DPP

DAILY PRACTICE PROBLEMS

Class : XIth
Date :

Solutions

Subject : CHEMISTRY
DPP No. : 8

Topic :- Equilibrium

1 **(d)**

$CO_3^{2-} + H^+ \longrightarrow HCO_3^-$(acid).

2 **(b)**

1. $CaCO_3(s) \xrightarrow{\Delta} CaO(g)(s) + CO_2(g)\uparrow K_p = 8 \times 10^{-2}$

$$K_p = \frac{p_{CaO(s)} \times p_{CO_2(g)}}{p_{CaCO_3(s)}}$$

(Heterogenous equilibrium)

$K_p = p_{CO_2}$

$p_{CO_2} = 8 \times 10^{-2}$

2. $CO_2(g) + C(s) \rightarrow 2CO(g), \quad K_p = 2$

$$K_p = \frac{p^2_{CO(g)}}{p_{CO_2} \times p_{C(s)}}$$

(Heterogenous equilibrium)

$$K_p = \frac{p^2_{CO}}{p_{CO_2}}$$

$$2 = \frac{p^2_{CO}}{8 \times 10^{-2}}$$

$p^2_{CO} = 2 \times 8 \times 10^{-2}$

$p_{CO} = 0.4$ atm

3 **(c)**

$H_2CO_3 \rightleftharpoons H^+ + HCO_3^-; \quad K_1 = 4.2 \times 10^{-7}$

$HCO_3^- \rightleftharpoons H^+ + CO_3^{2-}; \quad K_2 = 4.8 \times 10^{-11}$

$K_1 >> K_2$

$\therefore \quad [H^+] = [HCO_3^-]$

$$K_2 = \frac{[H^+][CO_3^{2-}]}{[HCO_3^-]}$$

So, $[CO_3^{2-}] = K_2 = 4.8 \times 10^{-1}$

4 **(d)**

Acid indicators are generally weak acid. The dissociation of indicator HIn takes place as follows

$$HIn \rightleftharpoons H^+ + In^-$$

$$K_{In} = \frac{[H^+][In^-]}{[HIn]}$$

or $[H^+] = K_{In}\frac{[HIn]}{[In^-]}$

$$pH = -\log[H^+]$$

$$= -\log\left(K_{In}\frac{[HIn]}{[In^-]}\right)$$

$$= -\log K_{In} + \log\frac{[In^-]}{[HIn]}$$

$$= pK_{In} + \log\frac{[In^-]}{[HIn]}$$

or $\log\frac{[In^-]}{[HIn]} = pH - pK_{In}$

5 **(c)**

Mole $OH^- = M \times V_{\text{in litre}}$

$\therefore$ No of $OH^- = 0.3 \times 0.005 \times 2 = 0.0030$.

6 **(a)**

	$H_2 +$	$I_2 \rightleftharpoons$	$2HI$
Initial concentration	4.5	4.5	0
	$(4.5-x)$	$(4.5-x)$	$2x$

From equation, $2x = 3$

$\therefore x = \frac{3}{2} = 1.5$

So, concentration at equilibrium

$[H_2] = 4.5 - 1.5 = 3$

$[I_2] = 4.5 - 1.5 = 3$

$[HI] = 3$

$\therefore K_c = \frac{[HI]^2}{[H_2][I_2]} = \frac{3 \times 3}{3 \times 3} = 1$

7 **(a)**

Given, $K_w = 10^{-14}, K_a = 10^{-5}$

Concentration of salt $= 0.001$ M

$\therefore \quad K_h = \frac{K_w}{K_a} = \frac{10^{-14}}{10^{-5}} = 10^{-9}$

According to equation

$$A^- + H_2O \rightleftharpoons HA + OH^-$$

Let degree of hydrolysis$=h$

$\therefore \quad 0.001(1-h)(0.001 \times h)(0.001 \times h)$

$\therefore \quad K_h = \frac{[HA][OH^-]}{[A^-]} = \frac{(0.001 \times h)(0.001 \times h)}{0.001(1-h)}$

or $\quad 10^{-9} = (0.001h)^2 \quad [\because 0.001(1-h) = 1]$

or $10^{-6} = h^2$

$\therefore$ $10^{-3} = h$

8 **(d)**

Unit of $K_c = [\ \ ]^{\Delta n}$. $\Delta n = +1$.

9 **(c)**

To precipitate soap from its saturated solution on addition of salt is called salting out action of soap.

