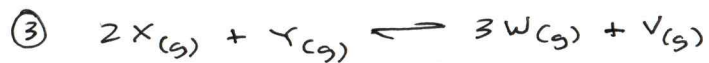
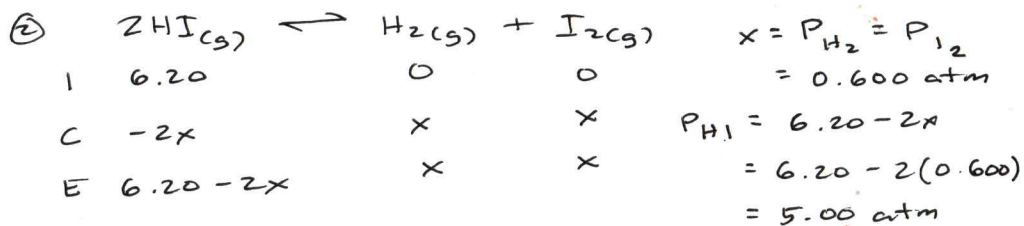


Answers to Chapter 14

① Among the choices, only D is a close system. There are 2 opposing processes that happened at the same time once equilibrium was achieved.



$$K_c = \frac{[\text{W}]^3 [\text{V}]}{[\text{X}]^2 [\text{Y}]}$$

④ K is only the ratio of pdts over rcts hence it can only be used to predict extent of a rxn.



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



I	$\frac{2.06 \text{ mol}}{2.0 \text{ L}} = 1.03$	0	0
C	$-2x$	$+x$	$+3x$
E	$1.03 - 2x$	x	$3x$

$$[\text{N}_2] = \frac{0.0227 \text{ mol}}{2.0 \text{ L}} = 0.01135 = x$$

$$K_c = \frac{[\text{N}_2][\text{F}_2]^3}{[\text{NF}_3]^2} = \frac{(x)(3x)^3}{(1.03 - 2x)^2}$$

$$= \frac{(0.01135)(3 \times 0.01135)^3}{[1.03 - 2(0.01135)]^2} = \frac{(0.01135)(3.95 \times 10^{-5})^3}{1.01}$$

$$= \cancel{3.478 \times 10^{-7}} 4.4807 \times 10^{-7}$$

$$K_p = K_c (RT)^2 = \cancel{3.478 \times 10^{-7}} 4.4807 \times 10^{-7} (0.0821 \times 800)^2 = 1.93 \times 10^{-3}$$



eq 0.059 0.054 0.019

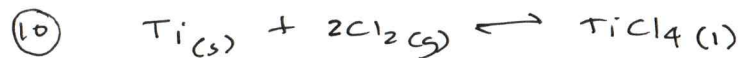
$$K_c = \frac{[\text{H}_2][\text{I}_2]}{[\text{HI}]^2} = \frac{(0.054)(0.019)}{(0.059)^2} = 0.2947 = 0.29$$

$$K_p = K_c \text{ since } \Delta n = 0$$

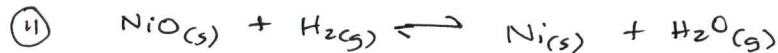
⑧ $K_p = K_c$ when there are the same mole of gaseous reactants and products like $2 \rightleftharpoons 3$.



All choices has a coefficient higher than $\frac{1}{2}$ except E where it is $\frac{1}{4} \text{N}_2\text{O}_4$ and $\frac{1}{2} \text{NO}_2$ which means the K_c will be one half of 3.3.



$$K_p = \frac{1}{P_{\text{Cl}_2}^2}$$



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

⑫ largest degree of decomposition means more pdts than rcts so we are looking for the highest K_p value

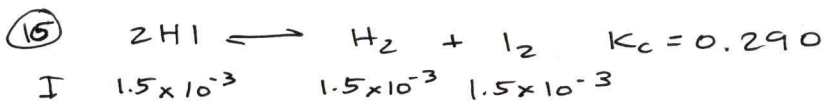
⑬ For $K_c = 4.4 \times 10^4$ means more pdts over rcts or forward rxn is more favored at equilibrium



I	1.0	0.360	0.750
	5.0	5.0	5.0
	$= 0.20$	$= 0.072$	0.15

$$Q = \frac{[\text{H}_2][\text{F}_2]}{[\text{HF}]^2} = \frac{(0.072)(0.15)}{(0.20)^2} = 0.270$$

