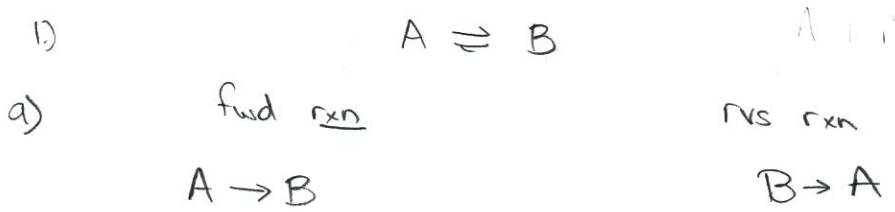


Class worksheet 12

(A)



at eq'm

$$r_{\text{fwd}} = r_{\text{rvs}}$$

$$K_{\text{fwd}}[A] = K_{\text{rvs}}[B]$$

$$\frac{K_{\text{fwd}}}{K_{\text{rvs}}} = \frac{[B]}{[A]} = K$$

$$K_{\text{fwd}} = 3.8 \times 10^2 \text{ s}^{-1}$$

$$K_{\text{rvs}} = 8.6 \times 10^{-1} \text{ s}^{-1}$$

$$K = \frac{3.8 \times 10^2}{8.6 \times 10^{-1}} = 4.42 \times 10^2$$

$$K = 4.42 \times 10^2$$

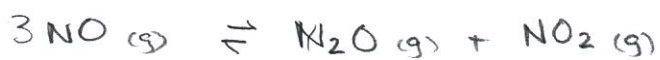
b) $[B] > [A]$
 $\rightarrow K \text{ is } > 1$ therefore fwd rxn is products favoured

K_c K_p

(B)

2

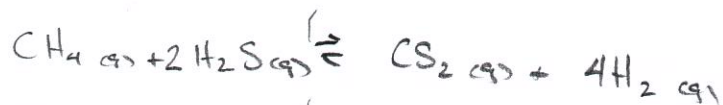
a)



$$K_c = \frac{[\text{N}_2\text{O}][\text{NO}_2]}{[\text{NO}]^3}$$

$$K_p = \frac{P_{\text{N}_2\text{O}} P_{\text{NO}_2}}{P_{\text{NO}}^3}$$

b)



$$K_c = \frac{[\text{CS}_2][\text{H}_2]^4}{[\text{CH}_4][\text{H}_2\text{S}]^2}$$

$$K_p = \frac{P_{\text{CS}_2} \cdot P_{\text{H}_2}^4}{P_{\text{CH}_4} P_{\text{H}_2\text{S}}^2}$$

c)

$$K_c = \frac{[\text{CO}]^4}{[\text{Ni}(\text{CO})_4]}$$

$$K_p = \frac{P_{\text{CO}}^4}{P_{\text{Ni}(\text{CO})_4}}$$

d)

$$K_c = \frac{[\text{H}_2\text{O}]^3}{[\text{H}_2]^3}$$

$$K_p = \frac{P_{\text{H}_2\text{O}}^3}{P_{\text{H}_2}^3}$$

e)

$$K_c = \frac{[\text{NO}_2]^4 [\text{O}_2]}{[\text{N}_2\text{O}_5]^2}$$

$$K_p = \frac{P_{\text{NO}_2}^4 P_{\text{O}_2}}{P_{\text{N}_2\text{O}_5}^2}$$

- 3a) mostly reactants $K_c < 1$
- b) mostly products $K_c > 1$

4. $K_p = K_c (RT)^{\Delta n}$ $\Delta n = \text{mol prod} - \text{mol react}$

$K_p = (6.042) [(0.0831)(773)]^{-1}$ $R = 0.0831$

$= 6.54 \times 10^{-4}$

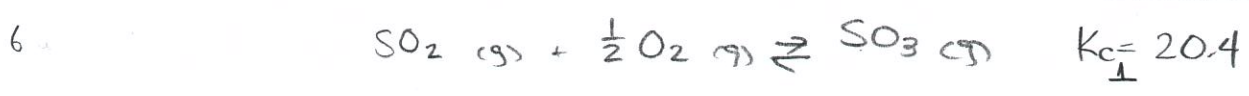


a) $K_c = \frac{[\text{SO}_2]^2 [\text{O}_2]}{[\text{SO}_3]^2}$ rvs $K_{c2} = \frac{[\text{SO}_3]^2}{[\text{SO}_2]^2 [\text{O}_2]}$

