

\*\*\*\*Show all work for credit\*\*\*\*

1. (4 Pts) The equilibrium constant for the reaction  $\text{Ni(s)} + 4\text{CO(g)} \rightleftharpoons \text{Ni(CO)}_4\text{(g)}$  is  $5.0 \times 10^4$  at  $25^\circ\text{C}$ . What is the equilibrium constant for the reaction  $\text{Ni(CO)}_4\text{(g)} \rightleftharpoons \text{Ni(s)} + 4\text{CO(g)}$ ?

$$\frac{[\text{Ni(CO)}_4]}{[\text{CO}]^4} = 5.0 \times 10^4 \quad \text{so:} \quad \frac{[\text{CO}]^4}{[\text{Ni(CO)}_4]} = \frac{1}{5.0 \times 10^4} = 2.0 \times 10^{-5}$$

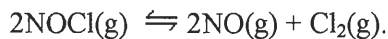
2. (3 Pts) The equilibrium constant expression for the reaction  $2\text{BrF}_5\text{(g)} \rightleftharpoons \text{Br}_2\text{(g)} + 5\text{F}_2\text{(g)}$  is

$$K_c = \frac{[\text{Br}_2] [\text{F}_2]^5}{[\text{BrF}_5]^2}$$

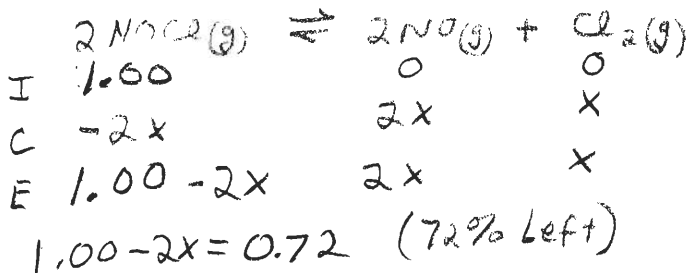
3. (7 Pts) On analysis, an equilibrium mixture for the reaction  $2\text{H}_2\text{S(g)} \rightleftharpoons 2\text{H}_2\text{(g)} + \text{S}_2\text{(g)}$  was found to contain 1.0 mol  $\text{H}_2\text{S}$ , 4.0 mol  $\text{H}_2$ , and 0.80 mol  $\text{S}_2$  in a 4.0 L vessel. Calculate the equilibrium constant,  $K_c$ , for this reaction.

$$K_c = \frac{[\text{H}_2]^2 [\text{S}_2]}{[\text{H}_2\text{S}]^2} = \frac{\left[\frac{4.0}{4.0}\right]^2 \left[\frac{0.80}{4.0}\right]}{\left[\frac{1.0}{4.0}\right]^2} = 3.2$$

4. (7 Pts) 2.50 mol  $\text{NOCl}$  was placed in a 2.50 L reaction vessel at  $400^\circ\text{C}$ . After equilibrium was established, it was found that 28% of the  $\text{NOCl}$  had dissociated according to the equation



Calculate the equilibrium constant,  $K_c$ , for the reaction.

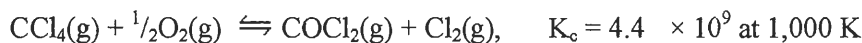


$$x = 0.14$$

$$K_c = \frac{[2(0.14)]^2 [0.14]}{[0.72]^2}$$

$$K_c = 0.021$$

5. (4 Pts) Carbon tetrachloride reacts at high temperatures with oxygen to produce two toxic gases, phosgene and chlorine.



Calculate  $K_c$  for the reaction  $2\text{CCl}_4\text{(g)} + \text{O}_2\text{(g)} \rightleftharpoons 2\text{COCl}_2\text{(g)} + 2\text{Cl}_2\text{(g)}$ .

$$\frac{[\text{COCl}_2] [\text{Cl}_2]}{[\text{CCl}_4] [\text{O}_2]^{1/2}} = 4.4 \times 10^9 \quad \text{so:} \quad \frac{[\text{COCl}_2]^2 [\text{Cl}_2]^2}{[\text{CCl}_4]^2 [\text{O}_2]} = (2.4 \times 10^9)^2 = 1.9 \times 10^{19}$$