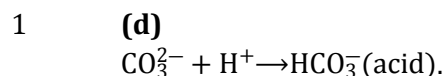
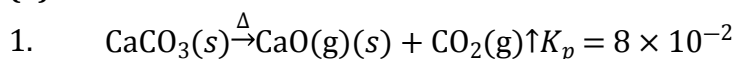


Topic :- Equilibrium



2 (b)

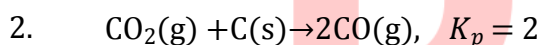


$$K_p = \frac{p_{\text{CaO}(\text{s})} \times p_{\text{CO}_2(\text{g})}}{p_{\text{CaCO}_3(\text{s})}}$$

(Heterogenous equilibrium)

$$K_p = p_{\text{CO}_2}$$

$$p_{\text{CO}_2} = 8 \times 10^{-2}$$



$$K_p = \frac{p_{\text{CO}(\text{g})}^2}{p_{\text{CO}_2} \times p_{\text{C}(\text{s})}}$$

(Heterogenous equilibrium)

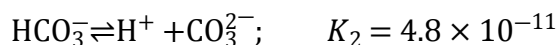
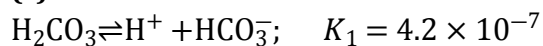
$$K_p = \frac{p_{\text{CO}}^2}{p_{\text{CO}_2}}$$

$$2 = \frac{p_{\text{CO}}^2}{8 \times 10^{-2}}$$

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

$$p_{\text{CO}} = 0.4 \text{ atm}$$

3 (c)



$$K_1 \gg K_2$$

$$\therefore [\text{H}^+] = [\text{HCO}_3^-]$$

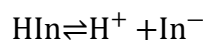
$$K_2 = \frac{[\text{H}^+][\text{CO}_3^{2-}]}{[\text{HCO}_3^-]}$$

$$\text{So, } [\text{CO}_3^{2-}] = K_2 = 4.8 \times 10^{-11}$$

4 (d)

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

place as follows



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

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

$$\begin{aligned} \text{pH} &= -\log [\text{H}^+] \\ &= -\log \left(K_{\text{In}} \frac{[\text{HIn}]}{[\text{In}^-]} \right) \end{aligned}$$

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

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

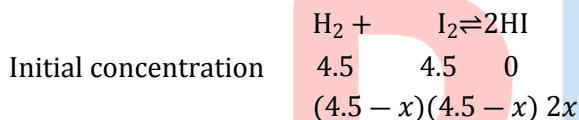
or $\log \frac{[\text{In}^-]}{[\text{HIn}]} = \text{pH} - \text{p}K_{\text{In}}$

5 **(c)**

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

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

6 **(a)**



From equation, $2x = 3$

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

So, concentration at equilibrium

$$[\text{H}_2] = 4.5 - 1.5 = 3$$

$$[\text{I}_2] = 4.5 - 1.5 = 3$$

$$[\text{HI}] = 3$$

$$\therefore K_c = \frac{[\text{HI}]^2}{[\text{H}_2][\text{I}_2]} = \frac{3 \times 3}{3 \times 3} = 1$$

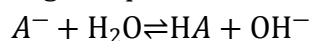
7 **(a)**

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

Concentration of salt = 0.001 M

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

According to equation



Let degree of hydrolysis = h

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

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

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

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

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

8 **(d)**

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

9 **(c)**

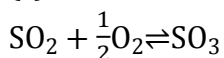
To precipitate soap from its saturated solution on addition of salt is called salting out action of soap.



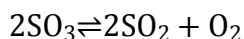
$$K_{sp} = [RCOO^-][Na^+]$$

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

10 **(c)**



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



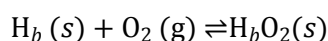
$$K_2 = \frac{[SO_2]^2[O_2]}{[SO_3]^2} \quad \dots(ii)$$

From Eqs. (i) and (ii)

$$\begin{aligned} K_2 &= \frac{1}{K_1^2} \\ &= \frac{1}{(5 \times 10^{-2})^2} = \frac{1}{25 \times 10^{-4}} \\ &= \frac{100 \times 10^2}{25} \\ &= 4 \times 10^2 \text{ atm} \end{aligned}$$

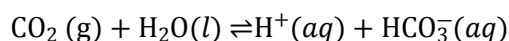
11 **(d)**

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



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 .

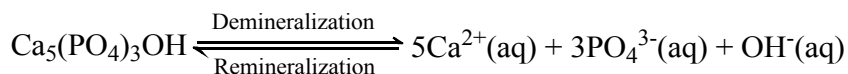
(ii) Removal of CO_2 from blood is based on the equilibrium,



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,



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)**

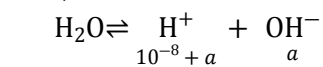
Aqueous solution of AlCl_3 is acidic due to the hydrolysis of aluminium ion



14 **(a)**

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

Also, if ionisation is not neglected



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

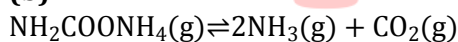
$$\therefore a = 9.9 \times 10^{-9}$$

$$\therefore \% \text{ emr} = \frac{10 \times 10^{-9} - 9.9 \times 10^{-9}}{10 \times 10^{-9}} = 1\%$$

15 **(d)**

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

16 **(b)**



At eq. if partial pressure of $\text{CO}_2 = p$

Then that of $\text{NH}_3 = 2p$

$$K_p = p_{\text{NH}_3}^2 \times p_{\text{CO}_2} = (2p)^2 \times p = 4p^3$$

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

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

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

17 **(d)**

K_w increases with increase in temperature

18 **(d)**

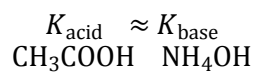
In all the given reactions, equilibrium is affected by the increase in volume at constant temperature

19 **(a)**

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

20 **(d)**

$\text{CH}_3\text{COONH}_4$ is a salt of weak acid and weak base and



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

PE