$R\text{COONa} \rightleftharpoons R\text{COO}^- + \text{Na}^+$

$K_{sp} = [R\text{COO}^-][\text{Na}^+]$

In presence of NaCl, $[\text{Na}^+]$ increases and thus, the product of $[\text{Na}^+][R\text{COO}^-]$ exceeds in K_{sp} to show precipitation of soap.

10 **(c)**

$SO_2 + \frac{1}{2}O_2 \rightleftharpoons SO_3$

$$K_1 = \frac{[SO_3]}{[SO_2][O_2]^{1/2}} \quad ...(i)$$

$2SO_3 \rightleftharpoons 2SO_2 + O_2$

$$K_2 = \frac{[SO_2]^2[O_2]}{[SO_3]^2} \quad ...(ii)$$

From Eqs. (i) and (ii)

$$K_2 = \frac{1}{K_1^2}$$

$$= \frac{1}{(5 \times 10^{-2})^2} = \frac{1}{25 \times 10^{-4}}$$

$$= \frac{100 \times 10^2}{25}$$

$$= 4 \times 10^2 \text{atm}$$

11 **(d)**

(i) The haemoglobin of RBC combines with oxygen in lungs following the equilibrium,

$$H_b\ (s) + O_2\ (g) \rightleftharpoons H_bO_2(s)$$

When these are at lungs, the partial pressure of O_2 being appreciable to show forward reaction, however, when they pass to tissues, the partial pressure of O_2 decreases to favour backward reaction releasing O_2.

(ii) Removal of CO_2 from blood is based on the equilibrium,

$$CO_2\ (g) + H_2O(l) \rightleftharpoons H^+(aq) + HCO_3^-(aq)$$

In tissues CO_2 gets dissolved in H_2O due to high pressure whereas in lungs, the CO_2 is released out because of low pressure of CO_2.

(iii) Tooth enamel substance (hydroxyapatite) $Ca_5(PO_4)_3OH$ shows the following equilibrium,

$$Ca_5(PO_4)_3OH \underset{\text{Remineralization}}{\overset{\text{Demineralization}}{\rightleftharpoons}} 5Ca^{2+}(aq) + 3PO_4^{3-}(aq) + OH^-(aq)$$

The use of sweet material or fermentation produces H^+, which combines with OH^- to favour demineralization of enamel causing tooth decay.

12 **(b)**

Pressure has no effect on equilibrium if $\Delta n = 0$

13 **(a)**

Aqueous solution of $AlCl_3$ is acidic due to the hydrolysis of aluminium ion

$AlCl_3 \xrightarrow{\text{Hydrolysis}} Al(OH)_3 + H^+$

14 **(a)**

$H^+ = 1.0 \times 10^{-8} = 10 \times 10^{-9}$

Also, if ionisation is not neglected

$$H_2O \rightleftharpoons \underset{10^{-8}+a}{H^+} + \underset{a}{OH^-}$$

$a \times (10^{-8} + a) = 10^{-14}$

$\therefore \quad a = 9.9 \times 10^{-9}$

$$\therefore \quad \%\ \text{emr} = \frac{10 \times 10^{-9} - 9.9 \times 10^{-9}}{10 \times 10^{-9}}$$

$= 1\%.$

15 **(d)**

Thus, a solution of blue and yellow ions appears green.

16 **(b)**

$NH_2COONH_4(g) \rightleftharpoons 2NH_3(g) + CO_2(g)$

At eq. if partial pressure of $CO_2 = p$

Then that of $NH_3 = 2p$

$K_p = p^2_{NH_3} \times p_{CO_2} = (2p)^2 \times p = 4p^3$

$= 2.9 \times 10^{-5}$ or $p^3 = 0.725 \times 10^{-5}$

or $p = 1.935 \times 10^{-2}$

Hence, total pressure $= p = 5.81 \times 10^{-2} = 0.0581$ atm

17 **(d)**

K_w increases with increase in temperature

18 **(d)**

In all the given reactions, equilibrium is affected by the increase in volume at constant temperature

19 **(a)**

Lewis bases are electron pair donor. I^+ is electron deficient, hence do not act as Lewis base.

20 **(d)**

CH_3COONH_4 is a salt of weak acid and weak base and

$$\underset{CH_3COOH}{K_{acid}} \approx \underset{NH_4OH}{K_{base}}$$

ANSWER-KEY										
Q.	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
A.	**D**	**B**	**C**	**D**	**C**	**A**	**A**	**D**	**C**	**C**
Q.	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**
A.	**D**	**B**	**A**	**A**	**D**	**B**	**D**	**D**	**A**	**D**