AQA GCSE Chemistry

Topic 6: The rate and extent of chemical change

Reversible reactions and dynamic equilibrium

Notes

(Content in bold is for Higher Tier only)

Reversible reactions

- In some chemical reactions, the products of the reaction can react to produce the original reactants
    - These are called reversible reactions
    - The direction of the reaction can be changed by changing the conditions (e.g. for forwards reaction use hot conditions and for reverse use cool)
- Use the symbol ⇌ instead of ⟶ to represent a reversible reaction
- E.g. The Haber Process: hydrogen + nitrogen ⇌ ammonia

Energy changes and reversible reactions

- If a reversible reaction is endothermic one way, it is exothermic in the opposite direction.
- The same amount of energy is transferred each way (just for one the energy will be lost and for the other the same amount will be gained)

Equilibrium

- When a reversible reaction occurs in a closed system, equilibrium is reached when the reactions occur at exactly the same rate in each direction.

The effect of changing conditions on equilibrium

- **The relative amounts of all the reacting substances at equilibrium depend on the conditions of the reaction.**
- **If a system is at equilibrium and a change is made to any of the conditions, then the system responds to counteract the change (Le Chatelier's principle)**

The effect of changing concentration

- **If the concentration of one of the reactants or products is changed, the system is no longer at equilibrium and the concentrations of all the substances will change until equilibrium is reached again.**
- **If concentration of reactants is increased: position of equilibrium shifts towards products so more product is produced until equilibrium is reached again**
- **if concentration of products is increased: position of equilibrium shifts towards reactants so more reactant is produced until equilibrium is reached again**

The effect of temperature changes on equilibrium

- **If temperature is increased: equilibrium moves in the direction of the endothermic reaction (e.g. if forwards reaction is endothermic and temperature is increased, equilibrium shifts right to produce more product)**
- **If temperature is decreased: equilibrium moves in the direction of the exothermic reaction**
- **For the forwards being exo/endothermic and yield meaning the amount of product from the forwards reaction:**

	Exothermic	**Endothermic**
An increase in temperature...	Decreases yield of reaction	Increases yield of reaction
A decrease in temperature...	Increases yield of reaction	Decreases yield of reaction

The effect of pressure changes on equilibrium

- **In gaseous reactions, an increase in pressure will favour the reaction that produces the least number of molecules as shown by the symbol equation for that reaction.**
- **If pressure is increased: equilibrium shifts to side of equation with fewer moles of gas (e.g. $N_2 + 3H_2 \rightleftharpoons 2NH_3$, left side has 4 moles of gas (1+3) and right has 2 moles of gas. If you increase the pressure equilibrium moves right as there are fewer moles of gas on the right hand side, making more product)**
- **if pressure is decreased: equilibrium will shift to side of equation with more moles of gas (e.g. for previous example equilibrium would move left, making more reactant)**

If a reaction produces a...	**...larger volume of gas (more moles)**	**...smaller volume of gas (fewer moles)**
An increase in pressure...	Decreases yield of reaction	Increases yield of reaction
A decrease in pressure...	Increases yield of reaction	Decreases yield of reaction