

Class Notes 2/11

HOMOGENEOUS VS HETEROGENEOUS EQUILIBRIA

- homogeneous equilibria occurs when all reactants and products are in the same phase

- heterogeneous equilibria occur when one of the materials in the equilibrium is in a different phase

→ the value used for the concentration of a pure substance (liquid/solid) is always 1

→ solids & liquids don't appear in the expression for K

EX:



$$K_c = [\text{CO}_2]$$

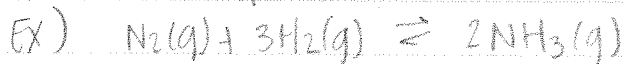
$$K_p = P_{\text{CO}_2}$$

- amount of CO_2 is independent of the amount of solid in jar

★ Bottom line: solids & liquids (generally) do not appear in expression for K

CALCULATING EQ CONSTANTS

- rxn set up, EQ is reached, & concentrations that appear in expression for K is reached



$$[\text{N}_2] = 0.84 \text{ M}$$

$$[\text{H}_2] = 0.35 \text{ M}$$

$$[\text{NH}_3] = 0.031 \text{ M}$$

$$K = \frac{(0.031)^2}{(0.84)(0.35)^3} = 0.027 \quad \left(< 1 \right) \quad \swarrow \text{reactant favored}$$

EX) closed system w/ $1 \times 10^{-3} \text{ M H}_2$ and $2 \times 10^{-3} \text{ M I}_2$ at 448°C

* At EQ, $[\text{HI}]$ is $1.87 \times 10^{-3} \text{ M}$

calculate K



* use ICE tables

ICE TABLE:

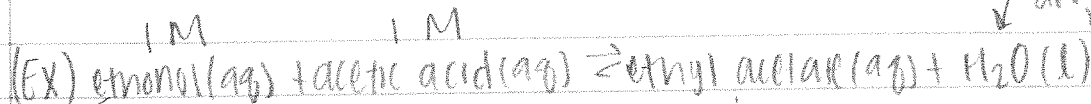
	$[\text{H}_2], \text{M}$	$[\text{I}_2], \text{M}$	$[\text{HI}], \text{M}$
Initial	1×10^{-3}	2×10^{-3}	0
change	-9.35×10^{-4}	-9.35×10^{-4}	$+1.87 \times 10^{-3}$
@ EQ	6.5×10^{-5}	1.065×10^{-3}	1.87×10^{-3}

$\leftarrow \div 2$

→

$$K = \frac{(1.87 \times 10^{-3})^2}{(6.5 \times 10^{-5})(1.065 \times 10^{-3})} = [5] \text{ product favored } (>1)$$

does not
appear in
K expression



EQ 7M $K = \frac{[\text{ethyl acetate}]}{[\text{ethanol}][\text{acetic acid}]} = ?$

	[ethanol]	[acetic acid]	[ethyl acetate]
I	1 M	1 M	0
C	-0.25 M	-0.25 M	+0.25 M
E	0.75 M	0.75 M	0.25 M

$$K = \frac{(0.25 M)}{(0.75)(0.75)} = [0.44] \text{ reactant favored}$$



1 L flask filled w/ 1.00 M of $\text{O}_2(g)$ & graphite. Given $K_c = 0.021$, what is the EQ constant of CO?

	$[\text{O}_2]$	$[\text{CO}]$
I	1.00 M	0
C	-X	+2X
E	1.00 - X	2X

$$K = \frac{[\text{CO}]^2}{[\text{O}_2]} = \frac{(2X)^2}{(1.00 - X)} = 0.021$$

→ Quadratic equation $\frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$

$$\frac{(2X)^2}{(1 - X)} = 0.021 \rightarrow 4X^2 = (0.021)(1 - X) \rightarrow 4X^2 = 0.021 - 0.021X$$

$$\Rightarrow 0 = 4X^2 + 0.021X - 0.021 \Rightarrow X = \frac{-(0.021) \pm \sqrt{(0.021)^2 - 4(4)(-0.021)}}{2(4)}$$

$X = 0.70, -0.075$ * ignore the negative solution

$$[\text{CO}] = 2(0.7) = 0.14 \text{ M}$$