

+2
CHEMISTRY

Q. 70

**Compulsory
Problems with Solution**



**Problems are solved in easiest way
(As per Government Answer Key)**

SALIENT FEATURES

Dear Students

- * Q.No: 70 is asked as compulsory problem in Govt Exam.
- * Two problems to be answered out of four problems.
- * To simplify the problem, hints and expected compounds related to molecular formula, general formula are given in this material.
- * Problems available in PTA book and Govt exam question paper (upto **March 2013**) are solved in easiest way.
- * Repeated practice is enough to get full marks.
- * Problems are given in the following order
 - 70(a) Hydroxy derivatives
 - (b) *d*-block elements
 - or
 - (c) Carbonyl compounds
 - (d) Electro chemistry - I

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16. Hydroxy Derivatives

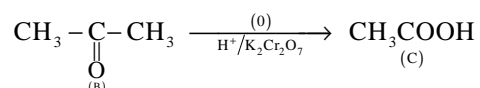
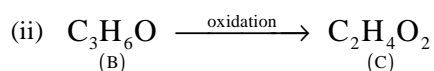
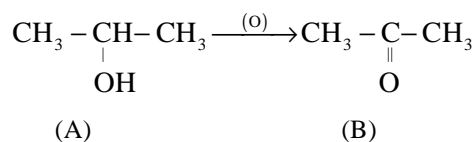
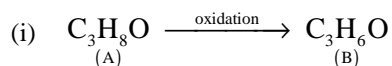
Q. No.
70 A

- * Hydroxy derivatives problems are classified into aliphatic group and aromatic group.
- * The aliphatic problem part is further classified to 1°, 2° and 3° alcohols, glycol and glycerol.
- * The aromatic problem part is subdivided into phenol and benzyl alcohol.
- * There is no need of writing equation for hints (e.g. undergoes iodoform test). Equations to be written for conversions. Such as $A \rightarrow B$, $B \rightarrow C$, $A \rightarrow D$.
- * The number of carbon atoms given in formula is C_1 to C_5 , then the molecules may be aliphatic compound. $C_2H_6O \Rightarrow C_2H_5OH$.
- * The number of carbon atoms are C_6 (or) greater than C_6 in molecular formula, then the molecules may be aromatic compounds $C_6H_6O \Rightarrow C_6H_5OH$
- * General formula for saturated aliphatic alcohols is $C_n H_{2n+2} O$ (Except Glycol, Glycerol)
- * The general formula for aliphatic aldehydes (or) ketones $C_n H_{2n} O$.

II. Problems based on Secondary alcohol

6. An organic compound (A) C_3H_8O answers Lucas test within 5-10 minutes and on oxidation forms (B) (C_3H_6O). This on further oxidation forms (C) ($C_2H_4O_2$) which gives effervescence with Na_2CO_3 . (B) also undergoes iodoform reaction. Identify (A), (B) and (C). Explain the conversion of (A) to (B) and (C).

(June-07, 09)

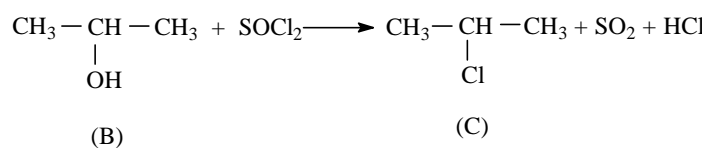
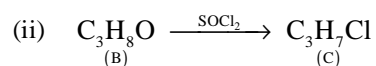
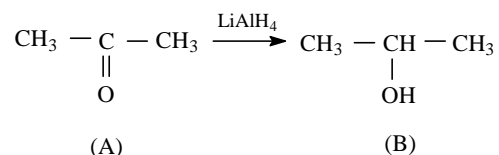
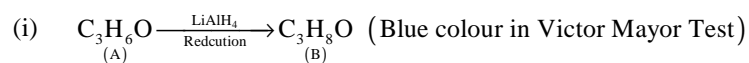


Compound	Structure	Name
A	$CH_3 - \underset{\substack{ \\ OH}}{CH} - CH_3$	Isopropyl alcohol
B	$CH_3 - \underset{\substack{ \\ O}}{C} - CH_3$	Acetone
C	CH_3COOH	Acetic Acid

5 Mark Compulsory Problems with Solution

7. An organic compound A of molecular formula C_3H_6O on reduction with $LiAlH_4$ gives B. Compound B gives blue colour in Victor Meyer's test and also forms a chloride C with $SOCl_2$. The chloride on treatment with alcoholic KOH gives B. Identify A, B and C and explain the reactions.

