

1. (6 Pts) 2.50 mol NOCl was placed in a 2.50 L reaction vessel at 400°C. After equilibrium was established, it was found that 28% of the NOCl had dissociated according to the equation: Calculate the equilibrium constant, K_c , for the reaction.



I	$\frac{2.50\text{ mol}}{2.50\text{ L}} = 1.00\text{ M}$	0	0
C	-2x	2x	x
E	$1.00 - 2x$	2x	x

$$K_c = \frac{[\text{NO}]^2 [\text{Cl}_2]}{[\text{NOCl}]^2}$$

$$K_c = \frac{[0.28]^2 [0.14]}{[0.72]^2}$$

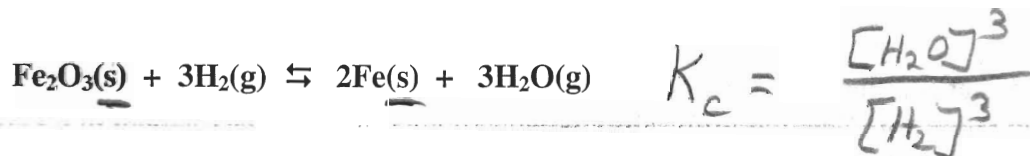
since $2x = 28\%$ of 1.00 M

$$x = 0.14$$

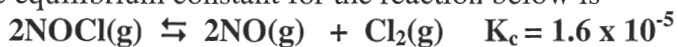
$$K_c = 0.0211$$

Therefore E 0.72 0.28 0.14

2. (3 Pts) Write the correct equilibrium constant expression for the following reaction.



3. (5 Pts) At 35°C, the equilibrium constant for the reaction below is



An equilibrium mixture was found to have the following concentrations of Cl_2 and NOCl :

$[\text{Cl}_2] = 1.2 \times 10^{-2}\text{ M}$; $[\text{NOCl}] = 2.8 \times 10^{-1}\text{ M}$. Calculate the concentration of $\text{NO}(g)$ at equilibrium.

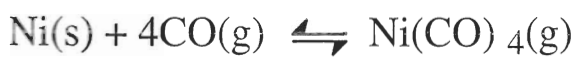
$$K_c = \frac{[\text{NO}]^2 [\text{Cl}_2]}{[\text{NOCl}]^2}$$

$$1.6 \times 10^{-5} = \frac{[\text{NO}]^2 [1.2 \times 10^{-2}]}{[2.8 \times 10^{-1}]^2}$$

$$[\text{NO}] = 0.010$$

Key

4. (4 Pts) The equilibrium constant for the reaction



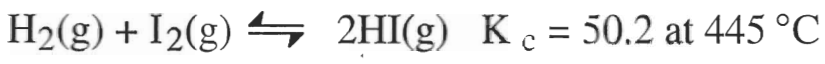
is 5.0×10^4 at 25°C . What is the equilibrium constant for the reaction below?



since this is the reverse reaction

$$K = \frac{1}{5.0 \times 10^4} = \underline{\underline{2.0 \times 10^{-5}}}$$

5. (3 Pts) For the reaction

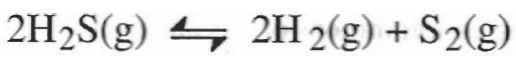


$$Q_c = \frac{[\text{HI}]^2}{[\text{H}_2][\text{I}_2]} = 1$$

if $[\text{H}_2] = [\text{I}_2] = [\text{HI}] = 1.75 \times 10^{-3} \text{ M}$ at 445°C , which one of the following statements is true?

- A. The system is at equilibrium, no concentration changes will occur.
- B. The concentrations of HI and I₂ will increase as the system approaches equilibrium.
- C. The concentration of HI will increase as the system approaches equilibrium. *since $Q_c < K_c$*
- D. The concentrations of H₂ and HI will fall as the system moves toward equilibrium.
- E. The concentrations of H₂ and I₂ will increase as the system approaches equilibrium.

6. (4 Pts) On analysis, an equilibrium mixture for the reaction



was found to contain 1.0 mol H₂S, 4.0 mol H₂, and 0.80 mol S₂ in a 4.0 L vessel. Calculate the equilibrium constant for this reaction.

E

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

$$K_c = \frac{[1.0]^2 \left[\frac{0.80}{4.0}\right]}{\left(\frac{1.0}{4.0}\right)^2}$$

$$K_c = 3.2$$