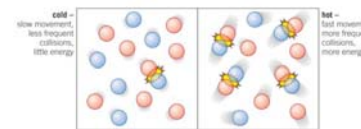
Surface area

More particles available to react.
More frequent collisions



Temperature

Particles **move faster**.
So they **collide more frequently**.
Particles collide **with more energy**.
So more of the collisions are **successful**.



Catalysts

Lower the energy needed for successful collisions. (Activation energy)
Not used up.
Biological catalysts are called **enzymes**

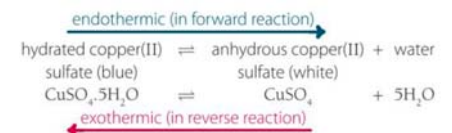


Reversible reactions

Can go in both directions.



If a reaction is exothermic in one direction it is endothermic in the other direction.



In a **closed system** (where nothing can get in or out) an **equilibrium** is reached where the **rate of reaction is the same in both directions**.

- 1) A + B → C + D reactants only at start of reaction
- 2) A + B ⇌ C + D rate of → much greater than ← at first
- 3) A + B ⇌ C + D rate of ← increases as C + D build up
rate of → slows down as reactants get used up
- 4) A + B ⇌ C + D eventually the rates of → and ← are the same

At equilibrium:

- Rate of forward reaction = rate of reverse reaction.
- Amount of products and reactants don't change.

