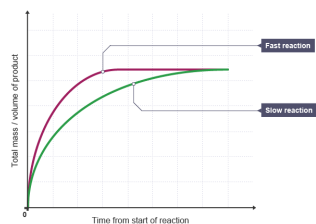


Knowledge Organiser – Year 8 Rates of Reaction

The rate of reaction can be analysed by plotting a graph of mass or volume of product formed against time. The graph shows this for two reactions.



The steeper the line, the greater the rate of reaction. Faster reactions - where the line becomes horizontal - finish sooner than slower reactions

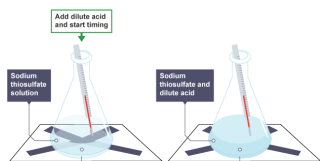
Rates, concentration and pressure

The greater the frequency of successful collisions, the greater the rate of reaction. If the concentration of a reacting solution or the pressure of a reacting gas is increased:

- the reactant particles become more crowded
- the frequency of collisions between reactant particles increases
- the rate of reaction increases

Note that the mean energy of the particles does not change. However, since the frequency of collisions increases, the frequency of successful collisions also increases.

Experiments to measure reaction time. Sulfur forms a cloudy yellow-white precipitate during the reaction. The time taken for this to achieve a given cloudiness provides a way to measure the reaction time.



Rate of reaction

The rate of a reaction is a measure of how quickly a reactant is used up, or a product is formed.

Collision theory

For a chemical reaction to happen: reactant particles must collide with each other the particles must have enough energy for them to react A collision that produces a reaction is called a successful collision. The activation energy is the minimum amount of energy needed for a collision to be successful. It is different for different reactions.

Dividing lumps

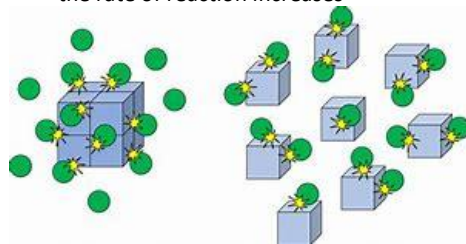
For a given mass of a solid, large lumps have smaller surface area to volume ratios than smaller lumps or powders. If a large lump is divided or ground into a powder:

- its total volume stays the same
- the area of exposed surface increases
- the surface area to volume ratio increases

Lumps vs powders

The greater the frequency of successful collisions, the greater the rate of reaction. If the surface area to volume ratio of a reacting solid is increased:

- more reactant particles are exposed at the surface
- the frequency of collisions between reactant particles increases
- the rate of reaction increases



surface area to volume ratio

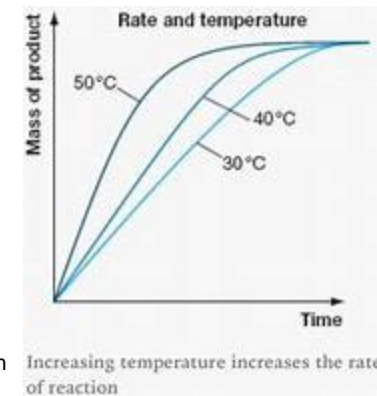
Make sure you answer questions in terms of **surface area to volume ratio**, rather than just surface area. This is because the surface area also depends on the mass of solid reactant used.



Rates and temperature

The greater the frequency of successful collisions, the greater the rate of reaction. If the temperature of the reaction mixture is increased:

- reactant particles move more quickly
- the energy of the particles increases
- the **frequency** of successful collisions between reactant particles increases
- the **proportion** of collisions which are successful increases

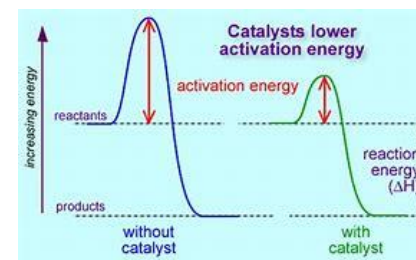


Catalysts

A catalyst is a substance that:

- speeds up the rate of a reaction
- does not alter the products of the reaction
- is not chemically changed or used up at the end of the reaction

Only a very small mass of catalyst is needed to increase the rate of a reaction. However, not all reactions have suitable catalysts. Different substances catalyse different reactions. Catalysts do not appear in the overall chemical equation for a reaction.



Useful experiments

There are many experiments you may carry out to investigate the rate of reaction. You may carry out an experiment that requires you to compare the volume of gas produced at different temperatures or at different concentration or using powders v's cubes of material

