K_p PROBLEMS

1) 1.000 moles of PCl_5 vapour are heated to 500 K in a sealed vessel. The equilibrium mixture, at a pressure of 625 kPa, contains 0.600 moles of chlorine. Calculate K_p.

$$PCl_5(g) \rightleftharpoons PCl_3(g) + Cl_2(g)$$

2) A mixture of 1.90 moles of H_2 and 1.90 moles of I_2 were allowed to reach equilibrium at 710 K. The equilibrium mixture was found to contain 3.00 moles of HI. Calculate K_p.

$$H_2(g) + I_2(g) \rightleftharpoons 2\,HI(g)$$

3) For the equilibrium below calculate K_p if pO_2 = 102 kPa, pSO_2 = 251 kPa, pSO_3 = 508 kPa.

$$2\,SO_2(g) + O_2(g) \rightleftharpoons 2\,SO_3(g)$$

4) 2.00 moles of sulphur dioxide and 1.00 mole of oxygen were mixed and allowed to reach equilibrium in the presence of a suitable catalyst under a total pressure of 500 kPa. At equilibrium, 0.67 moles of oxygen were present. Find K_p.

$$2\,SO_2(g) + O_2(g) \rightleftharpoons 2\,SO_3(g)$$

5) 2.00 moles of X was heated to a temperature of 2000°C until equilibrium was established under a total pressure of 80 MPa. At equilibrium, X was found to have undergone 20% dissociation. Calculate K_p.

$$X(g) \rightleftharpoons Y(g) + 2\,Z(g)$$

6) 2.00 moles of A was mixed with 2.00 moles of B and the mixture allowed to reach equilibrium at 500°C. The equilibrium mixture was found to contain 0.90 mole of A. Calculate K_p.

$$2\,A(g) + B(g) \rightleftharpoons 3\,C(g)$$

7) In the following reaction at 700 K, the amount of each gas present at equilibrium is 0.960 moles of NO_2, 0.040 moles of NO, and 0.020 moles of O_2. If $K_p = 6.80 \times 10^{-4}$ kPa, what must the total pressure have been to achieve this particular equilibrium mixture?

$$2\,NO_2(g) \rightleftharpoons 2\,NO(g) + O_2(g)$$

8) Calculate the number of moles of each species at equilibrium if 0.50 moles of A and 0.50 moles of B are mixed at 500 K, given that K_p = 2.55 at this temperature and pressure = P (you do **NOT** need to use a quadratic equation to solve this).

$$A(g) + B(g) \rightleftharpoons 2C(g)$$