

$$1. \quad [A]_I = [A] + \frac{V_A}{V_T}$$

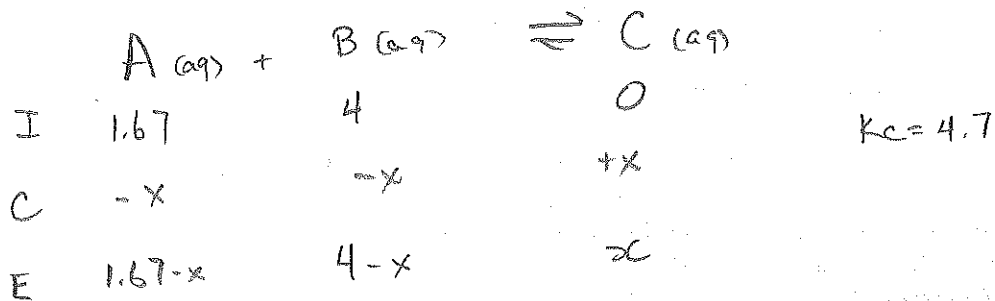
$$= 5.0 \frac{\text{mol}}{\text{L}} \times \frac{20.0 \text{ mL}}{60.0 \text{ mL}}$$

$$= 1.67 \text{ mol/L}$$

$$[B]_I = [B] \times \frac{V_B}{V_T}$$

$$= 6 \frac{\text{mol}}{\text{L}} \times \frac{40 \text{ mL}}{60 \text{ mL}}$$

$$= 4.0 \text{ mol/L}$$



$$K_c = \frac{[C]}{[A][B]}$$

$$4.7 = \frac{x}{(1.67-x)(4-x)}$$

$$4.7 = \frac{x}{6.68 - 5.67x + x^2}$$

$$x = 31.396 - 26.65x + 4.7x^2$$

$$0 = 4.7x^2 - 27.65x + 31.396$$

$$x = 1.5$$

$$[A]_{\text{eqm}} = 0.17 \text{ mol/L}$$

$$[B]_{\text{eqm}} = 2.5 \text{ mol/L}$$

$$[C]_{\text{eqm}} = 1.5 \text{ mol/L}$$

2.



	I	0.5	0.2	0	0
	C	-x	-x	+x	+x
$K_c = 40$	E	0.5-x	0.2-x	x	x

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

$$40 = \frac{(x)(x)}{(0.5-x)(0.2-x)}$$

$$40 = \frac{x^2}{0.1 - 0.7x + x^2}$$

$$40x^2 - 28x + 4 = x^2$$

$$0 = 39x^2 - 28x + 4$$

~~$x = 0.52$~~

$x = 0.1968$

$$[\text{NO}]_{\text{eqm}} = 0.5 - 0.2 = 0.3 \text{ mol/L}$$

$$[\text{CO}_2]_{\text{eqm}} = 0.2 - 0.1968 = 0.004 \text{ mol/L}$$

$$[\text{CO}]_{\text{eqm}} = [\text{NO}_2]_{\text{eqm}} = 0.2 \text{ mol/L}$$

3.