(PTA Question Bank, March-07)



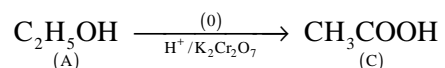
Compound	Structure	Name
A	$CH_3 - C - CH_3$ O	Acetone
B	$CH_3 - CH - CH_3$ OH	Iso propyl alcohol
C	$CH_3 - CH - CH_3$ Cl	Iso propyl chloride

8. Two organic compound A and B have the same molecular formula C_2H_6O . A react with metallic sodium to give hydrogen where 'B' does not. A on strong oxidation gives C. 'C' gives effervescence with $NaHCO_3$. Identify A, B and C. Explain the reactions.

(Model Question Paper-IV)

- (i) Compound 'A' (C_2H_6O) react with metallic sodium gives hydrogen. So 'A' is ethanol (C_2H_5OH). 'B' is dimethyl ether CH_3-O-CH_3

- (ii) $C_2H_6O \xrightarrow{(0)} (C)$ (gives brisk effervescence with $NaHCO_3$)
(A)



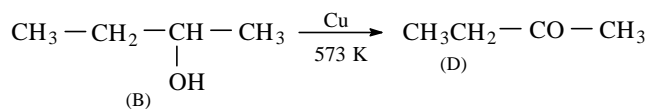
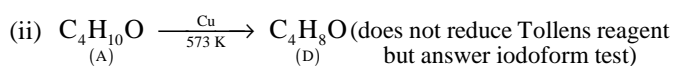
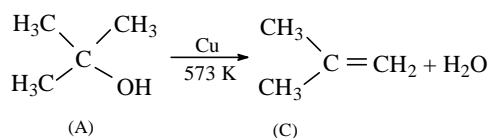
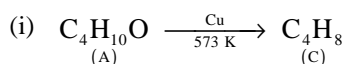
<i>Compound</i>	<i>Structure</i>	<i>Name</i>
A	C_2H_5OH	Ethanol
B	CH_3-O-CH_3	Dimethyl ether
C	CH_3COOH	Acetic acid

5 Mark Compulsory Problems with Solution

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9. Two isomers (A) and (B) have the same molecular formula $C_4H_{10}O$. (A) when heated with copper at 573 K gives an alkene (C) of molecular formula C_4H_8 . (B) on heating with copper at 573 K gives (D) of molecular formula C_4H_8O which does not reduce Tollen's reagent but answer iodoform test. Identify (A), (B), (C) and (D) and explain the reactions.

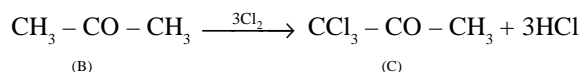
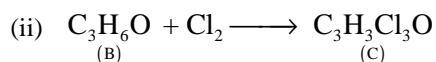
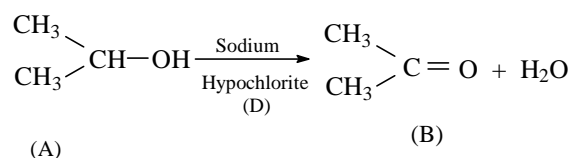
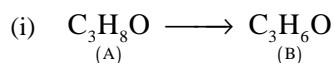
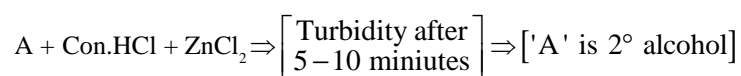
(March-09)



