Cambridge IGCSE Chemistry

Topic 7: Chemical reactions

Reversible reactions

Notes

*Understand that some chemical reactions can be reversed by changing the reaction conditions (Limited to the effects of heat and water on hydrated and anhydrous copper(II) sulfate and cobalt(II) chloride) (Concept of equilibrium is **not** required)*

- 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
- Dehydration of hydrated copper(II) sulfate
    - Anhydrous copper(II) sulfate + water ⇌ hydrated copper(II) sulfate
    - White solid turns blue in presence of water
    - Forward reaction add water
    - Reverse reaction heat the hydrated copper(II) sulfate (water evaporates)

The above is exactly the same with hydrated and anhydrous cobalt(II) chloride

(Extended only) Predict the effect of changing the conditions (concentration, temperature and pressure) on other reversible reactions

- 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.
    - Effects of changing conditions on a system at equilibrium can be predicted using Le Chatelier's Principle.

- 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 (right) so more product is produced until equilibrium is reached again
    - if concentration of products is increased: position of equilibrium shifts towards reactants (left) so more reactant is produced until equilibrium is reached again

- Effect of changing pressure:
    - 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 a reaction produces a..	...larger volume of gas (more moles on product side)	...smaller volume of gas (fewer moles on product side)
an increase in pressure...	decreases yield of reaction- equilibrium shifts left	increases yield of reaction- equilibrium shifts right
a decrease in pressure...	increases yield of reaction- equilibrium shifts right	decreases yield of reaction- equilibrium shifts left

- Effect of changing temperature:
  - 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- equilibrium moves left	Increases yield of reaction- equilibrium moves right
A decrease in temperature...	Increases yield of reaction- equilibrium moves right	Decreases yield of reaction- equilibrium moves left

(Extended only) Demonstrate knowledge and understanding of the concept of 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.