

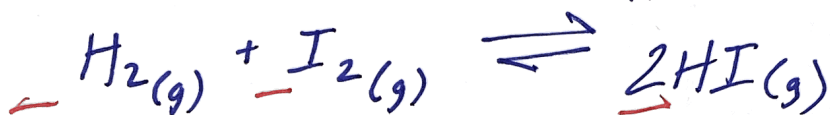
#3 Equilibrium Calculations (Cont.) = More Advanced

Ex: A closed system Initially containing:

$$1.000 \times 10^{-3} \text{ M } \text{H}_2$$

$$2.000 \times 10^{-3} \text{ M } \text{I}_2$$

At 448°C , EQ is established. Analysis of EQ mixture shows a concentration of $\text{HI} = 1.87 \times 10^{-3} \text{ M}$



Calculate the K_c at 448°C :

[CE Box

	$[\text{H}_2] \text{ M}$	$[\text{I}_2] \text{ M}$	$[\text{HI}] \text{ M}$
<u>Initial</u> []	1.000×10^{-3}	2.000×10^{-3}	0
<u>Change</u>	-0.935×10^{-3}	-0.935×10^{-3}	$\oplus 1.87 \times 10^{-3}$
<u>Equilibrium</u>	0.065×10^{-3} *	1.065×10^{-3} *	1.87×10^{-3}

← What changed

$$K_c = \frac{[\text{HI}]^2}{[\text{H}_2][\text{I}_2]} = \frac{(1.87 \times 10^{-3})^2}{(0.065 \times 10^{-3})(1.065 \times 10^{-3})} = 50.5$$

Ex 2

Starting concentrations of $H_2(g) + I_2(g) \rightleftharpoons 2HI(g)$

$$[H_2] = 1.00M$$

$$[I_2] = 2.00M$$

Value of K_c at $448^\circ C$
 $= 50.5$

What are the concentrations of $H_2, I_2, \text{ and } HI$ in the flask at EQ?

$K_c = 50.5$

	H_2	I_2	$2HI$
I	1.00M	2.00M	0M
C	-X	-X	+2X
E	1.00-X	2.00-X	2X

$$K_c = \frac{[HI]^2}{[H_2][I_2]} \rightarrow 50.5 = \frac{(2x)^2}{(1.00-x)(2.00-x)}$$

$$50.5(2.00 - 3x + x^2) = 4x^2$$

5) ↓

$$101 - 151.5x + 50.5x^2 = 4x^2$$

$$\rightarrow 4(6.5)x^2 - 151.5x + 101 = 0$$

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

$$X = \frac{151.5 \pm \sqrt{(-151.5)^2 - 4(46.5)(101)}}{2(46.5)}$$

$$X = \frac{151.5 \pm \sqrt{22952 - 18786}}{93}$$

$$X = \frac{151.5 \pm \sqrt{4166}}{93} = \frac{151.5 \pm 64.5}{93}$$

$$X = \underline{2.32}$$

$$\textcircled{0.93} = X$$

I
C
E

H_2	I_2	$2HI$
$1.00 - X$	$2.00 - X$	$2X$

$$H_2 = 1.00 - 0.93$$

$$H_2 = 0.07M$$

$$I_2 = 2.00 - 0.93$$

$$I_2 = 1.07$$

$$HI = 2(0.93)$$

$$HI = 1.86M$$