$\therefore K_{c \text{ rvs}} = \frac{1}{K_c} = \frac{1}{2.4 \times 10^{-3}} = 417$

b) favours SO_3

$K_c < 1 \therefore$ reactants favoured



a) $K_{c \text{ rvs}} = \frac{1}{K_c} = \frac{1}{20.4} = 0.049$

b) K_c for $2 \text{SO}_2 (g) + \text{O}_2 (g) \rightleftharpoons 2 \text{SO}_3 (g)$

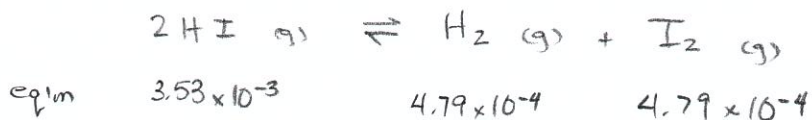
$K_c = (K_{c1})^2 = (20.4)^2 = 416.2$

c) $K_p = K_c (RT)^{\Delta n}$

$= (20.4) [(0.08314)(973)]^{-0.5}$

$K_p = 2.27$

7.

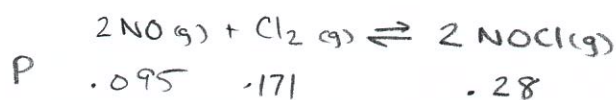


$$K_c = \frac{[\text{H}_2][\text{I}_2]}{[\text{HI}]^2}$$

$$= \frac{(4.79 \times 10^{-4})(4.79 \times 10^{-4})}{(3.53 \times 10^{-3})^2}$$

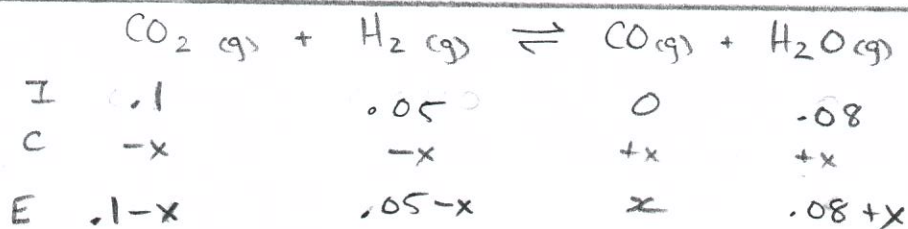
$$= 1.84 \times 10^{-2}$$

8.



$$K_p = \frac{P_{\text{NOCl}}^2}{P_{\text{NO}}^2 P_{\text{Cl}_2}} = \frac{(0.28)^2}{(0.95)^2 (0.171)} = 0.508$$

9.



$$[\text{H}_2\text{O}]_{\text{eq'm}} = 0.0856 = 0.08 + x$$

$$x = 0.0056$$

$$[\text{CO}]_{\text{eq'm}} = 0.0056 \text{ mol/L}$$

$$[\text{CO}_2]_{\text{eq'm}} = 0.1 - x = 0.0944 \text{ mol/L}$$

$$[\text{H}_2]_{\text{eq'm}} = 0.05 - x = 0.0444 \text{ mol/L}$$

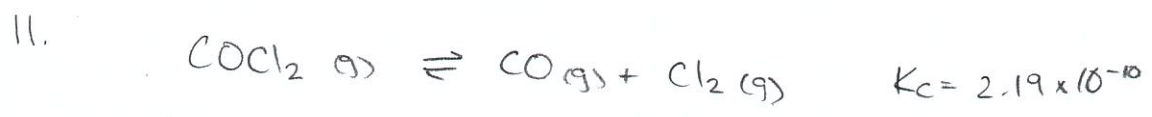
$$K_c = \frac{[\text{H}_2\text{O}][\text{CO}]}{[\text{CO}_2][\text{H}_2]}$$

$$= \frac{(0.0856)(0.0056)}{(0.0944)(0.0444)}$$

$$= 1.14 \times 10^{-1}$$

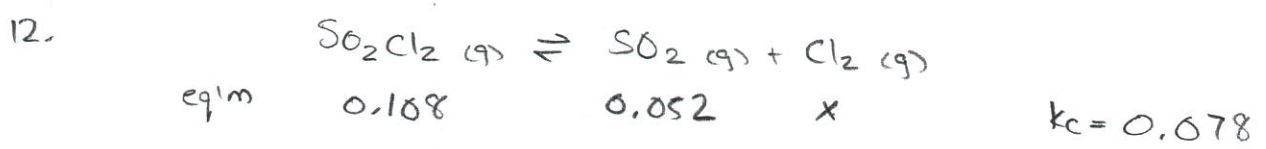
$K_c \rightarrow$ cannot be calculated
require temp

