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Chemistry

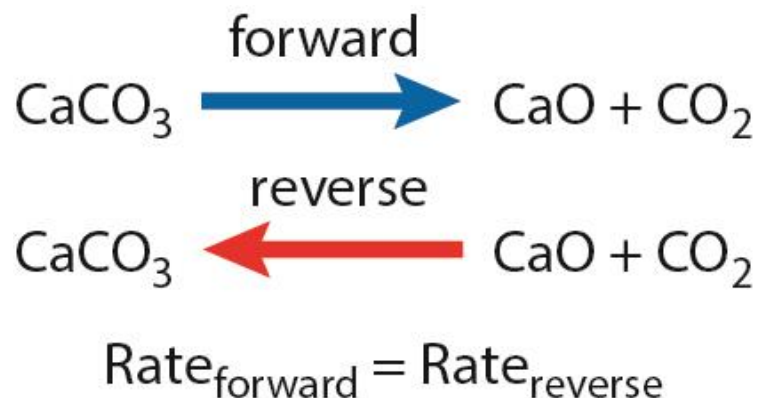
For the IB Diploma

> Chapter 18

How far? The extent of chemical change

> Equilibrium

Dynamic equilibrium macroscopic properties (all concentrations of reactants and products) are constant and the rate of the forward reaction is equal to the rate of the reverse reaction.



Equilibrium

- How does the concentration of the reactants and products change over time to get to equilibrium?
- What happens to the rate of the forwards and backwards reactions?

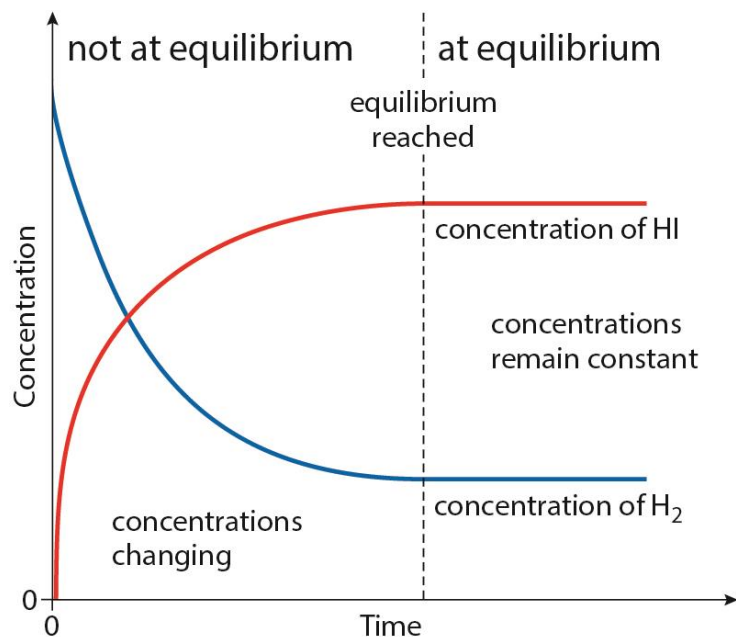


Figure 18.1: Graph showing how the concentrations of hydrogen and hydrogen iodide change with time.

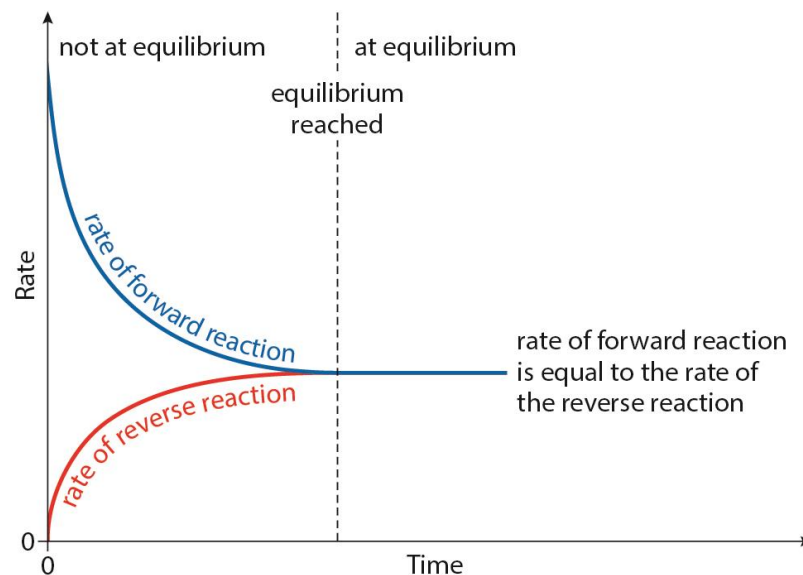


Figure 18.2: Graph showing how the rates of the forward and reverse reactions change as a reversible reaction comes to equilibrium.

