ORGIANIC CHEMISTRY..

ALIPHATIC COMPOUND

S.No	M.F Alcohol	FORMULA	COMMON NAME
1.	C_2H_6O	C_2H_5OH	Ethanol
2.	C_2H_4O	CH_3CHO	Acetaldehyde
3.	C_2H_4O	$CH_2=CH-OH$	Vinyl alcohol
4.	C_2H_3N	CH_3CN	Ethane nitrite.
5.	C_2H_4	$CH_2=CH_2$	Ethlene
6.	C_2H_3OCl	CH_3COCl	Acetyl chloride
7.	$C_2H_6O_2$	$HO-CH_2-CH_2-OH$	Ethylene Glycol
8.	$C_2H_4O_2$	CH_3COOH	Acetic Acid.
9.	C_3H_6	$CH_3-CH=CH_2$	Propylene
10.	C_3H_4O	$CH_2=CH-CHO$	Acoclein.
11.	C_3H_6O	$CH_2=CH-CH_2-OH$	Allyl alcohol
12.	C_3H_8O	$CH_3-O-C_2H_5$	Ethyl methyl ether.
13	C_3H_8O	$CH_3CHOH-CH_3$	Isopropyl alcohol
14.	C_3H_6O	$CH_3-\overset{O}{\overset{\|\|}{C}}-CH_3$	Acetone.
15.	$C_3H_8O_2$	CH_2-OH $\vert$ $CHOH$ $\vert$ CH_2OH	Glycerol
16.	$C_3H_3OCl_3$	$CCl_3-\overset{O}{\overset{\|\|}{C}}-CH_3$	Trichloro Acetone
17.	$C_3H_6O_3$	$CH_3-CH(OH)-COOH$	Lactic Acid.
18.	$C_3H_4O_3$	$CH_3-\overset{O}{\overset{\|\|}{C}}-COOH$	Pyruvic acid.
19.	C_3H_5ON	$CH_3-CH(OH)-CN$	Acetaldehyde cyano hydrin.
20.	$C_3H_5O_9N_3$	CH_2-ONO_2 $\vert$ $CHONO_2$ $\vert$ CH_2ONO_2	Nitroglycerine.

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21.	C_3H_5Br		cyclopropyl Bromide.
22.	C_3H_9N	$CH_3-N(CH_3)-CH_3$	
23.	C_3H_4	$CH_3-C\equiv CH$	Prop-1-yene.
24.	$C_3H_6O_2$	$OH-CH_2-CH_2-CHO$	Hydroxy Propanal
25.	$C_4H_{10}O$	$C_2H_5-O-C_2H_5$	Diethylene Glycol
26.	C_4H_8O	$CH_3-CH=CH-CH_2OH$	crotyl alcohol.
27.	C_4H_6O	$CH_3-CH=CH-CHO$	crotonaldehyde
28.	$C_4H_{10}O_3$	$HO-CH_2-CH_2$ / $OH-CH_2-CH_2$ / O	Diethylene Glycol.
29.	CH_2O_2	$H-COOH$	Formic Acid.
30.	$C_4H_6O_2$		cyclopropane carboxylic acid.
31.	$C_4H_{10}O_2$	$CH_3-CH(OCH_3)-OCH_3$	acetaldehyde dimethyl acetate.
32.	$C_4H_8O_2$		1,4 dioxene.
33.	$C_4H_{10}O$	$CH_3-CH_2-O-CH_2-CH_3$	Diethyl Ether.
34.	$C_5H_{10}O$	$CH_3-CH_2-CH_2-C(=O)-CH_3$	2-pentanone
35.	$C_5H_{12}O$	$CH_3-CH_2-O-CH(CH_3)-CH_3$	2-Ethoxy propane.
36.	C_2H_4O	$CH_2=CH-OH$	Vinyl alcohol.

