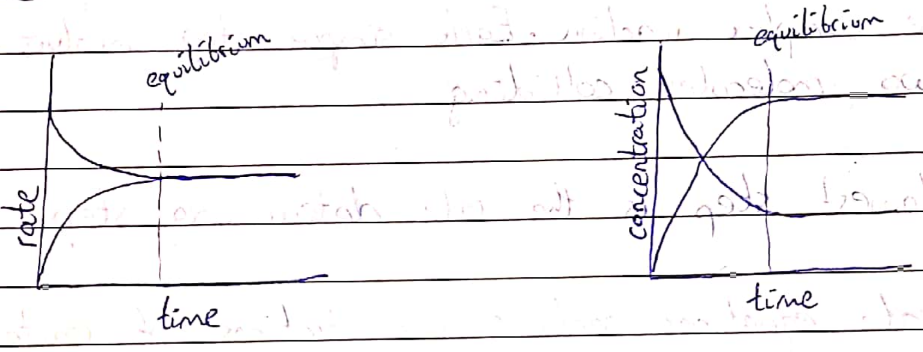
Equilibrium

- A system has reached equilibrium when no further change appears to occur - all concentrations remain constant.

- In dynamic equilibrium, macroscopic properties are constant (concentrations of all reactants and products remains constant) and the rate of the forward reaction is equal to the rate of the reverse reaction.



- At equilibrium the concentration of all reactants and products remain constant.

- The rate of ~~foo~~ forward reaction is equal to backward reaktion.

- Equilibrium is only attainted in a closed system.

- All species in the chemical equation are present in the equilibrium reaction mixture.

- Equilibrium can be attainted from either direction.

- Equilibrium doesn't imply 50% reactants and 50% products.

- If a system at equilibrium is subjected to a change, the position of equilibrium will shift in order to minimise the effect of the change. - Le Chatelier's principle.

- Heat reaction mixture: the position of the equilibrium is shifted in the endothermic direction.

- Cool reaction mixture: position of equilibrium is shifted in the exothermic direction.

- If a reaction ~~wit~~ involves a change in the number of gas molecules, an increases in pressure results in the position of equilibrium shifting in the direction that gives a decrease in the number of gas molecules.

- In general, if the concentration of one product/species is increased in an equilibrium mixture, the position of equilibrium shifts to the opposite direction to reduce the concentration of this species.

- $aA + bB \rightleftharpoons cC + dD$

$$K_c = \frac{[C]^c [D]^d}{[A]^a [B]^b} = \frac{[\text{products}]}{[\text{reactants}]}$$

K_c is the constant for a particular reaction at a particular temperature.

$K_c > 1$ - the reaction proceeds almost towards the products.
$K_c < 1$ - the reaction harldly proceeds towards the products.

The reaction quotient, Q, is the ratio of concentrations of the reactants and products at any point in time.

- $Q < K_c$, then the reaction must proceed towards the products to reach equilibrium.

- $Q > K_c$ then the reaction must proceed towards the reactants to reach the equilibrium.

$$K_c = \frac{[HI]^2}{[H_2][I_2]}$$

	Equilibrium Constant
reverse the reaction	& K_c^{-1}
halve the coefficients	$\sqrt{K_c}$
double the coefficients	K_c^2
triple the coefficients	K_c^3
Sum of equations	$K_{c_1} \times K_{c_2}$ .....

- The value of the K_c for a particular reaction is only affected by a change in temperature.

- Exothermic reaction, the value of the equilibrium constant decreases as the temperature is increased.

- Endothermic reaction, the value of the K_c increases as the temperature increases.

- The catalyst increases the rate of forward and reverse reactions equally. It doesn't affect the value of K_c and the position of equilibrium, it just reduces the time taken for a reaction.

- K_c - gives information about how far a reaction would proceed
- k - indicates how quickly equilibrium is attained.
  ↳ rate constant

- The value of the equilibrium constant is not affected by a change in concentration.

- The position of equilibrium corresponds to the mixture of reactants and products that produces the minimum value of the Gibbs free energy and the maximum value of entropy.

$$\Delta G = -RT \ln K$$

ΔG	K	Position of Equilibrium
negative	>1	closer to products than reactants
positive	<1	closer to reactants than products