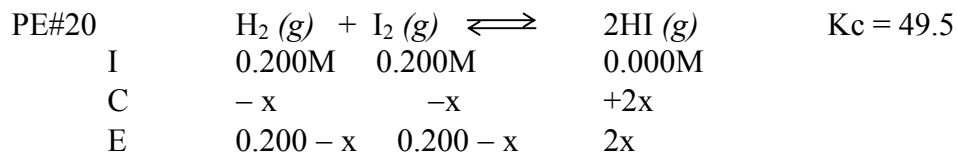


Chem 123
Fall 2009

Answer to HW#5
due Tues 10/20/09

Chapter 14 Practice Exercises #20, 21, 22, 23 (not from back of chapter but within the chapter)



$$K_c = \frac{(2x)^2}{(0.200 - x)^2} = 49.5$$

$$\sqrt{\frac{(2x)^2}{(0.200 - x)^2}} = \sqrt{49.5}$$

$$\frac{(2x)}{(0.200 - x)} = 7.04$$

$$2x = 7.04(0.200 - x)$$

$$2x = 1.41 - 7.04x$$

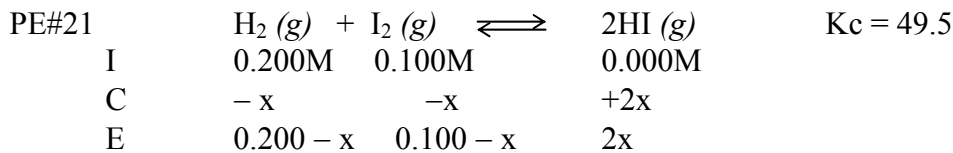
$$2x + 7.04x = 1.41$$

$$9.04x = 1.41$$

$$x = \frac{1.41}{9.04} = 0.156$$

$$[\text{H}_2] = [\text{I}_2] = 0.200 - 0.156 = \mathbf{0.044 \text{ M}} \quad (\mathbf{3 \text{ decimal places}})$$

$$[\text{HI}] = 2x = 2(0.156) = \mathbf{0.312 \text{ M}}$$



$$K_c = \frac{(2x)^2}{(0.200 - x)(0.100 - x)} = 49.5$$

$$4x^2 = 49.5(0.200 - x)(0.100 - x)$$

$$4x^2 = 49.5(0.0200 - 0.200x - 0.100x + x^2)$$

$$4x^2 = 49.5x^2 - 14.85x + 0.990$$

$$0 = 49.5x^2 - 4x^2 - 14.85x + 0.990$$

$$0 = 45.5x^2 - 14.85x + 0.990$$

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a} = \frac{+14.85 \pm \sqrt{14.85^2 - 4(45.5)(0.990)}}{2(45.5)}$$

$$= \frac{14.85 + 6.35}{91.0} \text{ or } \frac{14.85 - 6.35}{91.0}$$

$$= 0.233 \text{ or } 0.0934$$

$[\text{H}_2] = 0.200 - 0.233 =$ negative number which is not reasonable.

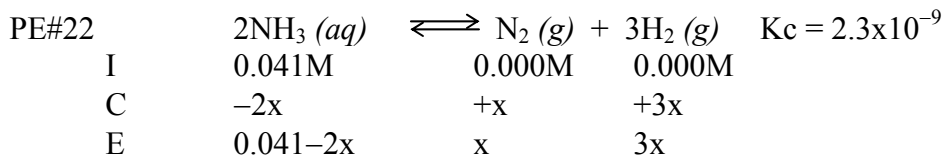
x must be 0.0934 and NOT 0.233

$$[\text{H}_2] = 0.200 - 0.0934 = \mathbf{0.107 \text{ M}}$$

$$[\text{I}_2] = 0.100 - 0.0934 = \mathbf{0.00660 \text{ M} = 0.007 \text{ M}} \quad (\text{3 decimal places})$$

$$[\text{HI}] = 2(0.0934) = \mathbf{0.187 \text{ M}}$$

$$\text{Check: } K_c = \frac{(0.187)^2}{(0.107)(0.00660)} = 49.5$$



$$K_c = \frac{(x)(3x)^3}{(0.041 - 2x)^2} = 2.3 \times 10^{-9} \text{ assume } x \text{ is negligible}$$

$$27x^4 = 2.3 \times 10^{-9} (0.041)^2$$

$$x^3 = \frac{2.3 \times 10^{-9} (0.041)^2}{27}$$

$$x = \sqrt[3]{\frac{2.3 \times 10^{-9} (0.041)^2}{27}} = \pm 6.2 \times 10^{-4}$$

Test assumption:

$$0.041 - 2x = 0.041 - 2(6.2 \times 10^{-4}) = 0.040$$

Assumption is justified.

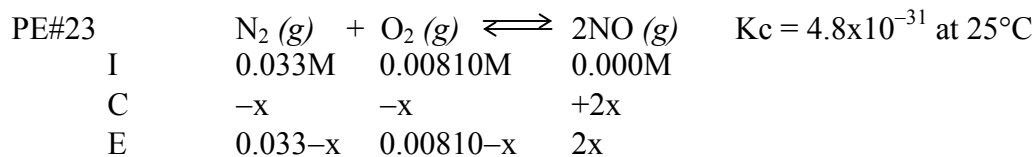
$$x = + 6.2 \times 10^{-4} \text{ M}$$

-6.2 $\times 10^{-4}$ M is unreasonable)

$$[\text{NH}_3] = 0.041 - 2(6.2 \times 10^{-4}) = \mathbf{0.040 \text{ M NH}_3}$$

$$[\text{N}_2] = \mathbf{6.2 \times 10^{-4} \text{ M N}_2}$$

$$[\text{H}_2] = 3(6.2 \times 10^{-4}) = \mathbf{1.9 \times 10^{-3} \text{ M H}_2}$$



$$\frac{(2x)^2}{(0.033-x)(0.00810-x)} = 4.8 \times 10^{-31} \quad \text{Assume } x \text{ is negligible.}$$

$$\frac{4x^2}{(0.033)(0.00810)} = 4.8 \times 10^{-31}$$

$$4x^2 = 4.8 \times 10^{-31} (0.033)(0.00810)$$

$$4x^2 = 1.28 \times 10^{-34}$$

$$x^2 = \frac{1.28 \times 10^{-34}}{4}$$

$$\sqrt{x^2} = \sqrt{3.2 \times 10^{-35}}$$

$$x = 5.7 \times 10^{-18}$$

$$[\text{NO}] = 2x = 2(5.7 \times 10^{-18}) = \mathbf{1.1 \times 10^{-17} \text{ M}}$$

Check assumption:

$$0.033 - 5.7 \times 10^{-18} = 0.033 \text{ (no difference)}$$

and

$$0.00810 - 5.7 \times 10^{-18} = 0.00810$$

(no difference)