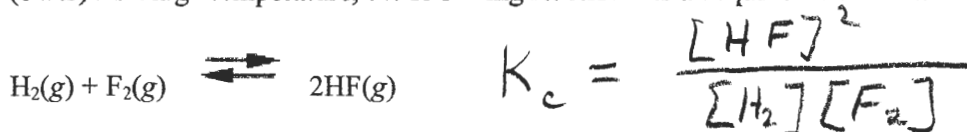


1. (8 Pts) At a high temperature, the following reaction has an equilibrium constant of 1.0×10^2 .



If 1.00 mol of each of H_2 and F_2 are allowed to come to equilibrium in a 10.0 L vessel, calculate the equilibrium amounts of H_2 and HF .

| | | | | | |
|---|--------------|--------------|----------------------|--------------|--|
| | H_2 | F_2 | \rightleftharpoons | 2HF | |
| I | 0.100 | 0.100 | | 0 | |
| C | -x | -x | | +2x | |
| E | 0.100-x | 0.100-x | | 2x | |

$$K_c = \frac{[2x]^2}{[0.100-x]^2} \quad \text{"perfect square"}$$

$$\sqrt{100} = \frac{2x}{0.100-x}$$

$$1 - 10x = 2x$$

$$x = \frac{1}{12} = 0.0833$$

$0.1 - 0.0833 = 0.0167\text{M}$

$\frac{10\text{L} \cdot 0.0167\text{mol}}{\text{L}} = 0.17\text{mol}$
 $(\text{H}_2 + \text{F}_2)$

$\text{HF } 2x = 0.166\text{M}$

$\frac{10\text{L} \cdot 0.166\text{mol}}{\text{L}} = 1.67\text{mol}$

2. (7 Pts) When 0.152 mol of solid PH_3BCl_3 is introduced into a 3.0 L container at a certain temperature, 8.44×10^{-3} mol of PH_3 is present at equilibrium. Calculate K_c at this temperature.

| | | | | |
|---|-------------------------------------|----------------------|---|---|
| | $\text{PH}_3\text{BCl}_3(\text{s})$ | \rightleftharpoons | $\text{PH}_3(\text{g}) + \text{BCl}_3(\text{g})$ | |
| I | | | 0 | 0 |
| C | N/A | | +x | +x |
| E | | | $\frac{8.44 \times 10^{-3}\text{mol}}{3.0\text{L}}$ | $\frac{8.44 \times 10^{-3}\text{mol}}{3.0\text{L}}$ |

$$K_c = \frac{[\text{PH}_3][\text{BCl}_3]}{[\text{PH}_3\text{BCl}_3]}$$

$$K_c = \left[\frac{8.44 \times 10^{-3}}{3.0} \right]^2$$

$$K_c = 7.91 \times 10^{-6}$$

3. (6 Pts) The equilibrium constant for the reaction of bromine with chlorine to form bromine monochloride is 58.0 at a certain temperature.



What is the equilibrium constant for the following reaction? SHOW WORK.

$$\text{BrCl}(\text{g}) \rightleftharpoons \frac{1}{2}\text{Br}_2(\text{g}) + \frac{1}{2}\text{Cl}_2(\text{g}) \quad K_{c2} = \frac{[\text{Br}_2]^{\frac{1}{2}}[\text{Cl}_2]^{\frac{1}{2}}}{[\text{BrCl}]}$$

$$K_{c2} = \sqrt{\frac{1}{K_{c1}}} = \sqrt{\frac{1}{58.0}} = 0.131$$

A. 2.97×10^{-4}
 B. 1.72×10^{-2}
 C. 3.45×10^{-2}
 D. 1.31×10^{-1}
 E. > 1.00

4. (4 Pts) Write the expression for K_c and K_p for the reaction

