

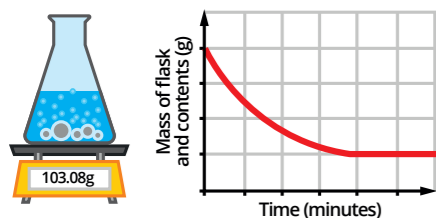
1.5 Rates of Reaction

Measuring Rates of Reaction:

- **Rate of Reaction** – the speed at which a reaction takes place.
- To measure the rate of reaction you:
 - » measure how quickly the reactants are used up
 - » measure how quickly the products are formed.

There are three main methods to measure the rate of reaction:

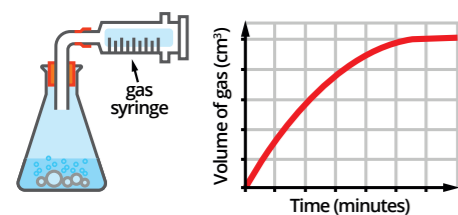
1. Change in mass



The mass of the flask and contents decreases as the gas formed leaves the flask.

- Recording the **loss in mass over time** gives an **accurate rate** measurement.

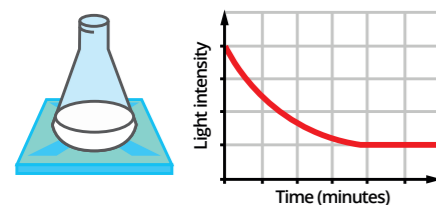
2. Volume of gas formed



A gas syringe is used to collect the gas as it is produced during the reaction.

- Recording the **volume of gas produced over time** gives an **accurate rate** measurement.

3. Formation of a precipitate

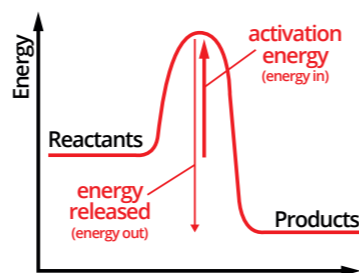


The solution turns milky / cloudy as the precipitate (insoluble solid) is produced.

- Recording the **decrease in light intensity over time** gives an **accurate rate** measurement.

Collision Theory:

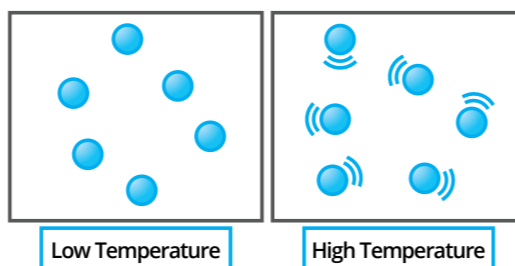
- For a reaction to happen the reacting particles must **successfully collide**
- A successful reaction is one that leads to a reaction happening
- A successful collision happens when the reacting particles have sufficient energy



The activation energy is the minimum energy reacting particles must have when they collide for the reaction to take place.

- Increasing the rate of reaction **increases the chance/frequency** of successful collisions.
- There are 4 ways of changing the rate of a reaction - temperature, concentration, surface area and catalyst.

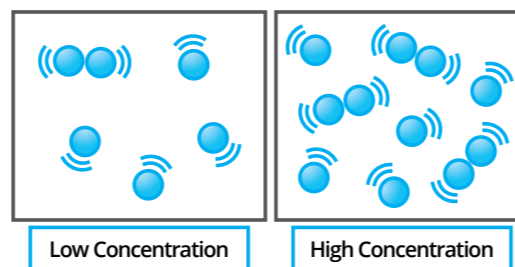
Temperature:



Increasing the temperature makes the particles move faster.

- At a higher temperature the particles have **more kinetic energy** and move faster
- This **increases the chance** of successful collisions - so a **faster rate of reaction**.

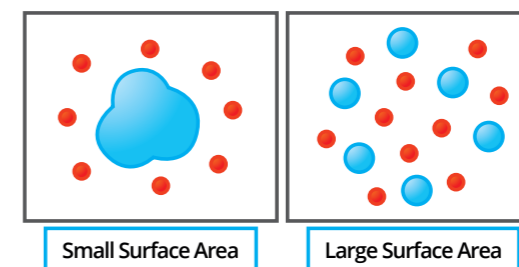
Concentration:



Increasing the concentration increases the number of reacting particles.

- At a higher pressure there are **more reacting particles** in the **same space**
- This **increases the chance** of successful collisions - so a **faster rate of reaction**.

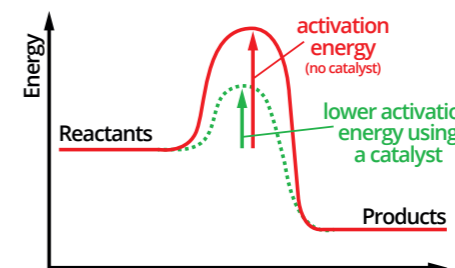
Surface area:



Breaking a solid into smaller pieces increases the surface area.

- A larger surface area provides more space for the reacting particles to collide.
- This **increases the chance** of successful collisions - so a **faster rate of reaction**.

Catalyst:



Adding a catalyst to the reaction lowers the activation energy of the reaction.

- A catalyst is a substance that speeds up a reaction **without being used up**
- By **lowering the activation energy** it **increases the chance** of successful collisions - so a **faster rate of reaction**.

Rate Graphs:

- A **graph** is used to follow the course of reaction
- **Comparing graphs** show the **differences in the rates** of similar reactions