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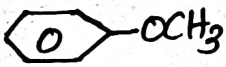
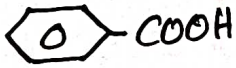
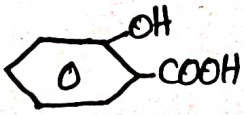
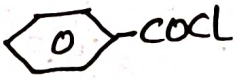
AROMATIC COMPOUND

S. NO		FORMULA	COMMON NAME
1.	C_6H_6O		Phenol
2.	C_6H_5N	$C_6H_5NH_2$	Aniline.
3.	$C_6H_4O_2$		Quinone
4.	$C_8H_{10}O$	$(H_3C)_2C=CH-COCH_3$	Mesityl oxide.
5.	$C_6H_6O_2N$		Nitrous acid.
6.	C_7H_8O	$C_6H_5CH_2OH$	Benzyl alcohol.
7.	C_7H_6O	C_6H_5CHO	Benzaldehyde.
8.	C_7H_8O		ANISOLE
9.	C_7H_6O		Benzoic Acid.
10.	$C_7H_6O_3$		salicylic Acid.
11.	C_7H_8	$C_6H_5-CH_3$	Toluene
12.	$C_7H_6O_2$		
13.	$C_7H_6O_3$		
14.	C_7H_5OCl		Benzylchloride
15.	C_7H_9N	$C_6H_5CH_2NH_2$	Benzylamine
16.	C_7H_9NO	$C_6H_5-CONH_2$	Benzamide

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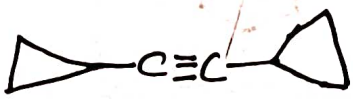
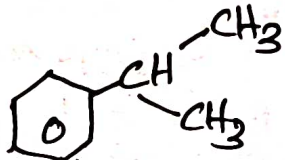
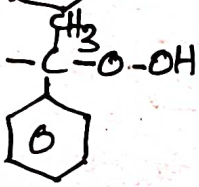
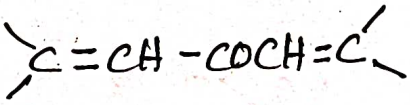
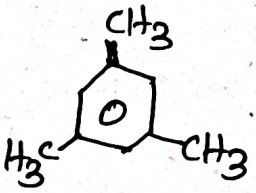
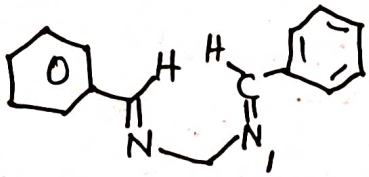
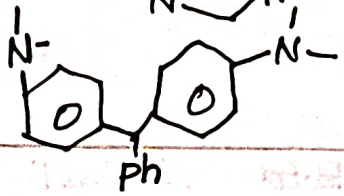
17.	C_7H_8O	$H_3C - C_6H_5 - OH$	Acetophenone
18.	$C_7H_5O_2$		Benzoate
19.	C_7H_5N		Benzonitrile.
20.	C_8H_8O	$C_6H_5COCH_3$	Acetophenone
21.	$C_8H_{10}O$	$C_6H_5CH(OH)CH_3$	Phenylmethylcarbinol
22.	C_8H_{10}		Dicyclo propyl Acetylen.
23.	C_9H_{12}		Cumene
24.	$C_9H_{12}O_2$		Cumene Hydro peroxide.
25.	$C_9H_8O_2$	$C_6H_5CH=CHCOOH$	Cinnamic Acid
26.	$C_9H_{14}O$		Phorone.
27.	C_9H_{12}		Mesitylene.
28.	$C_{10}H_{10}O$	$C_6H_5CH=CHCOCH_3$	Benzal Acetone
29.	$C_{14}H_{12}O_2$	$C_6H_5-CH(OH)-CO-C_6H_5$	Benzoin.
30.	$C_{13}H_{10}O$	$C_6H_5-C(=O)-C_6H_5$	Benzophenone.
31.	$C_{21}H_{18}N_2$.		Hydro benzonide
32.	$C_{23}H_{26}N_2$		Malachite Benzoni

Book back problems.

6. The concentration of hydroxide ion in a water sample is found to be 2.5×10^{-6} M. Identify the nature of the solution.

Sol:

$[OH^-] = 2.5 \times 10^{-6}$ M

$pOH = -\log_{10}[OH^-]$

$= -\log(2.5 \times 10^{-6} M)$

$= -\log 2.5 - \log 10^{-6}$

$= -\log 2.5 + 6(\log_{10}) = 1.$

$= 6 - 0.3979$

$pOH = 5.602.$

7. A lab assistant prepared a solution by adding a calculated quantity of HCl gas at 25°C to get a solution with $[H_3O^+] = 4 \times 10^{-5}$ M. Is the solution neutral (or) acidic (or) basic.

