

Eqm Practice Questions

①

	$4\text{NH}_3(g)$	$+ 5\text{O}_2(g)$	$\rightleftharpoons 4\text{NO}(g)$	$+ 6\text{H}_2\text{O}(g)$
Σ	2.50	1.25	2.0	3.625
Stress	$+y$	-	-	-
I	$2.50+y$	1.25	2	3.625
C	$-4x$	$-5x$	$+4x$	$+6x$
E	$2.50+y-4x$	$1.25-5x$	$2+4x$	$3.625+6x$
	$= 5.00$			

cannot solve for x bcz calculation is too complicated

②

	$\text{NOCl}(g)$	$\rightleftharpoons \text{NO}(g)$	$+ \frac{1}{2}\text{Cl}_2(g)$
I	0.0229	0	0
C	$-x$	$+x$	$+\frac{1}{2}x$
E	$0.0229-x$	x	$\frac{1}{2}x$

$$[\text{NOCl}]_{\text{initial}} = \frac{m}{MV} = \frac{1.50\text{g NOCl} \times \frac{1\text{mol NOCl}}{65.46\text{g NOCl}}}{1.0\text{L}} = 0.0229 \frac{\text{mol NOCl}}{\text{L}}$$

% dissociation = 57.2%

means 57.2% broke down and at eqm 42.8% of initial remains

$$[\text{NOCl}]_{\text{eqm}} = 42.8\% [\text{NOCl}]_{\text{initial}}$$

$$= 42.8\% (0.0229 \frac{\text{mol}}{\text{L}})$$

$$[\text{NOCl}]_{\text{eqm}} = 0.00980 \frac{\text{mol}}{\text{L}} = 0.0229 - x$$

$$x = 0.0131$$

$$[\text{NO}]_{\text{eqm}} = 0.0131 \frac{\text{mol}}{\text{L}}$$

$$[\text{Cl}_2]_{\text{eqm}} = \frac{1}{2}(0.0131) = 0.00655 \frac{\text{mol}}{\text{L}}$$

$$K_c = \frac{[\text{NO}][\text{Cl}_2]^{1/2}}{[\text{NOCl}]}$$

$$= \frac{(0.0131)(0.00655)^{1/2}}{(0.00980)}$$

$$= 0.1082$$

2B)

	NOCl (g)	\rightleftharpoons	NO (g)	+	$\frac{1}{2} \text{Cl}_2 \text{ (g)}$
Σ	0.00980		0.0131		0.00655
stress					-y
I	.0098		.0131		.00655 - y
C	-x		+x		+ $\frac{1}{2}x$
Σ	.0098 - x		0.0131 + x		.00655 - y + $\frac{1}{2}x$
			= 0.0262		

$[\text{NO}]_{E_2} = 0.0131 + x = 0.0262$
 $x = 0.0131$

$[\text{NOCl}]_{E_2} = 0.0098 - 0.0131$
 $= -0.0033$

\therefore since $[\text{NOCl}]_{E_2}$ would be -ve cannot double NO Cl

3.

	$\text{H}_2 \text{ (g)}$	+	$\text{I}_2 \text{ (g)}$	\rightleftharpoons	2HI (g)
E	0.015		0.015		0.087
stress					0.040
I	0.015		0.015		0.127
C	-x		-x		2x
E	0.015 - x		0.015 - x		0.127 - 2x

$K_c = \frac{[\text{HI}]^2}{[\text{H}_2][\text{I}_2]}$
 $= \frac{(0.087)^2}{(0.015)(0.015)}$
 $= 33.64$

$K_c = \frac{[\text{HI}]^2}{[\text{H}_2][\text{I}_2]}$

$33.64 = \frac{(0.127 - 2x)^2}{(0.015 - x)(0.015 - x)}$

$5.8 = \frac{0.127 - 2x}{0.015 - x}$

$5.8(0.015 - x) = 0.127 - 2x$
 $0.087 - 5.8x = 0.127 - 2x$
 $7.8x = 0.04$
 $x = 0.00513$

$[\text{H}_2] = [\text{I}_2]_{eq} = 0.015 - 0.005$
 $= 0.020 \text{ mol/L}$

$[\text{HI}] = 0.127 - 2(0.005)$
 $= 0.117 \text{ mol/L}$



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

$$1 = \frac{(x)(x)}{(1.5-x)(2.5-x)}$$

$$[\text{N}_2\text{O}_2]_{\text{eq'm}} = 1.50 - x = 0.56 \text{ mol/L}$$

$$[\text{H}_2]_{\text{eq'm}} = 2.5 - x = 1.56 \text{ mol/L}$$

$$[\text{N}_2\text{O}]_{\text{eq'm}} = [\text{H}_2\text{O}]_{\text{eq'm}} = 0.94 \frac{\text{mol}}{\text{L}}$$

