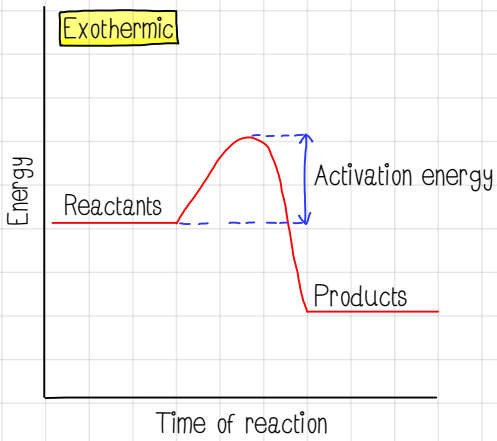
The effect of catalysts on the rate of reaction

Review

- Chemical reactions can only take place when the reacting particles **collide** with each other. The collisions must also have **sufficient energy** for the reaction to take place.
- The rate of a chemical reaction is determined by the **frequency** of successful **collisions** (collisions per second).

Activation energy



The activation energy is the minimum amount of energy that particles must have in order to react.

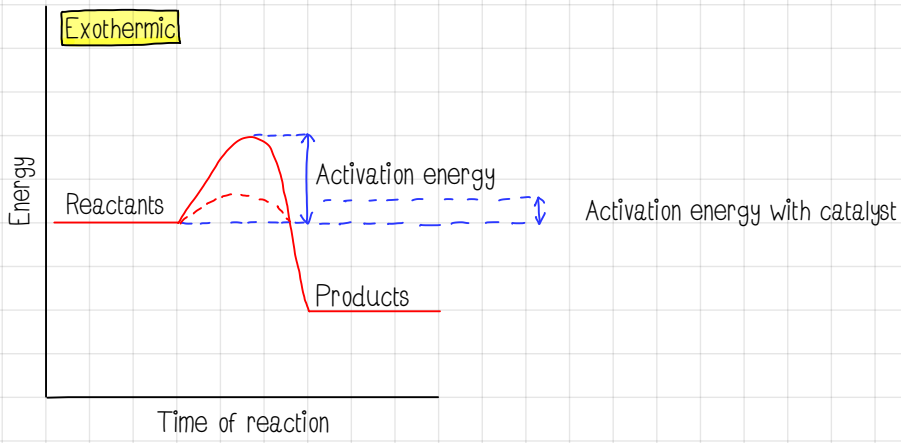
Catalysts

- Catalysts **increase** the **rate** of the reaction but are **not used up** in the reaction
- Catalysts allow reactions to be carried out quickly without needing to increase the temperature or pressure. This **saves money** during chemical production.
- Because catalysts are **not used up** during a reaction they can be used again and again.

Activation energy and catalysts

- The rate of reaction depends on the number of particles that have enough energy to cross the activation energy barrier and collide successfully.
- Catalysts can increase the rate of reaction by **lowering** the **activation energy** required for a successful collision to take place.

The effect of catalysts on the rate of reaction...



When a catalyst is present the particles require less energy to cross the activation energy barrier. This means that more particles can successfully collide per second.

As a result the rate of reaction will increase.

Catalysts and reactions

$$\text{sulfur dioxide} + \text{oxygen} \xrightarrow{\text{vanadium oxide}} \text{sulfur trioxide}$$

Catalysts are not included in the chemical equation for the reaction because they are not used up. They may be placed over the arrow to show that they are present.

Different reactions require different catalysts. Enzymes act as catalysts in living organisms. They allow a wide range of reactions to occur at body temperature.

Industrial uses of catalysts

Removal of combustion pollutants from car exhausts (platinum)
Cracking of hydrocarbons (Zeolites)
Production of ammonia (iron)

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