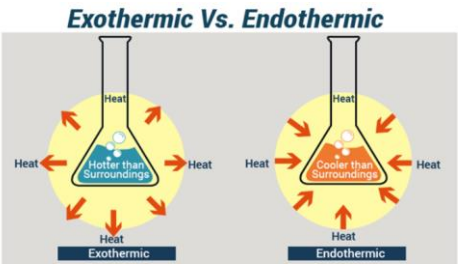
Exothermic vs Endothermic

Exothermic

In some reactions more energy come **OUT** than goes in

The reactants have more energy than the products

e.g. combustion, oxidation, neutralisation



Endothermic

In some reactions more energy goes **IN** than comes out

The products have more energy than the reactants

e.g. thermal decomposition

Uses

Exothermic

Self heating cans, hand warmers

Chemicals react in an exothermic reaction and give **OUT** heat energy

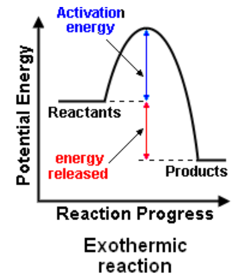
Endothermic

Cool packs for sports injuries

Chemicals react in an Endothermic reaction and taken **IN** heat energy – therefore cooling the surroundings

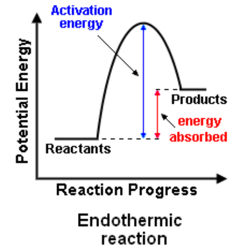
Reaction Profiles

Exothermic



Products at LOWER energy than reactants

Endothermic



Products at HIGHER energy than reactants

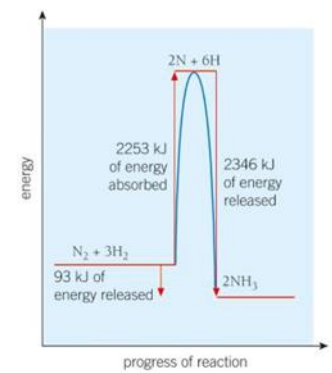
Activation Energy is the energy needed to start a reaction

Bond Energy Calculation (HT)

BINMIX
Bond Breaking is eNdothermic
Bond Making is eXothermic

Exothermic

More energy comes **OUT** making bonds



Endothermic

More energy goes **IN** breaking bonds

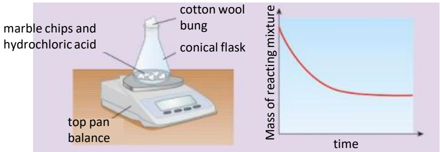
Exmouth Community College
Academy Trust

Year 10 – Chemistry / Rates and Equilibrium – HT2

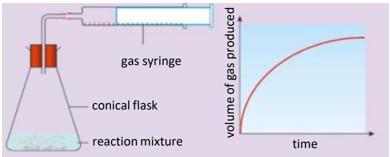
Measuring Rate

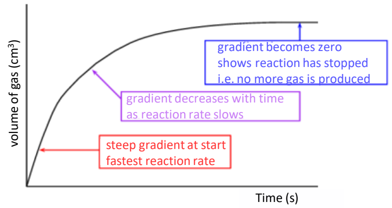
To measure the rate of a reaction you can:
- Measure how fast the reactants are used up
- Measure how fast the products are made

e.g. measure mass lost due to gas formed



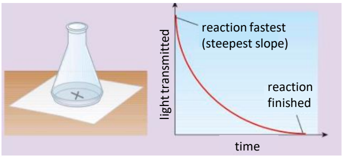
e.g. measure volume of gas made





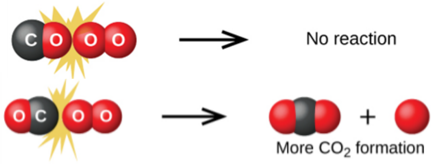
Rate = volume of gas ÷ time
cm^3/s

e.g. measure time for insoluble product to form



Collision Theory

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



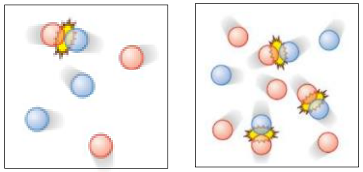
A successful collision is one that leads to a reaction

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

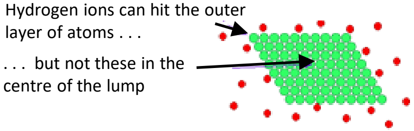
More particles in the same space.
More frequent collisions