15) $Q = 7.2 \times 10^2$ $K = 36$ so $Q > K$
 when $Q > K$, the backward rxn is favored hence more rcts than pdts



$$Q_c = \frac{[H_2][I_2]}{[HI]^2} = \frac{(1.5 \times 10^{-3})(1.5 \times 10^{-3})}{(1.5 \times 10^{-3})^2} = 1$$

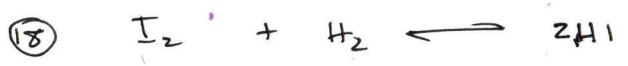
$Q_c > K_c$ so backward rxn is favored, forming more rcts as it reach equilibrium.



$$K_c = \frac{[PCl_3][Cl_2]}{[PCl_5]} \quad 4.0 = \frac{(x)(x)}{0.13}$$

$$(4.0)(0.13) = x^2 \quad 0.52 = x^2$$

$$x = \sqrt{0.52} = 0.72$$



I	0.30	0.30	0
C	-x	-x	+2x
E	0.30-x	0.30-x	2x

$$K_c = \frac{[HI]^2}{[I_2][H_2]} \quad 49 = \frac{(2x)^2}{(0.30-x)(0.30-x)}$$

$$49 = \frac{2x^2}{(0.30-x)^2}$$

perfect square so get square root on both sides

$$\sqrt{49} = \sqrt{\frac{2x^2}{(0.30-x)^2}}$$

$$7 = \frac{2x}{0.30-x} \quad 7(0.30-x) = 2x$$

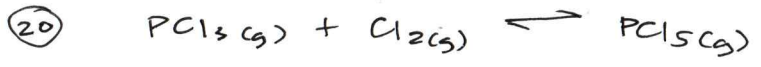
$$0.21 - 7x = 2x \quad 0.21 = 9x$$

$$0.21/9 = x \quad x = 0.0233$$

$$2x = 2 \times 0.0233 = 0.0466 \text{ or } 0.047 M$$

I am not sure if there is an error in the number for choice D.

19) If its moist, H_2O is present hence it will favor backward rxn. so pink dessicant will be observed.



Among the choices, only E will drive the rxn backward increasing $[PCl_3]$

21) Eventhough there are same moles of CO & O_2 on both sides hence P will have no effect, let's look from the perspective of concentration.

22) When liquid H_2O is sprayed into the system, NH_3 will dissolved in it resulting in less amount $[NH_3]$ of it driving the forward rxn to produce more NH_3

23) In most of the choices, there are unequal mol of gaseous of rcts and pdts except D where there is equal mol of gaseous pdts and rcts

24) Rkns 1 & 2 have unequal moles of rcts & pdts hence affected by volume change

25) Decreasing volume will force choice A to shift rxn to the right since there is less number of moles of pdts than rcts.

26) Increase in volume means favoring the rxn toward the side with more number of moles. Among the choices, only B will have more mole of pdts than rcts.

27) Given $2\text{ICl}(g) \rightleftharpoons \text{I}_2(g) + \text{Cl}_2(g)$ and it is endothermic, increasing T will result to more products resulting to a higher K_p value. Choice E is the answer since K_p increase and one of the products (I_2) partial pressure also increase.

28) For $\text{Br}_2(g) + 2\text{NO}(g) \rightleftharpoons 2\text{NOBr}$ with exothermic rxn, the decrease of T will favor forward rxn. The other choices all favor the backward rxn.

29) For $\text{N}_2(g) + 3\text{H}_2 \rightleftharpoons 2\text{NH}_3$ $\Delta H = -92.94 \text{ kJ}$
the following conditions will shift the rxn to either forward or backward rxn

I. $\uparrow T$ favor ~~forward~~ backward

II. $\downarrow T$ favor ~~backward~~ forward

III. $\uparrow V$ favor backward

IV. $\downarrow V$ favor forward

V. $\downarrow [\text{NH}_3]$ favor forward

VI. $\uparrow [\text{NH}_3]$ favor backward

VII. $\downarrow [\text{N}_2]$ favor backward

VIII. $\uparrow [\text{N}_2]$ favor forward

\therefore II, IV, V & VIII favor forward rxn

30) All statements are correct except choice D. Catalyst don't increase product yield.

21) When P_{O_2} increases, it also means $[\text{O}_2]$ increases hence favoring the backward rxn, preventing CO to react with hemoglobin.