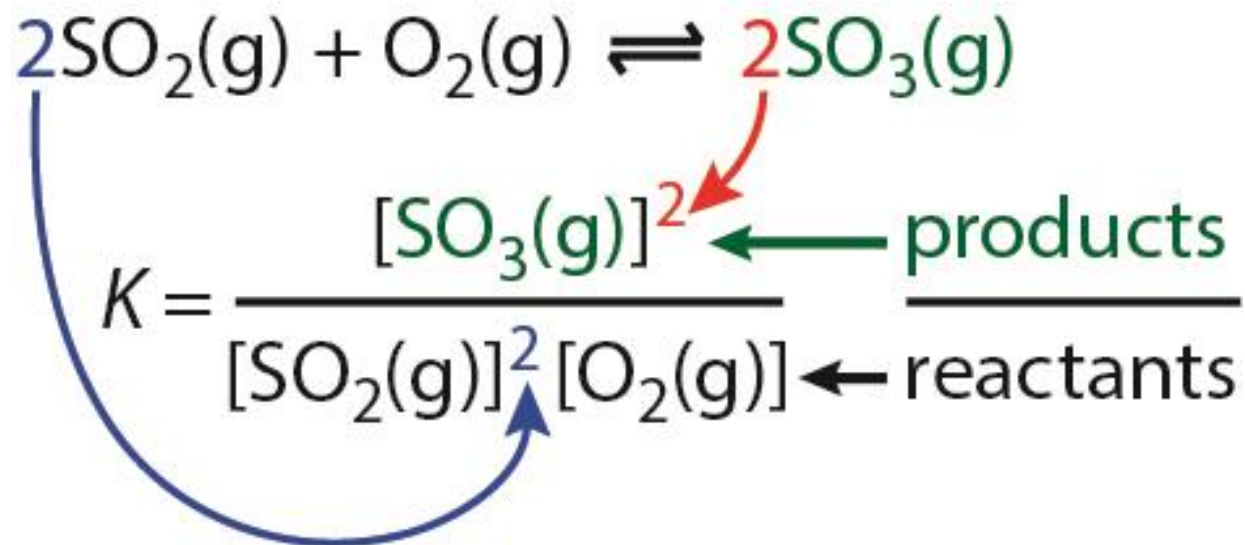
> Le Chatelier's principle

If a system at equilibrium is subjected to some change, the position of equilibrium will shift in order to minimise the effect of the change.

➤ How do different conditions affect the position of equilibrium and the value of the equilibrium constant?

Condition	Effect on position of equilibrium	Effect on value of K
Pressure	If a reaction involves a change in the number of moles of gas, an increase in pressure results in the position of equilibrium shifting in the direction that gives a decrease in the number of moles of gas.	No change
Concentration	The position of equilibrium will shift to use up any substance that has been added or replace any substance that has been removed from the equilibrium mixture.	No change
Catalyst	no effect	No change
Temperature	If the temperature is increased, the position of equilibrium shifts in the endothermic direction. If the temperature is decreased, the position of equilibrium shifts in the exothermic direction.	For an exothermic reaction, K decreases as the temperature is increased. For an endothermic reaction, K increases as the temperature is increased.

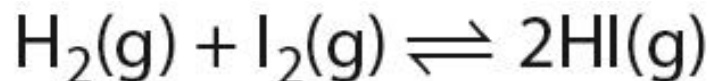
➤ Write expressions for the equilibrium constant for different reactions



[] (square brackets) are used to show they are concentrations

> Reaction quotient (Q)

Reaction quotient (Q) the ratio of the concentrations of the reactants and products (raised to the appropriate powers) at any point in time
An expression for Q is exactly the same as that for the equilibrium constant – except that the concentrations are not equilibrium concentrations.



$$Q = \frac{[\text{HI}(\text{g})]^2}{[\text{H}_2(\text{g})][\text{I}_2(\text{g})]}$$