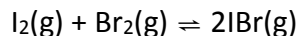


**G12 Chemistry: Class 11 Homework**

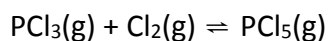
1. Iodine and bromine react to form iodine monobromide, IBr. **[5 marks]**



At 250°C, an equilibrium mixture in a 2.0 L flask contained 0.024 mol of  $\text{I}_2(\text{g})$ , 0.050 mol of  $\text{Br}_2(\text{g})$ , and 0.38 mol of  $\text{IBr}(\text{g})$ . What is the value of  $K_{\text{eq}}$  for the reaction at 250°C?

2. At high temperatures, carbon dioxide gas decomposes into carbon monoxide and oxygen gas. At equilibrium, the gases have the following concentrations:  $[\text{CO}_2(\text{g})] = 1.2 \text{ mol/L}$ ,  $[\text{CO}(\text{g})] = 0.35 \text{ mol/L}$ , and  $[\text{O}_2(\text{g})] = 0.15 \text{ mol/L}$ . Determine  $K_{\text{eq}}$  at the temperature of the reaction. **[3 marks]**

3. Phosphorus trichloride reacts with chlorine to form phosphorus pentachloride.



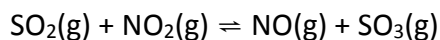
0.75mol of  $\text{PCl}_3$  and 0.75mol of  $\text{Cl}_2$  are placed in an 8.0L reaction vessel at 500K. What is the equilibrium concentration of the mixture? The value of  $K_c$  at 500K is 49. **[7 marks]**

4. Hydrogen gas has several advantages and disadvantages as a potential fuel. Hydrogen can be obtained by the thermal decomposition of water at high temperatures. **[7 marks]**



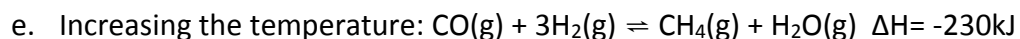
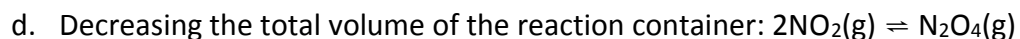
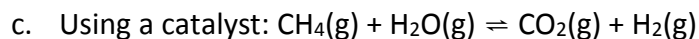
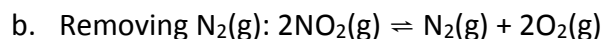
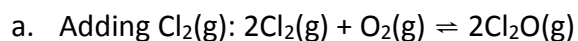
- a) The initial concentration of water in a reaction vessel is 0.055 mol/L. What is the equilibrium concentration of  $\text{H}_2(\text{g})$  at  $1000^\circ\text{C}$ ?  
b) Comment on the practicality of the thermal decomposition of water to obtain  $\text{H}_2(\text{g})$ .

5. A chemist was studying the following reaction.

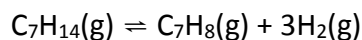


In a 1.0 L container, the chemist added  $1.7 \times 10^{-1}$  mol of  $\text{SO}_2(\text{g})$  to  $1.1 \times 10^{-1}$  mol of  $\text{NO}_2(\text{g})$ . The value of  $K_{\text{eq}}$  for the reaction at a certain temperature is 4.8. What is the equilibrium concentration of  $\text{SO}_3(\text{g})$  at this temperature? **[5 marks]**

6. In which direction does the equilibrium shift as a result of the change to each homogenous equilibrium system? **[5 marks]**

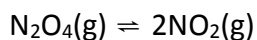


7. Toluene  $\text{C}_7\text{H}_8$  is an important organic solvent. It is made industrially from methyl cyclohexane.



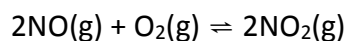
The forward reaction is endothermic. State three different changes to an equilibrium mixture of these reacting gases that would shift the equilibrium toward greater production of toluene. **[3 marks]**

8. Calculate the equilibrium concentrations of  $\text{N}_2\text{O}_4$  and  $\text{NO}_2$  at  $25^\circ\text{C}$  in a vessel that contains an initial  $\text{N}_2\text{O}_4$  concentration of  $0.0500\text{M}$ . The equilibrium constant  $K_{\text{eq}}$  for the reaction is  $4.64 \times 10^{-3}$  at  $25^\circ\text{C}$ . **[6 marks]**



9. Calculate the equilibrium concentrations at 25°C for the reaction in Question (8) for initial concentrations of  $[\text{N}_2\text{O}_4]=0.0200\text{M}$  and  $[\text{NO}_2]=0.0300\text{M}$ . **[6 marks]**

10. The equilibrium constant  $K_{\text{eq}}$  for the reaction is  $6.9 \times 10^5$  at 500K.



A 5.0L reaction vessel at this temperature was filled with 0.060mol of NO, 1.0mol of  $\text{O}_2$  and 0.80mol of  $\text{NO}_2$ . **[7 marks]**

- Is the reaction mixture at equilibrium? If not, in which direction does the net reaction proceed?
- What is the direction of the net reaction if the initial amounts are  $5.0 \times 10^{-3}$  mol of NO, 0.20mol of  $\text{O}_2$  and 4.0mol of  $\text{NO}_2$ ?