CHAPTER 19 EQUILIBRIUM CONSTANT K_p

1 Consider the equilibrium system below.

$2SO_{2\,(g)} + O_{2\,(g)} \rightleftharpoons 2SO_{3\,(g)}$

The partial pressures for the gases in the equilibrium mixture are:

$pSO_2 = 0.080$ atm
$pO_2 = 0.90$ atm
$pSO_3 = 5.0$ atm

Calculate k_p for the system. Give your answer to an appropriate number of significant figures. Include the unit.

.....

.....

.....

.....

.....

(3 marks)

2 Calculate the value of K_p for the system shown below.

$2NO_{2\,(g)} \rightleftharpoons N_2O_{4\,(g)}$

At 65°C the partial pressures of the gases at equilibrium are:

$pNO_2 = 0.80$ atm
$pN_2O_4 = 0.25$ atm

.....

.....

.....

.....

.....

(3 marks)

3 A chemist analysed the equilibrium system below

$3H_{2\,(g)} + N_{2\,(g)} \rightleftharpoons 2NH_{2\,(g)}$

and found that there were 26.0 moles of NH_3, 13.0 moles of H_2, and 65.0 moles of N_2 present in the equilibrium mixture.

The total pressure of the system was 12.0 atm.

(a) Calculate the mole fraction of each gas at equilibrium.

.....

.....

.....

(1 mark)

(b) Calculate the partial pressure of each gas at equilibrium.

.....

.....

.....

(1 mark)

(c) Calculate K_p for this system. Give your answer to 3 decimal places and include any units.

.....

.....

.....

.....

(3 marks)

4 A chemist investigated the equilibrium system below, at 450°C and 3.00 atm.

$$H_{2\,(g)} + I_{2\,(g)} \rightleftharpoons 2HI_{(g)}$$

At equilibrium there was 0.30 mol of H_2, 0.40 mol of I_2, and 1.40 mol of HI.

Calculate the K_p. Give your answer to 2 significant figures and include units.

.....

.....

.....

.....

(3 marks)

5 Phosphorus pentachloride, PCl_5, decomposes on heating to form phosphorus trichloride, PCl_3, and chlorine, Cl_2, according to the equation below.

$$PCl_5 \rightleftharpoons PCl_3 + Cl_2$$

At a temperature of 350°C and a pressure of 12.0 atm the amount of gas present at equilibrium was 0.40 mol of PCl_5, 0.75 mol of PCl_3, and 0.90 mol of Cl_2.

Calculate the value of K_p. Give your answer to two significant figures and include any units.

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

(5 marks)

6 Calculate the value of K_p for the system shown below.

$$3H_{2\,(g)} + N_{2\,(g)} \rightleftharpoons 2NH_{3\,(g)}$$

At 800°C the partial pressures of the gases at equilibrium are:

pH_2 = 0.80 atm
pN_2 = 0.25 atm
pNH_3 = 0.35 atm

Give your answer to two significant figures and include any units.

.....

.....

.....

.....

(3 marks)