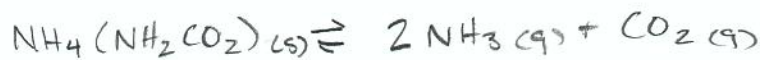


Eq'm Calc

0.321 mol $\text{NH}_4(\text{N}_2\text{CO}_2)$ (A)



I
C
E

/

0
+2x
2x

0
+x
x

$$K_c = 58.3$$

$$K_c = [\text{NH}_3]^2 [\text{CO}_2]$$

$$58.3 = (2x)^2 (x)$$

$$4x^3 = 58.3$$

$$x = 2.44$$



I 0.20 mol

0.80 mol

I 0.0667

0.267

0

0

C -2x

-2x

+4x

+x

E 0.0667-2x

0.267-2x

4x

x

give mol ratio. Cl_2 is limiting bcz other in less

$$\therefore \text{mol HCl theor} = 0.20 \text{ mol Cl}_2 \times \frac{4 \text{ mol HCl}}{2 \text{ mol Cl}_2} = 0.40 \text{ mol HCl}$$

$$\% \text{ rxn} = \frac{n_{\text{HCl eq'm}}}{n_{\text{HCl theor}}} \times 100\%$$

$$n_{\text{HCl eq'm}} = \left(\frac{45\%}{100\%} \right) 0.40 \text{ mol HCl} \\ = 0.18 \text{ mol HCl}$$

$$[\text{HCl}]_{\text{eq'm}} = \frac{0.18 \text{ mol}}{3\text{L}} = 0.06 \frac{\text{mol}}{\text{L}}$$

$$4x = 0.06 \frac{\text{mol}}{\text{L}}$$

$$x = 0.015$$

(B)

$$[\text{HCl}]_{\text{eq'm}} = 0.06 \text{ mol/L}$$

$$[\text{O}_2]_{\text{eq'm}} = 0.015 \text{ mol/L}$$

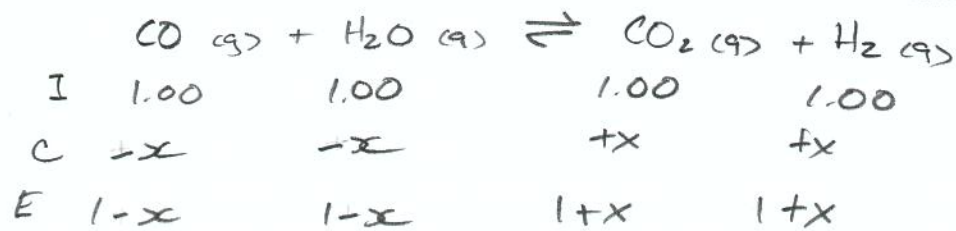
$$[\text{Cl}_2]_{\text{eq'm}} = 0.0667 - 2x \\ = 0.0667 - 2(0.015)$$

$$[\text{Cl}_2]_{\text{eq'm}} = 0.0367 \frac{\text{mol}}{\text{L}}$$

$$[\text{H}_2\text{O}]_{\text{eq'm}} = 0.267 - 2x \\ = 0.237 \frac{\text{mol}}{\text{L}}$$

$$K_c = \frac{[\text{HCl}]^4 [\text{O}_2]}{[\text{Cl}_2]^2 [\text{H}_2\text{O}]^2} \\ = \frac{(0.06)^4 (0.015)}{(0.0367)^2 (0.237)^2} \\ = \frac{1.94 \times 10^{-7}}{7.28 \times 10^{-5}}$$

$$K_c = 2.66 \times 10^{-3}$$



$$Q = \frac{[\text{CO}_2][\text{H}_2]}{[\text{CO}][\text{H}_2\text{O}]}$$

$$= \frac{(1)(1)}{(1)(1)}$$

$$= 1$$

$$Q < K_c$$

\therefore shifts right

$$K_c = \frac{[\text{CO}_2][\text{H}_2]}{[\text{CO}][\text{H}_2\text{O}]}$$

$$2.38 = \frac{(1+x)(1+x)}{(1-x)(1-x)}$$

$$1.543 = \frac{1+x}{1-x}$$

$$1.543(1-x) = 1+x$$

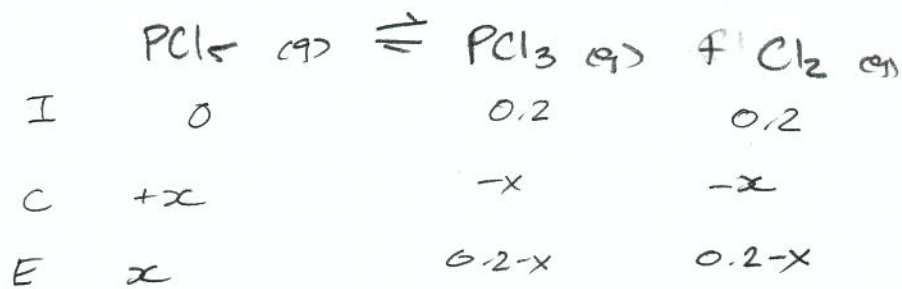
$$1.543 - 1.543x = 1+x$$

$$0.543 = 2.543x$$

$$x = 0.214$$

$$[\text{H}_2\text{O}]_{\text{eq'm}} = 1 - x \\ = 1 - 0.214 \\ = 0.786 \frac{\text{mol}}{\text{L}}$$

6



$$K_c = \frac{[\text{PCl}_3][\text{Cl}_2]}{[\text{PCl}_5]}$$

$$0.040 = \frac{(0.2-x)(0.2-x)}{(x)}$$

$$0.040x = 0.04 - 0.4x + x^2$$

$$0 = x^2 - 0.44x + 0.04$$

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

$$= \frac{-(-0.44) \pm \sqrt{(0.44)^2 - 4(1)(0.04)}}{2(1)}$$

$$= \frac{0.44 \pm \sqrt{0.0336}}{2}$$

$$x = \frac{0.44 \pm 0.183}{2}$$

$$x = 0.129 \quad x = 0.208$$

$$[\text{PCl}_5]_{\text{eq'm}} = 0.129 \frac{\text{mol}}{\text{L}}$$

$$[\text{PCl}_3]_{\text{eq'm}} = [\text{Cl}_2]_{\text{eq'm}} = 0.2 - 0.129 = 0.071 \frac{\text{mol}}{\text{L}}$$