- 10.
- a) $K_c \rightarrow$ at eq'm
 $Q \rightarrow$ not necessarily at eq'm
 - b) $Q < K$
 \rightarrow shift towards products
 - c) $Q = K$
 \rightarrow at eq'm



$$Q = \frac{[\text{CO}][\text{Cl}_2]}{[\text{COCl}_2]}$$

- a) $Q = \frac{(3.31 \times 10^{-6})(6.62 \times 10^{-6})}{(2 \times 10^{-3})} = 1.10 \times 10^{-8}$ $Q > K_c$
shift left
- b) $Q = \frac{(1.1 \times 10^{-7})(2.25 \times 10^{-6})}{(4.5 \times 10^{-2})} = 5.50 \times 10^{-12}$ $Q < K_c$
shift right
- c) $Q = \frac{(1.48 \times 10^{-6})(1.48 \times 10^{-6})}{(0.01)} = 2.19 \times 10^{-10}$ $Q = K_c$
at eq'm no shift



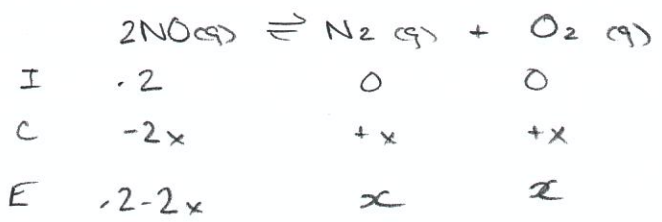
$$K_c = \frac{[\text{SO}_2][\text{Cl}_2]}{[\text{SO}_2\text{Cl}_2]}$$

$$0.078 = \frac{(0.052)(x)}{(0.108)}$$

$$[\text{Cl}_2]_{\text{eq'm}} = 0.162 \frac{\text{mol}}{\text{L}}$$

$$x = 0.162$$

13.



$$K_c = \frac{[\text{N}_2][\text{O}_2]}{[\text{NO}]^2} = \frac{(x)(x)}{(.2-2x)^2} = 2.4 \times 10^3$$

$$\frac{x}{.2-2x} = 49.0$$

$$x = 49.0(.2-2x)$$

$$x = 9.798 - 98x$$

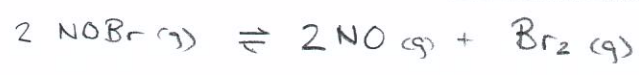
$$99x = 9.798$$

$$x = 0.0990$$

$$[\text{N}_2]_{\text{eqm}} = [\text{O}_2]_{\text{eqm}} = 0.0990 \frac{\text{mol}}{\text{L}}$$

$$[\text{NO}] = .2 - 2x = 2.06 \times 10^{-3} \frac{\text{mol}}{\text{L}}$$

14.



eqm

$$P_{\text{NOBr}} = P_{\text{NO}}$$

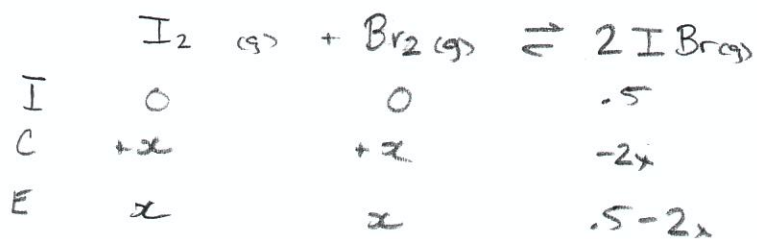
$$P_{\text{Br}_2} = x$$

$$K_p = \frac{(P_{\text{NO}})^2 P_{\text{Br}_2}}{(P_{\text{NOBr}})^2}$$

$$0.416 = \frac{(x)^2 P_{\text{Br}_2}}{(x)^2}$$

$$P_{\text{Br}_2} = 0.416$$

15.



$$K_c = \frac{[\text{IBr}]^2}{[\text{I}_2][\text{Br}_2]}$$

$$280 = \frac{(.5-2x)^2}{(x)(x)}$$

$$\sqrt{280} = \frac{.5-2x}{x}$$

$$16.73x = .5-2x$$

$$18.73x = .5$$

$$x = 0.0267$$

$$[\text{I}_2]_{\text{eq'm}} = [\text{Br}_2]_{\text{eq'm}} = 0.0267 \frac{\text{mol}}{\text{L}}$$

$$[\text{IBr}]_{\text{eq'm}} = .5-2x = 0.447 \frac{\text{mol}}{\text{L}}$$

16



a) no effect

b) no effect

c) $\downarrow T$ rvs rxn favoured as it is exothermic \therefore [reactants] \uparrow [products] \downarrow $\therefore K_c$ will decrease

d) no effect