Sol:

$[H_3O^+] = 4 \times 10^{-5}$ m

$pH = -\log_{10}[H_3O^+]$

$= -\log(4 \times 10^{-5})$

$= -\log 4 - \log_{10}^{-5}$

$= -\log 4 + 5 \log 10$

$= 5 - 0.6021$

$= 1.3979.$

4. Calculate the pH of 1.5×10^{-3} M solution of $Ba(OH)_2$.

Sol: Acidity of $Ba(OH)_2$ is 2.

Normality = Molarity × acidity.

$= 1.5 \times 10^{-3} \times 2$

$= 3 \times 10^{-3}$

$[OH^-] = 3 \times 10^{-3}$

$pOH = -\log_{10}[OH^-]$

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

$= -\log_{10}3 - \log_{10}10^{-3}$

$= -\log_{10}3 + 3\log_{10}10$

$= 3 - \log_{10}3$

$= 3 - 0.4771$

$pOH = 2.5229$

$pH + pOH = 14 - 2.5229$

$= 11.4771 \Rightarrow 11.48.$

8. Calculate the pH of 0.04 M HNO_3

Sol: $[H_3O^+]$ = Normality = Molarity × basicity

$= 0.04 \times 1$

$[H_3O^+] = 4 \times 10^{-2}$

$pH = -\log_{10}[H_3O^+]$

$= -\log_{10}(4 \times 10^{-2})$

$= -\log_{10}4 - \log_{10}10^{-2}$

$= -\log_{10}4 + 2\log_{10}10$

$= -\log_{10}4 + 2$

$= 2 - \log_{10}4$

$= 2 - 0.6021$

$= 1.3979 \Rightarrow pH = 1.40.$

9 9 9
1 10 10 10 10
2.0000
0.6021
1.3979

16. The k_a value for HCN is 10^{-9}. What is the pH of 0.4M HCN solution?

Sol:

$k_a = 10^{-9}$; $C = 0.4M$ PH = ?

HCN is a weak acid:

$$[H_3O^+] = C\alpha = \sqrt{k_a \cdot c}$$

$$[H_3O^+] = \sqrt{k_a \times c} = \sqrt{10^{-9} \times 0.4}$$

$$= \sqrt{4 \times 10^{-10}} = \boxed{2 \times 10^{-5} \Rightarrow H_3O^+}$$

$$pH = -\log_{10}[H_3O^+]$$

$$= -\log_{10}(2 \times 10^{-5})$$

$$= -\log_{10} 2 - \log_{10} 10^{-5}$$

$$= -\log_{10} 2 + 5 \log_{10} 10$$

$$= 5 - 0.3010$$

$$pH = 4.6990.$$

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17. Calculate the extent of hydrolysis and the pH of 0.1M ammonium acetate. Given that $k_a = k_b = 1.8 \times 10^{-5}$.

Sol:

$k_w = 1 \times 10^{-14}$

$k_a = k_b = 1.8 \times 10^{-5}$

$$h = \sqrt{k_h} = \sqrt{\frac{k_w}{k_a k_b}}$$

$$= \sqrt{\frac{1 \times 10^{-14}}{1.8 \times 10^{-5} \times 1.8 \times 10^{-5}}}$$

$$= \sqrt{\frac{1 \times 10^{-4}}{1.8 \times 1.8}}$$

$$h = \sqrt{0.3086 \times 10^{-4}}$$

$$= 0.5555 \times 10^{-2}$$

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$K_a = K_b \Rightarrow Pk_a = Pk_b$; $Pk_w = 14$

$\therefore PH = \frac{1}{2} pk_w + \frac{1}{2} pk_a - \frac{1}{2} pk_b$

$= \frac{1}{2} + Pk_w +$

$= \frac{1}{2} \times 14$

$pH = 7$

15. 50ml of 0.05M HNO_3 is added to 50 ml of 0.025 M KOH. calculate the pH of the resultant solution:

Sol:-

No. of millimoles = V_{mL} × molarity

Millimoles of $HNO_3 = 50 \times 0.05 \Rightarrow 2.5$

$KOH = 50 \times 0.025 \Rightarrow 1.25$.