	I	0.3	0.5	0
	C	-x	-x	+2x
	E	0.3-x	0.5-x	2x

$K_c = 90.0$

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

$$90 = \frac{(2x)^2}{(0.3-x)(0.5-x)}$$

$$90 = \frac{4x^2}{0.15 - 0.8x + x^2}$$

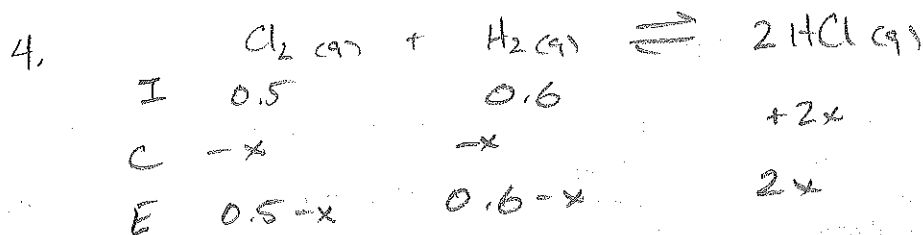
$$0 = 86x^2 - 72x + 13.5$$

$x = 0.28$

$$[\text{H}_2]_{\text{eqm}} = 0.02 \text{ mol/L}$$

$$[\text{I}_2]_{\text{eqm}} = 0.22 \text{ mol/L}$$

$$[\text{HI}]_{\text{eqm}} = 0.56 \text{ mol/L}$$



$$K_c = \frac{[\text{HCl}]^2}{[\text{Cl}_2][\text{H}_2]}$$

$$0.5 = \frac{(2x)^2}{(0.5-x)(0.6-x)}$$

$$0.15 - 0.55x + 0.5x^2 = 4x^2$$

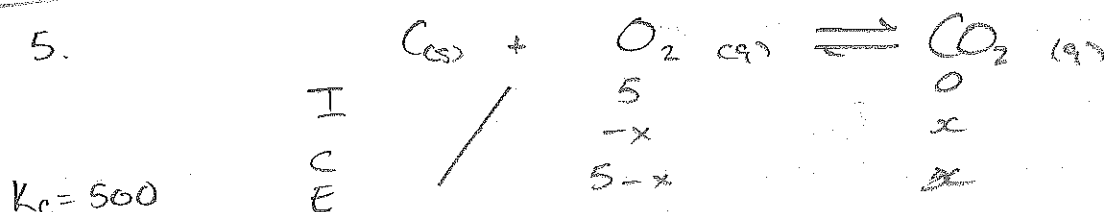
$$0 = 3.5x^2 + 0.55x - 0.15$$

$$x = 0.14$$

$$[\text{Cl}_2]_{\text{eq'm}} = 0.36 \text{ mol/L}$$

$$[\text{H}_2]_{\text{eq'm}} = 0.46 \text{ mol/L}$$

$$[\text{HCl}]_{\text{eq'm}} = 0.28 \text{ mol/L}$$



$$K_c = 500$$

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

$$500 = \frac{x}{5-x}$$

$$2500 - 500x = x$$

$$2500 = 501x$$

$$x = 4.99$$

$$[\text{O}_2]_{\text{eq'm}} = 0.01 \frac{\text{mol}}{\text{L}}$$

$$[\text{CO}_2]_{\text{eq'm}} = 4.99 \frac{\text{mol}}{\text{L}}$$

6. x + $y \rightleftharpoons z + w$

$$[x] = [X] \times \frac{V_x}{V_T}$$

$$= 0.30 \frac{\text{mol}}{\text{L}} \times \frac{150 \text{ mL}}{400 \text{ mL}}$$

$$= 0.1125 \frac{\text{mol}}{\text{L}}$$

$$[Y] = [Y] \times \frac{V_Y}{V_T}$$

$$= 0.7 \frac{\text{mol}}{\text{L}} \times \frac{250 \text{ mL}}{400 \text{ mL}}$$

$$= 0.438 \text{ mol/L}$$

$$[x]_{\text{eq'm}} = 0.003 \text{ mol/L}$$

$$[Y]_{\text{eq'm}} = 0.328 \text{ mol/L}$$

$$[Z]_{\text{eq'm}} = [W]_{\text{eq'm}} = 0.11 \frac{\text{mol}}{\text{L}}$$

I	0.113	0.438		
C	-x	-x	+x	+x
E	0.113-x	0.438-x	x	x

$$K_c = \frac{[Z][W]}{[X][Y]}$$

$$15.2 = \frac{(x)(x)}{(0.113-x)(0.438-x)}$$

$$15.2 = \frac{x^2}{0.0495 - 0.551x + x^2}$$

$$15.2x^2 - 8.38x + 0.752 = x^2$$

$$14.2x^2 - 8.38x + 0.752 = 0$$

$$x = 0.11$$

7. $2\text{H}_2(\text{g}) + \text{O}_2(\text{g}) \rightleftharpoons 2\text{H}_2\text{O}(\text{g})$

