AQA C6 RATE OF REACTION COMBINED HIGHER
RPs: disappearing cross & gas collection

Key Word	Definition
concentration	The amount of dissolved solid (solute) in a volume of solution. A high concentration means there is a lot of solute in solution.
pressure	This is caused when lots of gas particles hit the surface of a container.
surface area	A measure of the total area around a substance.
catalyst	A substance that speeds up the rate of a reaction, but is unchanged.
enzyme	These are biological catalysts.
activation energy	The minimum amount of energy colliding particles need for a reaction to take place.

REVERSIBLE REACTIONS

A reversible reaction occurs in some chemical reactions. This is when the products can react again to re-form the reactants.

In a reaction we use a double arrow to represent that is a reversible reaction:

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

The direction of reversible reactions can be changed by changing conditions:

$$A + B \underset{\text{cool}}{\overset{\text{heat}}{\rightleftharpoons}} C + D$$

Looking at the reaction above, to make C and D, we can apply heat. If we want to make A and B, we can cool the reaction mixture.

If one direction of a reversible reaction is exothermic, the opposite direction is endothermic. The same amount of energy is transferred in each case.
For example:

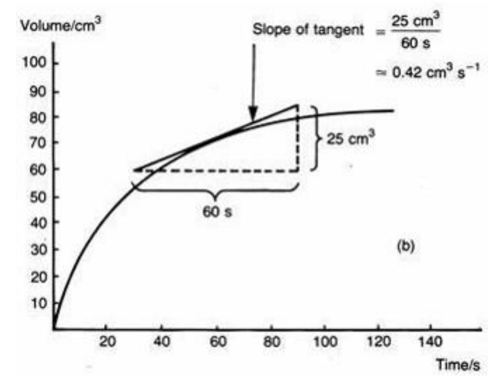
hydrated copper sulfate $\underset{\text{exothermic}}{\overset{\text{endothermic}}{\rightleftharpoons}}$ anhydrous copper sulfate + water

CALCULATING THE RATE OF A REACTION

The rate of a reaction can be calculated from either the amount of product made in a reaction or the amount of reactant used up in a reaction. The equations are;

$$\text{rate} = \frac{\text{amount of reactant used}}{\text{time}} \qquad \text{rate} = \frac{\text{amount of product made}}{\text{time}}$$

You can also calculate it by drawing a tangent from a graph:

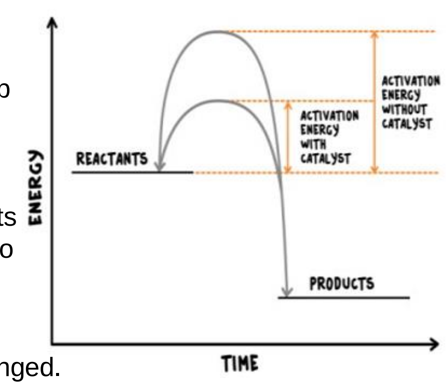


HOW CATALYSTS WORK

Catalysts and enzymes speed up reactions.

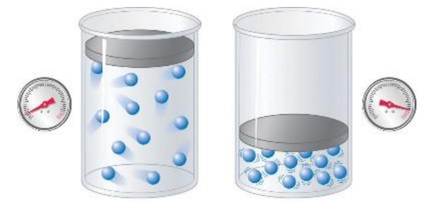
Catalysts provide a different reaction pathway where reactants do not require as much energy to react when they collide.

Catalysts do not appear in word equations as they remain unchanged.



UNITS IN CALCULATING RATE

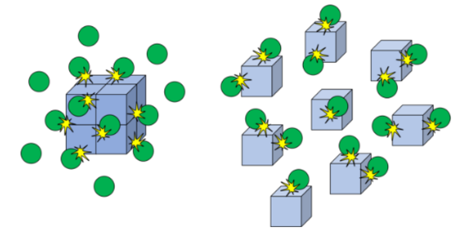
Quantity	Unit
mass	grams (g)
volume	centimetres cubed (cm^3)
rate	grams per second (g/s) cm^3 per second (cm^3/s)
	moles per second (mol/s)



(a) Low pressure (b) High pressure

EQUILIBRIUM IN REVERSIBLE REACTIONS

When a reversible reaction occurs in apparatus which prevents the escape of reactants and products, equilibrium is reached when the forward and reverse reactions occur exactly at the same rate.



low surface area high surface area

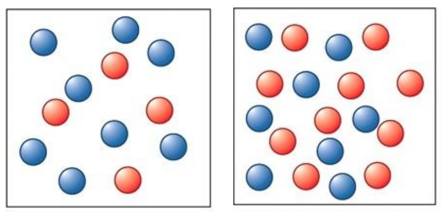
THE FACTORS THAT EFFECT THE RATE OF A REACTION

Temperature: The higher the temperature the faster the reaction rate.

Concentration: The higher the concentration of a *solution* the faster the reaction rate.

Surface Area: The larger the surface area of a *solid* reactant, the faster the reaction rate.

Pressure: The higher the pressure of a *gas*, the faster the reaction rate.



low concentration high concentration

EXPLAING CHANGE IN RATE USING COLLISION THEORY

What is collision theory?
Chemical reactions can only occur when reacting particles collide with each other with sufficient energy.

Explaining the change in the rate of a reaction.
Increasing the temperature increases the frequency of collisions and makes the collisions more energetic, therefore increasing the rate of reaction.

Increasing the concentration, pressure (gases) and surface area (solids) of reactions increases the frequency of collisions, therefore increasing the rate of reaction.

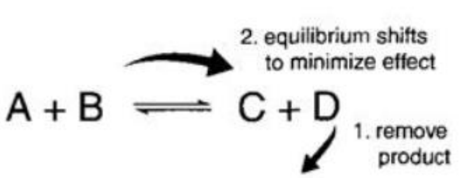
CHANGING CONDITIONS AND THE EFFECT ON EQUILIBRIUM POSITION IN REVERSIBLE REACTIONS

The relative amounts of reactants and products at equilibrium depend on the conditions of the reaction.

LeChateliers principle states that when we change the conditions of a reaction, the "position of equilibrium" will shift to counteract that change. (Position moves right = more of the right side is made)

Changing concentration:
If the concentration of a reactant is increased, more products will be formed. The "position of equilibrium" moves to the right.

Changing temperature:
If the temperature of a system at equilibrium is increased:
- Exothermic reaction = products decrease
- Endothermic reaction = products increase



Changing pressure:
If the pressure of a system at equilibrium is increased:
- The equilibrium moves to produce more of the side with the LEAST gas molecules

If pressure is decreases, the equilibrium moves to the side with the MOST gas molecules