DPP

DAILY PRACTICE PROBLEMS

Class : XIth
Date :

Solutions

Subject : CHEMISTRY
DPP No. : 6

Topic :- Equilibrium

1 **(a)**

$$\text{pH} = \text{p}K_a + \log\frac{[\text{Conjugate base}]}{[\text{Acid}]}$$

or $5.24 = 4.74 + \log\frac{[\text{Conjugate base}]}{[\text{Acid}]}$

$\therefore \frac{[\text{Conjugate base}]}{[\text{base}]} = 3.$

2 **(a)**

$[\text{H}^+] = C\alpha = \sqrt{K_a.C}$

$$\text{pH} = -\log(K_a.C)^{1/2}$$
$$= \frac{1}{2}[-\log K_a - \log C]$$
$$= \frac{1}{2}[4.74 - \log 10^{-2}]$$
$$= \frac{1}{2}[4.74 + 2] = 3.37$$

3 **(a)**

$1M$ solution of CH_3COONa on addition to acid shows a decrease in dissociation of acid due to common ion effect.

4 **(d)**

Weak monoacidic base *e.g.*, BOH is neutralised as follows

$$BOH + HCl \rightarrow BCl + H_2O$$

At equivalence point all BOH gets converted into salt and remember! The concentration of H^+ (or pH of solution) is due to hydrolysis of resultant salt (BCl, cationic, hydrolysis here)

$$B^+ + H_2O \rightleftharpoons BOH + H^+$$
$$C(1-h) \qquad Ch \qquad Ch$$

Volume of HCl used up

$$V_a = \frac{N_bV_b}{N_a} = \frac{2.5 \times 2 \times 15}{2 \times 5} = 7.5 \text{ mL}$$

Concentration of salt

$$[\text{BCl}] = \frac{\text{conc.of base}}{\text{total volume}} = \frac{2 \times 2.5}{5(7.5 + 2.5)} = \frac{1}{10} = 0.1$$

$$K_h = \frac{Ch^2}{1-h} = \frac{K_w}{K_b}$$

(h should be estimated whether that can be neglected or not)

on calculating h=0.27 (significant, not negligible)

$[\mathrm{H}^+] = Ch = 0.1 \times 0.27 = 2.7 \times 10^{-2}\mathrm{M}$

5 **(c)**

A salt is precipitated only when the product of ionic concentration is more than its solubility product.

$$K_{sp} = 1 \times 10^{-8}$$

$$[A^+] = 10^{-3}\ \mathrm{M}$$

$$[B^-] = \frac{1 \times 10^{-8}}{10^{-3}} = 10^{-5}\ \mathrm{M}$$

So, AB will be more precipitated only when the concentration of $[B^-]$ is more than 10^{-5} M.

6 **(b)**

According to Le-Chatelier's principle exothermic reactions are favourable at low pressure. The reaction in which number of moles decreases are favourable at high pressure or low volume.

$\mathrm{C_2H_4 + H_2 \rightleftharpoons C_2H_6},\ \Delta H = -130\ \mathrm{kJ\ mol^{-1}}$

$\because$ The reaction is exothermic and number of moles of reactants are decreasing.

$\because$ The reaction rate is increased by decreasing temperature and increasing pressure.

7 **(d)**

The reaction does not cease up but goes in both directions with same speed.

8 **(a)**

Haber's process of synthesis of ammonia

$$\mathrm{N_2 + 3H_2 \rightleftharpoons 2NH_3}$$

$$\mathrm{N_2 + 3H_2 \underset{750\ K,\ 2000\ atm}{\overset{Fe,\ Mo}{\rightleftharpoons}} 2NH_3}$$

Since, the number of molecules of gaseous products are less than the number of molecules of gaseous reactants, thus according to Le-Chatelier's principle, high pressure favours the forward reaction *i.e.*, more ammonia will be obtained.

9 **(d)**

Buffer capacity of an acidic buffer is maximum when the ratio of HA *to* A^- is unity.

Since, pH of acidic buffer $= \mathrm{p}K_a + \log\frac{[A^-]}{[\mathrm{H}A]}$

For maximum buffer capacity, $[A^-] = [\mathrm{H}A]$

$\therefore$ $\mathrm{pH} = \mathrm{p}K_a$

10 **(c)**

$\therefore$ $\mathrm{pH} = 2$

$\therefore \quad [H^+] = 10^{-2}$

$[H^+] = N.\alpha$

$10^{-2} = 0.1 \times \alpha$

$\alpha = \frac{10^{-2}}{0.1}$

$\alpha = 0.1$

11 **(c)**

Since, catalyst increases the rate of forward reaction as well as the rate of backward reaction, it does not affect the equilibrium constant.

12 **(d)**

Meq. of H_2SO_4 needed for 20 Meq. of NaOH $= 20$

Thus, volume of H_2SO_4 needed $= V_{mL}$

or $V \times 0.25 \times 2 = 20$

$\therefore \quad V = 40$ mL

Also, temperature increases during neutralization and then decreases after neutralization on further addition of acid.

13 **(b)**

The dissociation of H_2S decreases in presence of acid (or H^+ a common ion furnished by an acid).

14 **(a)**

H_2	+	I_2	$\rightleftharpoons$	2HI
15		5.2		0
(15-5)		(5.2-5)		10

Equilibrium constant

$$(K_c) = \frac{[HI]^2}{[H_2][I_2]} = \frac{10 \times 10}{10 \times 0.2} = 50$$

15 **(c)**

New concentration of,

$$HCl = \frac{10^{-6}}{100} = 10^{-8}\, M$$

$\therefore \quad [H^+] = 10^{-18} + 10^{-7}$

$= 1.1 \times 10^{-7}\, M$

$\therefore \quad pH \approx 7$

17 **(a)**

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

$= -\log(3 \times 10^{-3})$

$= 3 - \log 3$

$= 3 - 0.4771$

$= 2.5229$

18 **(d)**

The dissociation of HCN will decrease in presence of NaCN due to common ion effect.

19 **(c)**

Meq. of HCl $= 10 \times 10^{-1} = 1$

Meq. of NaOH $= 10 \times 10^{-1} = 1$

Thus, both are neutralized and 1 Meq. Of NaCl (a salt of strong acid and strong base) which does not hydrolyse and thus, pH = 7.

20 **(d)**

$PbCl_2 \rightleftharpoons Pb^{2+} + 2I^-$

s mol/L $\quad s \quad 2s$

Hence, $K_{sp} = [Pb^{2+}][I^-]^2$

$= (s)(2s)^2$

$= 4s^3$

$\therefore \quad s = \sqrt[3]{\frac{K_{sp}}{4}} = \sqrt[3]{\frac{2.3 \times 10^{-32}}{10}}$

$= 1.78 \times 10^{-11} \text{mol/L}$

$= 1.78 \times 10^{-11} \times 278 \text{ g/L}$

$= 4.95 \times 10^{-9} \text{ g/L}$

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