**Exercise 5.1.2**

1. The Haber process is a reversible exothermic reaction with a Kc of 46.2 mol-2dm6

N2(g) + 3H2(g) == 2NH3(g)

1. A reaction mixture is found to contain 0.4 moldm-3 N2, 1.2 moldm-3 H2 and 4.2 moldm-3 NH3. Show that the reaction is not at equilibrium and state the direction in which the reaction will proceed in order to reach equilibrium
2. Once the system has reached equilibrium, extra nitrogen is added. Explain with reference to Kc the effect of adding extra nitrogen to the equilibrium position.
3. The pressure of the system is then reduced. Explain with reference to Kc the effect of decreasing the pressure on the equilibrium position.
4. The temperature of the system is now increased. State and explain the effect this will have on Kc and on the equilibrium position.
5. Phosphorus pentachloride decomposes in a reversible endothermic reaction with a Kc of 0.3 moldm-3

PCl5(g) == PCl3(g) + Cl2(g)

1. A reaction mixture is found to contain 0.5 moldm-3 PCl5, 0.5 moldm-3 Cl2 and 0.5 moldm-3 PCl3. Show that the reaction is not at equilibrium and state the direction in which the reaction will proceed in order to reach equilibrium.
2. Once the system has reached equilibrium, extra chlorine is added. Explain with reference to Kc the effect of adding extra chlorine to the equilibrium position.
3. The pressure of the system is then reduced. Explain with reference to Kc the effect of decreasing the pressure on the equilibrium position.
4. The temperature of the system is now increased. State and explain the effect this will have on Kc and on the equilibrium position.