KNOCKHARDY NOTES

A LEVEL CHEMISTRY

EQUILIBRIUM

AT A GLANCE

When a chemical equilibrium is established . . .

- the reaction is dynamic - it is moving forwards and backwards
- the rates of forward and backward reactions are equal
- both the reactants and the products are present at all times
- the equilibrium can be approached from either side
- concentrations of reactants and products remain constant

The Equilibrium Law

"If the concentrations of all the substances present at equilibrium are raised to the power of the number of moles they appear in the equation, the product of the concentrations of the products divided by the product of the concentrations of the reactants is a constant, provided the temperature remains constant"

There are several forms of the constant; all vary with temperature.

K_c equilibrium values are expressed as concentrations of mol dm^{-3}

K_p equilibrium values are expressed as partial pressures
(can be used for reactions with at least one gas in the equation)

$$aA + bB \rightleftharpoons cC + dD$$

then

$$\frac{[C]^c \,.\, [D]^d}{[A]^a \,.\, [B]^b} = \text{a constant, } (K_c)$$

[ ] denotes the equilibrium concentration in mol dm^{-3}

K_c is known as the Equilibrium Constant

it is AFFECTED by a change of temperature
but NOT AFFECTED by changes in concentration
a change of pressure
adding a catalyst

Le Chatelier's Principle

"When a change is applied to a system in dynamic equilibrium, the system reacts in such a way as to oppose the effect of the change."

FACTORS AFFECTING THE EQUILIBRIUM POSITION

CONCENTRATION

K_c is not affected if you change any concentration at constant temperature
to maintain the constant the composition of the equilibrium mixture changes

$$aA + bB \rightleftharpoons cC + dD$$

increase	**[A] or [B]**	equilibrium **moves to right**
decrease	**[C] or [D]**	equilibrium **moves to right**
increase	**[C] or [D]**	equilibrium **moves to left**
decrease	**[A] or [B]**	equilibrium **moves to left**

PRESSURE

Pressure Change	*Effect on Equilibrium*
INCREASE	moves to side with FEWER GASEOUS MOLECULES
DECREASE	moves to side with MORE GASEOUS MOLECULES

TEMPERATURE

Type of reaction	ΔH	*Increase T*	*Decrease T*
EXOTHERMIC	–	moves to LEFT	moves to RIGHT
ENDOTHERMIC	+	moves to RIGHT	moves to LEFT

CATALYSTS

Do **not affect the position** of equilibrium but equilibrium is **reached quicker**