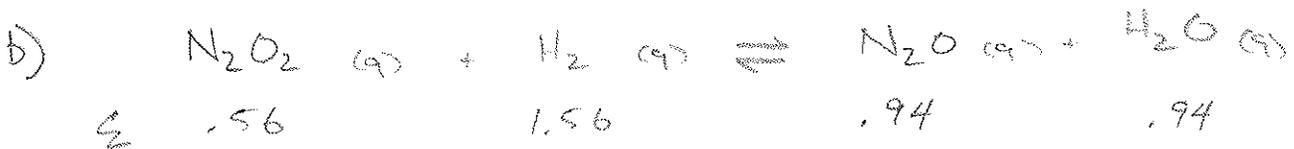
$$1 = \frac{x^2}{3.75 - 4x + x^2}$$

$$3.75 - 4x + x^2 = x^2$$

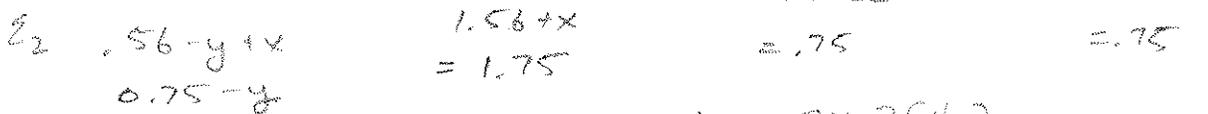
$$3.75 - 4x = 0$$

$$3.75 = 4x$$

$$x = 0.938$$



stress -y



$$[\text{N}_2\text{O}]_{\text{eq'm}} = 0.75 = 0.94 - x$$

$$x = 0.19$$

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

$$1 = \frac{(0.75)(0.75)}{(0.75-y)(1.75)}$$

$$.75 - y = 0.32$$

$$y = 0.43$$

$[\text{N}_2\text{O}_2]$ will change by $0.43 \frac{\text{mol}}{\text{L}}$

5.

	CO_2 (g)	+	H_2 (g)	\rightleftharpoons	CO (g)	+	H_2O (g)
Σ_1	0.8		0.3		0.6		0.5
stress	-y						
I	0.8-y		0.3		0.6		0.5
change	+x		+x		-x		-x
Σ_2	0.8-y+x		0.3+x		0.6-x		0.5-x

$$[\text{CO}]_{E_2} = 0.6 - x = 0.5 \text{ mol/L}$$

$$x = 0.1$$

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

$$[\text{H}_2\text{O}]_{E_2} = 0.5 - x = 0.4 \frac{\text{mol}}{\text{L}}$$

$$\frac{(0.6)(0.5)}{(0.8)(0.3)} = \frac{(0.5)(0.4)}{(0.9-y)(0.4)}$$

$$[\text{H}_2]_{E_2} = 0.3 + x = 0.4 \frac{\text{mol}}{\text{L}}$$

$$0.9 - y = \frac{(0.5)(0.8)(0.3)}{(0.8)(0.6)}$$

$$[\text{CO}_2]_{E_2} = 0.8 - y + x = 0.9 - y \frac{\text{mol}}{\text{L}}$$

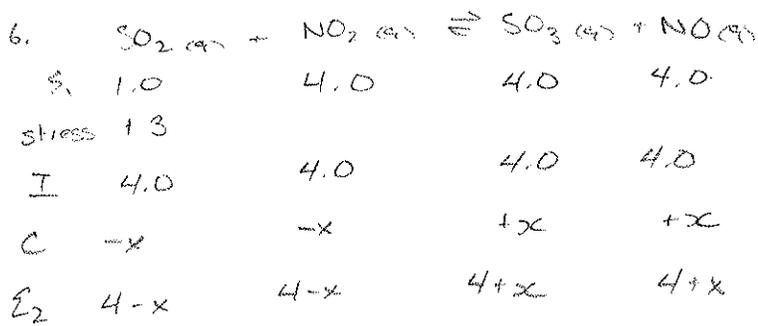
$$0.9 - y = 0.4$$

$$y = 0.5$$

$$n = [\text{CO}_2] \times V$$

$$= \frac{0.5 \text{ mol CO}_2}{\text{L}} \times 5.00 \text{ L}$$

$$= 2.5 \text{ mol CO}_2$$



$$K_c = \frac{[\text{SO}_3][\text{NO}]}{[\text{SO}_2][\text{NO}_2]}$$

$$\frac{(4.0)(4.0)}{(1.0)(4.0)} = \frac{(4+x)(4+x)}{(4-x)(4-x)}$$

$$4 = \frac{(4+x)^2}{(4-x)^2}$$

$$2 = \frac{4+x}{4-x}$$

$$8 - 2x = 4 + x$$

$$4 = 3x$$

$$x = 1.33$$

$$[\text{NO}]_{E_2} = [\text{NO}]_{E_2} = 4 + x = 5.33 \text{ mol/L}$$

$$[\text{SO}_2]_{E_2} = [\text{NO}_2]_{E_2} = 4 - x = 2.67 \frac{\text{mol}}{\text{L}}$$



\$\uparrow\$ P by \$\downarrow\$ V

\$\rightarrow\$ no shift in eqm position bcz same number of moles in both reactants & products

\$\rightarrow\$ bcz Vol decreases [] of all gases \$\uparrow\$



I. add Cl_2 shift forward increase [] HCl
bcz fwd rxn will consume the added Cl_2 .

II \$\uparrow\$ T shift forward increase [] HCl
fwd rxn endothermic and will consume the added Energy

III \$\downarrow\$ V / \$\uparrow\$ P shifts right decrease [] HCl
fewer gas particles in reactants