Equilibria — free sample worksheet

Chemistry 9701 · Topic 7 · 20 marks

Answer every question. Show all your working — method marks are given for working even when the final answer is wrong. The levels go from easy to hard.

Question 1

EASY [2 marks]

State and explain the effect of adding a catalyst on the position of an equilibrium.

Question 2

EASY [2 marks]

State two features of a system that is in dynamic equilibrium.

Question 3

MEDIUM [2 marks]

For the equilibrium $N_2O_4(g) \rightleftharpoons 2\,NO_2(g)$, write the expression for K_c and deduce its units.

Question 4

MEDIUM [5 marks]

Ammonia is made in the Haber process.

$$N_2(g) + 3\,H_2(g) \rightleftharpoons 2\,NH_3(g) \qquad \Delta H = -92\,\text{kJ mol}^{-1}$$

(a) Write an expression for K_c for this equilibrium. [1]

(b) Explain the effect of increasing the pressure on the equilibrium yield of ammonia. [2]

(c) State and explain the effect of increasing the temperature on the value of K_c. [2]

Question 5

HARD [5 marks]

2.00 mol of ethanoic acid and 2.00 mol of ethanol were mixed with a little acid catalyst and left to reach equilibrium. The equilibrium mixture contained 1.33 mol of ethyl ethanoate.

(a) Write the equation for this equilibrium. [1]

(b) Calculate K_c, giving your answer to three significant figures. Explain why the volume of the mixture is not needed. [4]

Question 6

HARD [4 marks]

Ethanol is manufactured from ethene and steam.

$$C_2H_4(g) + H_2O(g) \rightleftharpoons C_2H_5OH(g) \qquad \Delta H = -46\,\text{kJ mol}^{-1}$$

The process is run at about 300 °C. Explain why this temperature is a compromise.