After mixing millimoles of HNO_3 remaining

$= 2.5 - 1.25$

$= 1.25$

Total volume $= 50 + 50$

$= 100ml$

$$\text{Molarity} = \frac{\text{No. of millimoles}}{V_{mL}}$$

$$= \frac{1.25}{100} \Rightarrow 1.25 \times 10^{-2}.$$

(HNO_3) is mono basic

Normality = Molarity × basicity

$= 1.25 \times 10^{-2} \times 1$

$[H_3O^+] = 1.25 \times 10^{-2}$

$pH = -\log_{10}[H_3O^+]$

$= -\log_{10} 1.25 \times 10^{-2}$

$= -\log_{10} 1.25 - \log_{10} 10^{-2}$

$= -\log_{10} 1.25 + 2\log_{10} 10$

$= 2 - 0.0969$

$pH = 1.9031$

2.0000
0.0969
1.9031

19. Solubility product of Ag_2CrO_4 is 1×10^{-12}. What is the solubility of Ag_2CrO_4 in 0.01 M $AgNO_3$ solution?

Sol:

$$Ag_2CrO_4 \longrightarrow 2Ag^+ + CrO_4^{2-}$$

Solubility $\underset{0.01M}{AgNO_3} \longrightarrow \underset{0.01M}{Ag^+} + \underset{0.01M}{NO_3}$

concentration

$[Ag^+] = 2S + 0.01$

$\boxed{\therefore 0.01 >> 2S, 2S}$

can be neglated

$[Ag^+] = 0.01 \Rightarrow 1\times10^{-2}$

$[CrO_4^-] = S$

$k_{sp} = [Ag^+]^2[CrO_4^-]$

$1\times10^{-12} = (1\times10^{-2})^2 \times S$ (2×2=4)

$\frac{1\times10^{-12}}{1\times10^{-4}} = S$

$S = 10^{-8} M$

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20. Write the expression for the solubility product of $Ca_3(PO_4)_2$.

Sol:

$$Ca_3(PO_4)_2 \rightarrow 3Ca^{2+} + 2PO^{3-}$$

$$k_{sp} = [Ca^{2+}]^3 [PO_4^{3-}]^2$$

$$= (3s)^3 (2s)^2$$

$$= 27s^3 \times 4s^2$$

$$k_{sp} = 108s^5.$$

24. Write the expression for the solubility product of Hg_2Cl_2.

Sol:

$$Hg_2Cl_2 \rightleftharpoons Hg_2^{2+}(aq) + 2Cl^-(aq)$$

$$k_{sp} = [Hg_2^{2+}][Cl^-]^2$$

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

$$= 4s^2 \cdot s^1$$

$$= 4s^3.$$

21. A saturated solution, prepared by dissolving $CaF_2(s)$ in water, has $[Ca^{2+}] = 3.3 \times 10^{-4}$ M. What is the k_{sp} of CaF_2?

Sol:

$$\underset{S}{CaF_2(s)} \longrightarrow \underset{3.3\times10^{-4}M}{Ca^{2+}(aq)} + \underset{2\times3.3\times10^{-4}M}{2F^-(aq)}.$$

$$k_{sp} = [Ca^{2+}][F^-]^2$$

$$= (3.3\times10^{-4})(2\times3.3\times10^{-4})^2$$

$$= 3.3\times6.6^2\times10^{-4}\times10^{-8}$$

$$= 143.748\times10^{-12}$$

$$k_{sp} = 1.44\times10^{-10}.$$

22. k_{sp} of AgCl is 1.8×10^{-10}. Calculate molar solubility in 1M $AgNO_3$.

Sol: $k_{sp} = 1.8\times10^{-10}$

$AgNO_3(aq) = 1M$.

$AgCL(s) \longrightarrow Ag^+(aq) + Cl^-(aq)$

$\underset{1M}{AgNO_3(aq)} \longrightarrow \underset{1M}{Ag^+(aq)} + \underset{1M}{NO_3^-}$

$[Ag^+] = s + 1 \approx 1 \quad (\because s << 1)$

$[Cl^-] = 1$

$k_{sp} = [Ag^+][Cl^-]$

$1.8\times10^{-10} = 1\times s$

$s = 1.8\times10^{-10} M$.

23. A particular saturated solution of silver chromate Ag_2CrO_4 has $[Ag^+] = 5\times10^{-5}$ and $[CrO_4]^{2-} = 4.4\times10^{-4}M$. What is the value of k_{sp} for Ag_2CrO_4?

Sol:

$Ag_2CrO_4 \rightleftharpoons 2Ag^+(aq) + CrO_4^{2-}(aq)$.

$[Ag^+] = 5\times10^{-5} M$

$[CrO_4^{2-}] = 4.4\times10^{-4} M$

$k_{sp} = ?$

$k_{sp} = [Ag^+]^2[CrO_4^{2-}]$

$= (5\times10^{-5})(4.4\times10^{-4})$

$k_{sp} = 1.1\times10^{-12}$

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25. k_{sp} of Ag_2CrO_4 is 1.1×10^{-12}. What is solubility of Ag_2CrO_4 in 0.1M k_2CrO_4.

