The Equilibrium Constant Kc

① When equilibrium had been established at 764K, the mixture was found to contain hydrogen 2.484×10^{-3} mol dm^{-3}; iodine 2.514×10^{-3} mol dm^{-3}; hydrogen iodide 1.695×10^{-2} mol dm^{-3}. Calculate a value for Kc at this temperature.

② If an ester like ethyl ethanoate reacts with water in the presence of an acid catalyst, the following equilibrium is established:

$$\underset{\text{ethyl ethanoate}}{CH_3COOC_2H_{5(l)}} + H_2O_{(l)} \rightleftharpoons \underset{\text{ethanoic acid}}{CH_3COOH_{(l)}} + \underset{\text{ethanol}}{C_2H_5OH_{(l)}}$$

Exactly 1 mole of ethyl ethanoate was mixed with exactly one mole of water (from dilute hydrochloric acid) and allowed to reach equilibrium. The equilibrium mixture was analysed and found to contain 0.300 moles of ethanoic acid. Calculate a value for K_c at the temperature of the reaction.

(3) This problem relates to the gaseous equilibrium:

$$B_{(g)} + C_{(g)} \rightleftharpoons A_{(g)}$$

0·500mole of B and 0·300mole of C were mixed in a container of volume $10{\cdot}0dm^3$ at a temperature of 400K. At equilibrium there was found to be 0·100moles of A present. Calculate the value for K_c at this temperature.

④ The question refers to the gaseous equilibrium:

$$A_{(g)} \rightleftharpoons 2B_{(g)}$$

4.00 moles of A was placed in a 20.0 dm^3 container and heated to 320K until equilibrium had been established. The equilibrium mixture was found to contain 1.50 moles of A. Calculate the value for K_c at this temperature.

(5) 24.0g of ethanoic acid and 23.0g of ethanol were mixed in a stoppered bottle and left for several days to reach equilibrium at room temperature. At the end of that time, the mixture was poured into pure water and made up to a total volume of $250cm^3$. A $25.0cm^3$ sample of this needed $26.5cm^3$ of $0.400mol dm^{-3}$ sodium hydroxide to neutralise the remaining ethanoic acid. Calculate a value for K_c for the reaction:

$$\underset{\text{ethanoic acid}}{CH_3COOH_{(l)}} + \underset{\text{ethanol}}{C_2H_5OH_{(l)}} \rightleftharpoons \underset{\text{ethyl ethanoate}}{CH_3COOC_2H_5{}_{(l)}} + \underset{\text{water}}{H_2O_{(l)}}$$

the neutralisation reaction is:

$$CH_3COOH + NaOH \longrightarrow CH_3COONa + H_2O$$

(6) This example is about a simple equilibrium

$$A_{(l)} \rightleftharpoons B_{(l)}$$

If 1.00 mole of A was allowed to reach equillibrium, how many moles of B would be formed if Kc had a value of 0.0200 at the temperature of the reaction?

7) if K_c for the following reaction is 36 at a particular temperature, calculate the fraction of P converted into Q and R at equilibrium:

$$2P_{(g)} \rightleftharpoons Q_{(g)} + R_{(g)}$$

⑧ The equilibrium constant, K_c, for the following reaction is 4.0 at 20°C.

$$E_{(l)} + F_{(l)} \rightleftharpoons G_{(l)} + H_{(l)}$$

If 2.0 moles of E and 1.0 mole of F were mixed and allowed to reach equillibrium at 20°C, calculate the number of moles of H formed.