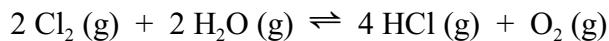


## Worksheet 9

1. Consider the following equilibrium, for which  $K_p = 0.0752$  at  $480\text{ }^\circ\text{C}$ .

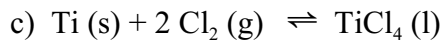
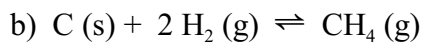
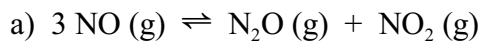


a) What is the value of  $K_p$  for the reaction  $4 \text{HCl} (\text{g}) + \text{O}_2 (\text{g}) \rightleftharpoons 2 \text{Cl}_2 (\text{g}) + 2 \text{H}_2\text{O} (\text{g})$ ?

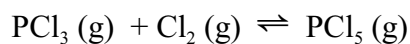
b) What is the value of  $K_p$  for the reaction  $\text{Cl}_2 (\text{g}) + \text{H}_2\text{O} (\text{g}) \rightleftharpoons 2 \text{HCl} (\text{g}) + \frac{1}{2} \text{O}_2 (\text{g})$

c) What is the value of  $K_c$  for the reaction in part (b)

2. Write the equilibrium constant expression,  $K_c$ , for the following reactions. In each case indicate whether the reaction is homogeneous or heterogeneous



3. Phosphorous trichloride gas and chlorine gas react to form phosphorous pentachloride gas:



A gas vessel is charged with a mixture of  $\text{PCl}_3 (\text{g})$  and  $\text{Cl}_2 (\text{g})$ , which is allowed to equilibrate at 450 K. At equilibrium the partial pressures of the three gases are  $P_{\text{PCl}_3} = 0.124 \text{ atm}$ ,  $P_{\text{Cl}_2} = 0.157 \text{ atm}$ , and  $P_{\text{PCl}_5} = 1.30 \text{ atm}$ . a) What is the value of the  $K_p$  at this temperature? b) Does the equilibrium favor reactants or products?

4. At 218 °C,  $K_c = 1.2 \times 10^{-4}$  for the equilibrium



Calculate the equilibrium concentrations of  $\text{NH}_3$  and  $\text{H}_2\text{S}$  if a sample of solid  $\text{NH}_4\text{HS}$  is placed in a closed vessel and decomposes until equilibrium is reached.