I	0.3	0.2	/
C	-2x	-x	+2x
E	0.3-2x	0.2-x	+2x

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

$$1 \times 10^{-5} = \frac{(2x)^2}{(0.3)^2(0.2)}$$

$$x = 2.12 \times 10^{-4}$$

check
 $\frac{[]_I}{K_c}$

$$\frac{0.2}{1 \times 10^{-5}} > 77500$$

$$\therefore 0.2 - x \approx 0.2$$

$$0.3 - 2x \approx 0.3$$

proof

$$\frac{2x}{[\text{H}_2\text{O}]} \times 100\%$$

$$\frac{2(2.12 \times 10^{-4})}{0.3} \times 100\%$$

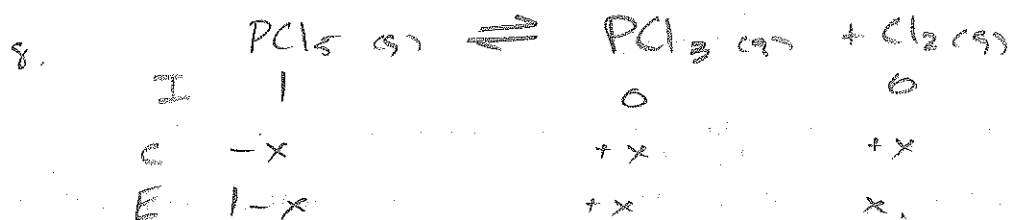
$$0.14\% < 5\%$$

\therefore -assump valid

$$[\text{H}_2\text{O}]_{\text{eq'm}} = 4.24 \times 10^{-4} \text{ mol/L}$$

$$[\text{H}_2] = 0.3 \text{ mol/L}$$

$$[\text{O}_2] = 0.2 \text{ mol/L}$$



$$[\text{PCl}_5]_{\text{eqm}} = 0.861 [\text{PCl}_5]_{\text{I}} = 1 - x$$

$$0.861 = 1 - x$$

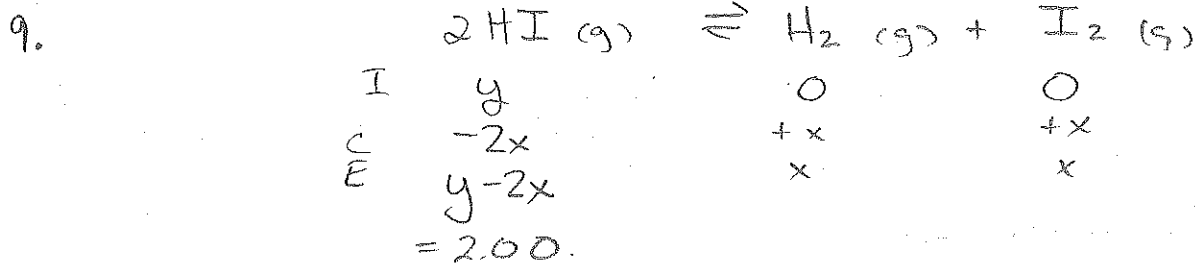
$$x = 0.139$$

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

$$= \frac{(0.139)(0.139)}{(0.861)}$$

$$\therefore [\text{PCl}_3]_{\text{eqm}} = [\text{Cl}_2]_{\text{eqm}} = 0.139 \text{ mol/l}$$

$$K_c = 0.022$$



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

$$5 \times 10^{-4} = \frac{(x)(x)}{(2)^2}$$

$$x = 0.045$$

$$y - 2x = 2.00$$

$$y = 2 + 2x$$

$$= 2.00 + 2(0.045)$$

$$y = 2.09$$

$$\therefore [\text{HI}]_{\text{initial}} = 2.09 \frac{\text{mol}}{\text{L}}$$