

a. 4.5 atm N_2O_4

$$K_p = \frac{(P_{NO_2})^2}{P_{N_2O_4}}$$



I	4.5	0
C	-x	+2x
E	4.5-x	2x
	4.5-x	2(1.5)
	4 ATM	1 ATM

$$0.25 = \frac{(2x)^2}{4.5-x}$$

$$1.125 - 0.25x = 4x^2$$

$$0.4x^2 + 0.25x - 1.125 = 0$$

$$x = 0.5$$

b. 9 atm NO_2

$$K_p = 4$$



I	9.0	0
C	-2x	+x
E	9-2x	x

$$K_p = \frac{P_{N_2O_4}}{(P_{NO_2})^2}$$

$$4 = \frac{x}{(9-2x)^2}$$

$$(9-2x)^2 = \frac{x}{4}$$

$$1 \text{ atm} \quad 4 \text{ atm}$$

$$4 = \frac{x}{(9-2x)^2}$$

$$81 - 36x + 4x^2$$

$$324 - 145x + 16x^2 = x$$

$$16x^2 - 145x + 324 = 0$$

$$x = 5.0625$$

$$(4)$$

c. No it does not matter from which direction an equilibrium position is reached.



a. 2 mol NOCl in 2L flask = 1M

$$K = \frac{[\text{NO}]^2 [\text{Cl}_2]}{[\text{NOCl}]^2}$$



I 1 0 0

C -2x 2x +x

E 1-2x 2x x

.9683M .03175M .01587M

$$K = \frac{(2x)^2 x}{(1-2x)^2}$$

assume x is small \therefore

$$1-2x = 1$$

$$1.6 \times 10^{-5} = \frac{4x^3}{1}$$

$$\frac{1.6 \times 10^{-5}}{4} = x^3 \quad x = 0.01587$$

b. 1 mol NOCl and 1 mol NO in a 1L flask



I 1 1 0

C -2x +2x +x

E 1-2x 1+2x x

0.999968M 1.000032M 1.6×10^{-5} M

$$K = \frac{(1+2x)^2 x}{(1-2x)^2}$$

assume x is small \therefore

$$1-2x = 1 \quad 1+2x = 1$$

$$1.6 \times 10^{-5} = \frac{(1)^2 x}{(1)^2}$$

$$1.6 \times 10^{-5} = x$$

c. 2 mol NOCl and 1 mol Cl_2 in a 1L flask



$$K = \frac{(2x)^2 (1+x)}{(2-2x)^2}$$

x is small \therefore

I 2 0 1

C -2x +2x +x

E 2-2x 2x 1+x

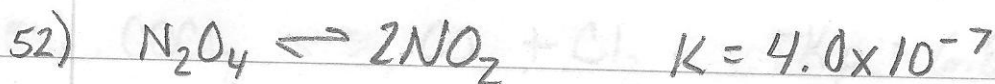
1.992M .008M 1.004M

$$1.6 \times 10^{-5} = \frac{4x^2}{(2)^2}$$

$$1+x = 1, \quad 2-2x = 2$$

$$.000016 = x^2$$

$$x = .004$$



1 mol N_2O_4 in a 10 L vessel.

0.1 M



$$K = \frac{[\text{NO}_2]^2}{[\text{N}_2\text{O}_4]}$$

I 0.1 0

C -x +2x

$$K = \frac{(2x)^2}{(0.1-x)}$$

E 0.1-x 2x

0.0999 M 0.0002 M

assume x is small $\therefore 0.1-x = 0.1$

$$4.0 \times 10^{-7} = \frac{4x^2}{0.1}$$

$$x = 0.0001$$



$$K = 2.0 \times 10^{-6}$$

I 0.4 0 0

2 mol CO_2 in 5 L vessel

C -2x +2x +x

0.4 M

E 0.4-2x +2x +x

0.391 M 0.00862 M 0.00431 M

$$K = \frac{[\text{CO}]^2 [\text{O}_2]}{[\text{CO}_2]^2}$$

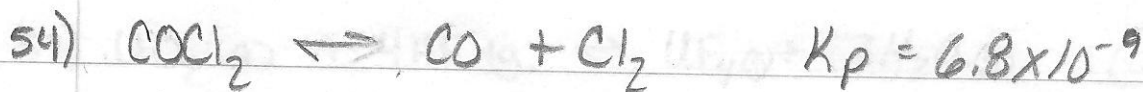
$$2.0 \times 10^{-6} = \frac{(2x)^2 x}{(0.4)^2}$$

