1.6 CHEMICAL EQUILIBRIA, LE CHATELIER'S PRINCIPLE AND KC

Le Chatelier's Principle

- Predicts how changes in temperature, pressure and concentration affect equilibrium position
  - E.g. if the temperature is increased, the position of equilibrium will shift to try to cool the reaction down again
- Compromise conditions used for reversible reactions in industrial processes
  - E.g. Haber Process: $N_2 + 3H_2 \rightleftharpoons 2NH_3$ Compromise conditions of 450°C and 200 atm
    - Increase in temperature
      - Higher rate but favours backward reaction
    - Favours the forward reaction but dangerous and expensive if too high
      - Increase in pressure

Reversible reactions

- Denoted by: $\rightleftharpoons$

Dynamic Equilibrium

- Occurs in a closed system
  - Nothing can get in or out
- Rate of forward reaction equals to rate of the backward reaction
  - Concentration of the reactants and products remains constant

Effect of Catalyst

- Allows equilibrium to be reached faster
- No effect on the position of equilibrium
  - Rate of the forwards and backwards reactions are increased by equal amounts

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1.6 CHEMICAL EQUILIBRIA, LE CHATELIER'S PRINCIPLE AND KC: EQUILIBRIUM CONSTANT, KC

Homogeneous Systems

Reactants in the same phase (same state) as the products

Concentration of a species in mol dm^{-3} is represented by square brackets: [X]

$aA + bB \rightleftharpoons dD + eE$

$$K_c = \frac{[D]^d[E]^e}{[A]^a[B]^b}$$

Units of Kc found by substituting the concentration units into the equation for Kc and cancelling down

Reversible Reactions

Not affected by changes in concentration of a reactant or product

Not affected by catalyst

The value of Kc is only valid for a certain temperature

The value of Kc is only valid for a certain temperature

E.g. If the temperature change means that the concentration of products increases then Kc increases

Use Le Chatelier's principle to deduce how temperature affects equilibrium position

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