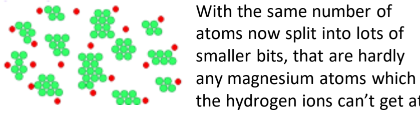


low concentration/ low pressure | high concentration/ high pressure

Surface Area

More particles available to react.
More frequent collisions

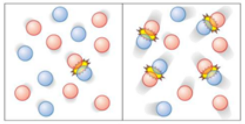




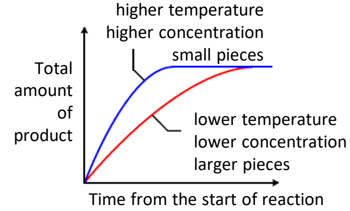
TEMPERATURE

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

COLD slow movement, less frequent collisions, little energy

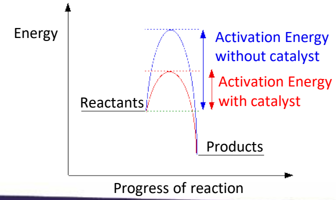


HOT fast movement, more frequent collisions, more energy



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

$$A + B \rightleftharpoons C + D$$

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

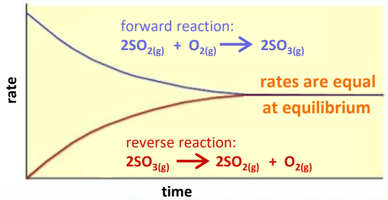
endothermic (in forward reaction) →

hydrated copper (II) sulfate (blue) ⇌ anhydrous copper (II) sulfate (white) + water
$CuSO_4.5H_20 \rightleftharpoons CuSO_4 + 5H_20$

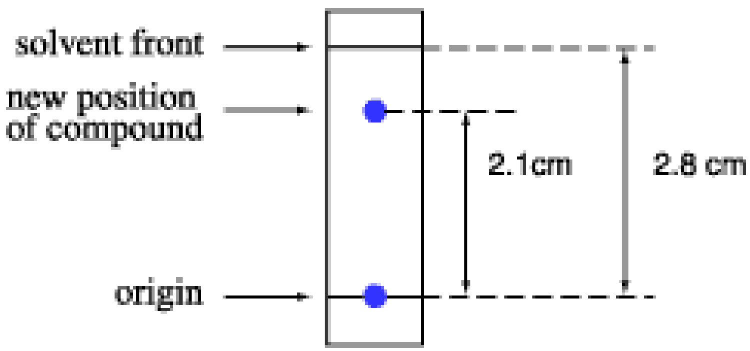
← exothermic (in reverse reaction)

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**

At equilibrium:
- Rate of forward reaction = rate of reverse reaction
- Mount of products and reactants don't change

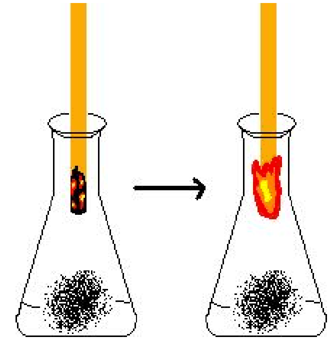


Pure substance	A single element or compound that is not mixed with any other substance.
Formulation	A mixture that has been designed as a useful product.
Chromatography	A technique that can be used to separate mixtures and the identify substances.

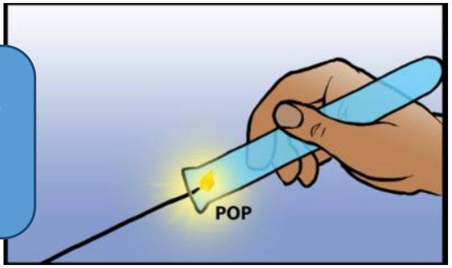


$$R_f = \frac{2.1}{2.8} = 0.75$$

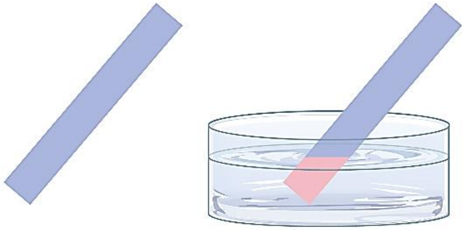
Testing for oxygen

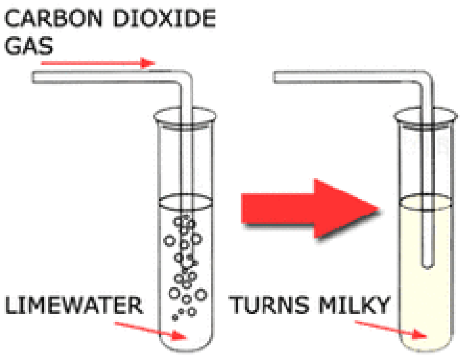


Testing for hydrogen



Testing for chlorine using litmus paper





Testing for CO_2