Sol:

$k_{sp} = 1.1 \times 10^{-12}$ $[k_2CrO_4] = 0.1M$

$S = ?$

$$Ag_2CrO_4 \rightleftharpoons 2Ag^+ + CrO_4^{2-}$$

$$\underset{0.1M}{k_2CrO_4} \longrightarrow \underset{2\times0.1M}{2k^+} + \underset{0.1M.}{CrO_4^{2-}}$$

$[Ag^+] = 2S$

$[CrO_4^{2-}] = S + 0.1 \approx 0.1$ $(\because S << 0.1)$

$k_{sp} = [Ag^+]^2 [CrO_4^{2-}]$

$1.1 \times 10^{-12} = (2S)^2 (0.1)$

$1.1 \times 10^{-12} = 4S^2 \times 0.1$

$\frac{1.1 \times 10^{-12}}{4 \times 0.1} = S^2$

$S^2 = 2.75 \times 10^{-12}$

$S = \sqrt{2.75 \times 10^{-12}}$

$S = 1.658 \times 10^{-6} M.$

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26. Will a precipitate be formed when 0.150L of 0.1M $pbL(NO_3)_2$ and 0.100L of 0.2M NaCl are mixed? $k_p(pbCL_2) = 1.2 \times 10^{-5}$.

Sol:

Total volume $= 0.150 + 0.100 = 0.250$

$$\underset{0.1M}{Pb(NO_3)_2} \rightleftharpoons \underset{0.1M}{Pb^{2+}} + \underset{2\times0.1M.}{2NO_3^-}$$

No. of moles of pb^{2+} $= V \times M$

$= 0.150 \times 0.1$

After mixing $[Pb^{2+}]$

$$= \frac{\text{No. of moles of } Pb^{2+}}{\text{Total volume}}$$

$$= \frac{0.100 \times 0.2}{0.250} \longrightarrow 0.08\,M.$$

After mixing $[Pb^{2+}]$

$= 0.06\,M = [Cl] = 0.08\,M$

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

Ionic product $= [Pb^{2+}][Cl]^2$

$= (0.06)(0.08)^2$

$= 3.84 \times 10^{-4}$

Given: $k_{sp} = 1.2 \times 10^{-5}$

product $> k_{sp}$

$\Rightarrow$ precipitation of $PbCl_2$ will occurs.

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27. k_{sp} of $Al(OH)_3$ is 1×10^{-15} M. At what pH does 1.0×10^{-3} M precipitate on the addition of buffer of NH_4Cl and NH_4OH solution?

Sol:

$$Al(OH)_3 \rightleftharpoons Al^{3+} + 3OH^-$$

$$k_{sp} = [Al^{3+}][OH^-]^3$$

$Al(OH)_3$ precipitates when ionic product $> k_{sp}$

$$[Al^{3+}][OH^-]^3 > k_{sp}$$

$$(1 \times 10^{-3})[OH^-]^3 > 1 \times 10^{-15}$$

$$[OH]^3 > \frac{1 \times 10^{-15}}{1 \times 10^{-3}}$$

$$[OH]^3 > 1 \times 10^{-\cancel{12}\,4}$$

$$[OH^-] > 1 \times 10^{-4}$$

$$[OH^-] = 1 \times 10^{-4} M$$

$$pOH = 4$$

$$pH = 14 - pOH$$

$$= 14 - 4$$

$$pH = 10$$

$AlCOH_3$ precipitates at a pH = 10.

1. Calculate the pH of 10^{-7} M HCl.

Sol:

$$[H_3O^+] = [HCl] = 10^{-7} M.$$

$[H_3O^+] = 10^{-7}$ from HCl + 10^{-7} from H_2O

$= 10^{-7}(1+1)$

$[H_3O^+] = 2 \times 10^{-7}$

$$pH = -\log_{10}[H_3O^+]$$

$$= -\log_{10}(2 \times 10^{-7}).$$

$$= -\log_{10} 2 - \log_{10} 10^{-7}$$

$$= -\log_{10} 2 + 7 \log_{10} 10$$

$$= -\log_{10} 2 + 7$$

$$= 7 + 0.3010$$

$$= 6.6990.$$

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