$$K = \frac{(2x)^2 x}{(0.4-2x)^2}$$

$$2.0 \times 10^{-6} = \frac{4x^3}{.16}$$

x is assumed small $\therefore 0.4-2x = 0.4$

$$x = 0.00431$$



I 1 atm

0 0

C -x

+x +x

$$K_p = \frac{P_{\text{CO}} P_{\text{Cl}_2}}{P_{\text{COCl}_2}}$$

E 1-x

x x

0.99991 atm

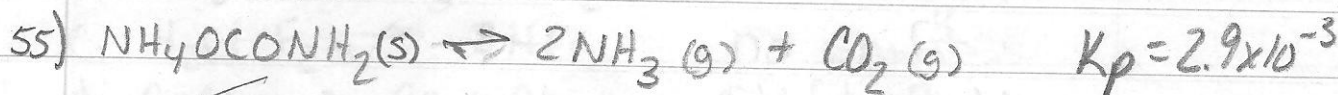
8.246×10^{-5} atm 8.246×10^{-5} atm

$$K = \frac{(x)(x)}{(1-x)}$$

$$6.8 \times 10^{-9} = \frac{x^2}{1}$$

$$x = 0.000082462$$

x is small $\therefore 1-x = 1$



I

0

0

$$K_p = (P_{\text{NH}_3})^2 P_{\text{CO}_2}$$

C

+2x

x

E

2x

x

$$P_{\text{CO}_2} = 0.0898 \text{ atm}$$

$$P_{\text{NH}_3} = 0.1797 \text{ atm}$$

$$P_{\text{total}} = 0.2695 \text{ atm}$$

$$K_p = (2x)^2 x$$

$$2.9 \times 10^{-3} = 4x^3$$

$$x = 0.0898$$



I

0

0

$$? K_p =$$

C

+x

+x

E

x

x

$$K_p = (P_{\text{NH}_3})(P_{\text{HCl}})$$

2.2 atm

2.2 atm

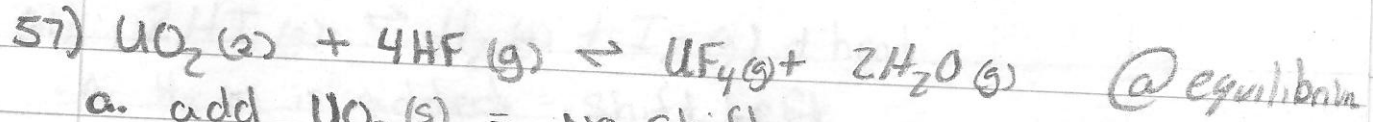
$$P_{\text{total}} = x + x$$

$$K_p = (2.2)(2.2)$$

$$4.4 = 2x$$

$$K_p = 4.84$$

$$x = 2.2$$

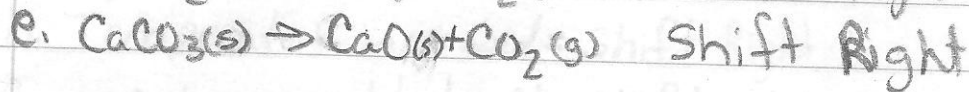
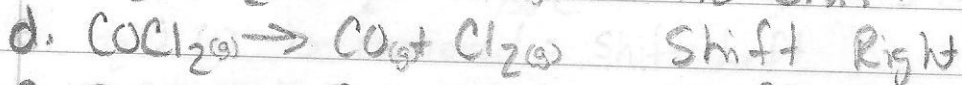
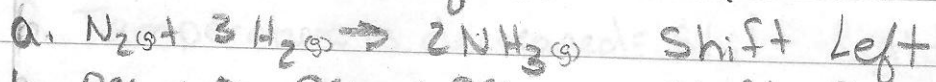


a. add $\text{UO}_2(\text{s})$ = NO shift

b. HF reacting w/ glass container = shift Left

c. H_2O vapor is removed = shift Right.

