Year 11 – Paper 2 - Chemistry Knowledge Organiser – Rate of reaction

Rate of Reaction

The rate of a reaction means how quickly reactants are turned into the products.

$$\underbrace{2\,H_2 + O_2}_{\text{reactants}} \longrightarrow \underbrace{2\,H_2O}_{\text{products}}$$

If this happens quickly then you have a high rate of reaction, if it takes a long time then you have a slow rate of reaction.

An example of a slow reaction could be rusting
An example of a fast reaction could be an explosion.

Calculating the Rate of Reaction

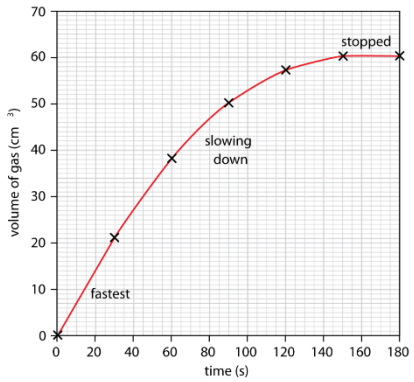
The rate of a reaction can be found by the equation below.

$$\text{mean rate of reaction} = \frac{\text{quantity of reactant used}}{\text{time taken}}$$

$$\text{mean rate of reaction} = \frac{\text{quantity of product formed}}{\text{time taken}}$$

This is the same as saying on a graph like the one shown that

the change in Y / the change in X = the rate of a reaction.



The line is curved. This means that the rate of reaction changes as it progresses.

Collision theory

Why do things react in the first place?

Things will only react if the particles collide with enough energy to cause a effective collision. This is best illustrated in the diagram to the right. A faster reaction will have a higher frequency of collisions with sufficient energy

Low energy collision

No reaction

High energy collision

More CO_2 formation

Factors effecting the rate of a reaction

There are several factors that can effect the rate of a chemical reaction, however it essentially boils down to increasing the amount of successful collision.

These factors are.

Temperature
The hotter the particles are, the faster they move and therefore the frequency of successful collisions is greater.

Pressure and concentration
More particle in the same space means that collisions happen with greater frequency.

Surface area
If there are more particles exposed to the reactants then the frequency of successful collision is greater.

Catalysis
See the box below.

Reversible Reactions

Reversible reaction are ones that will react in both directions.

This means that as quickly as products are formed they can be turned back into reactants.

Reversible reactions are identifiable by the arrow in the middle of the reaction.

$$N_2 + 3H_2 \rightleftharpoons 2NH_3$$

Catalysts

Catalysts are substances that speed up the rate of a reaction without being used up themselves. They work by lowering the activation energy. This is the amount of energy needed to get a reaction going. Just like striking a match, you need to put some energy into it, the match will not just burst into flames by itself. The graph to the right shows an energy profile of a catalysed reaction when compared to the same one that is not catalysed.