58) Increase volume of Container



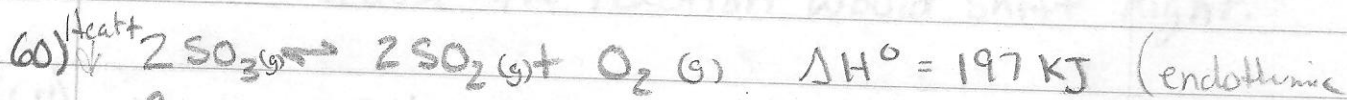
a. $CO_2(g)$ removed = Shift Right

b. $H_2O(g)$ added = Shift Right

c. He(g) added to increase Pressure = No shift

d. Temperature is increased = Shift left

e. Volume of Container decreased = No Shift



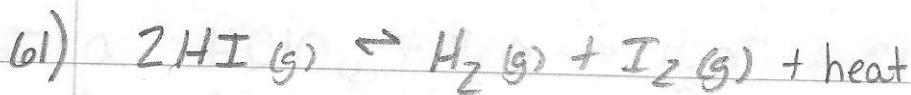
a. $O_2(g)$ added = Shift left - moles SO_3 increase

b. decrease volume of Container = Shift left - moles SO_3 increase

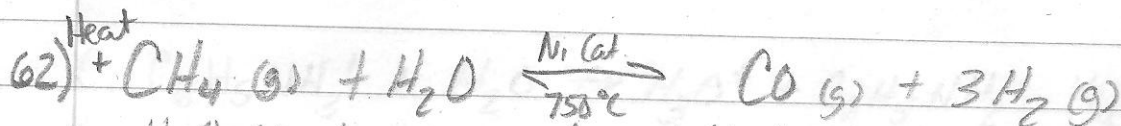
c. Ar(g) added to increase pressure = No shift - moles SO_3 stays Same

d. Temperature is decreased = Shift left - moles SO_3 increase

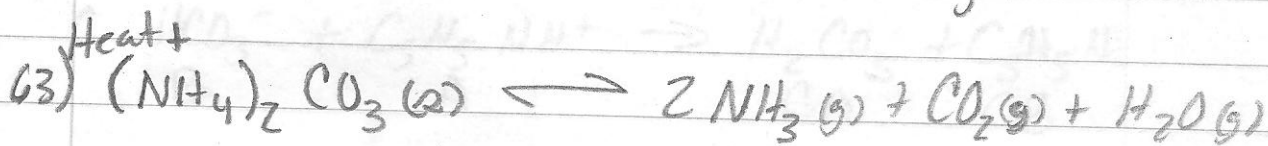
e. $SO_2(g)$ is removed = Shift Right - moles SO_3 decrease



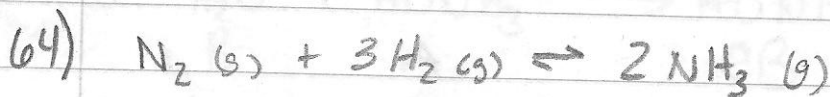
- $\text{H}_2(\text{g})$ is added = Shift Left
- $\text{I}_2(\text{g})$ is removed = Shift Right
- $\text{HI}(\text{g})$ is removed = Shift Left
- $\text{Ar}(\text{g})$ is added = No shift
- Volume of container is doubled = No shift
- Temperature is decreased = Shift Right



- $\text{H}_2\text{O}(\text{g})$ is removed = Shift Left
- Temperature increased = Shift Right
- inert gas added = No shift
- $\text{CO}(\text{g})$ is removed = Shift Right
- Container volume tripled = Shift Right.



increase temperature would increase the ammonia smell because the reaction would shift Right.



$$K_p = \frac{[\text{NH}_3]^2}{[\text{N}_2][\text{H}_2]^3}$$

as Temp. \uparrow $K_p \downarrow \therefore$

as Temp \uparrow $[\text{NH}_3] \downarrow$ and $[\text{N}_2] + [\text{H}_2] \uparrow \therefore$

Heat must be a product which makes the reaction exothermic.