Compounds	Structure	Name
A	$\begin{array}{c} H_3C \quad CH_3 \\ \diagdown \quad / \\ C \\ / \quad \diagdown \\ H_3C \quad OH \end{array}$	3° butyl alcohol
B	$CH_3CH_2 - \underset{\substack{ \\ OH}}{CH} - CH_3$	2° butyl alcohol
C	$\begin{array}{c} CH_3 \\ \diagdown \\ C = CH_2 \\ / \\ CH_3 \end{array}$	Isobutylene
D	$CH_3 - CH_2 - CO - CH_3$	Ethyl methyl ketone

10. An organic compound 'A' has the formula C_3H_8O with sodium hypochlorite it gives 'B' (C_3H_6O). 'B' reacts with chlorine to give 'C' ($C_3H_3Cl_3O$). 'A' with anhydrous zinc chloride and conc HCl gives turbidity after 5 to 10 minutes. What are A, B and C? Explain the reactions.

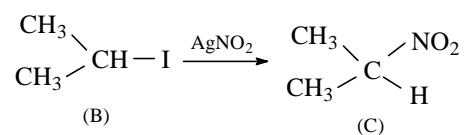
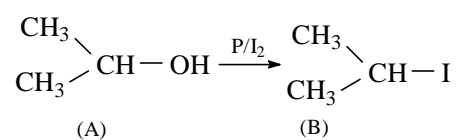
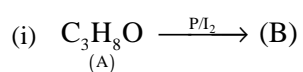
(PTA, March-06)



Compounds	Structure	Name
A	$\begin{array}{c} \text{CH}_3 \\ \diagdown \\ \text{CH}-\text{OH} \\ \diagup \\ \text{CH}_3 \end{array}$	Iso propyl alcohol
B	$\begin{array}{c} \text{CH}_3 \\ \diagdown \\ \text{C}=\text{O} \\ \diagup \\ \text{CH}_3 \end{array}$	Acetone
C	$\text{CCl}_3-\text{CO}-\text{CH}_3$	Trichloro acetone

11. Compound (A) of molecular formula C_3H_8O liberates hydrogen with sodium metal. (A) with P/I_2 gives (B). Compound (B) on treatment with silver nitrite gives (C) which gives blue colour with nitrous acid. Identify (A), (B) and (C) and explain the reactions.

(Sep-09)



Compounds	Structure	Name
A	$\begin{array}{c} CH_3 \\ \diagdown \\ CHOH \\ \diagup \\ CH_3 \end{array}$	Isopropyl Alcohol
B	$\begin{array}{c} CH_3 \\ \diagdown \\ CH-I \\ \diagup \\ CH_3 \end{array}$	Isopropyl Iodide
C	$\begin{array}{c} CH_3 \\ \diagdown \\ C-NO_2 \\ \diagup \\ CH_3 \\ \diagdown \\ H \end{array}$	2-Nitro propane

4. d-Block Elements

Q.No.
70 b

	Name of the elements				
	Copper (Cu)	Chromium (Cr)	Zinc (Zn)	Silver (Ag)	Gold (Au)
Period	4	4	4	5	6
Group	11	6	12	11	11

Name of the compounds	Formula
Copper sulphate penta hydrate (Blue vitriol)	$\text{CuSO}_4 \cdot 5\text{H}_2\text{O}$
Potassium dichromate	$\text{K}_2\text{Cr}_2\text{O}_7$
Silver Nitrate (Lunar Caustic)	AgNO_3
Zinc carbonate (Calamine)	ZnCO_3
Purple of cassius	Colloidal gold (Au)

	Hints given in Problem	Name
1.	Orange Red orystals	Potassium dichromate
2.	Yellow colour compound	Potassium chromate
3.	Philosopher's cool	Zinc oxide
4.	Compound used in photography	Silver bromide

I. Problems based on Copper

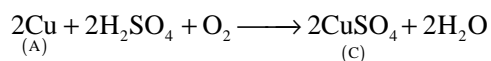
1. An element (A) occupies group number 11 and period number 4. This metal is extracted from its mixed sulphide ore (B). (A) reacts with dil. H_2SO_4 in presence of air and forms (C) which is colourless. With water (C) gives a blue colour compound D. Identify (A), (B), (C) and D and explain the reactions.

(March-07, July-10)

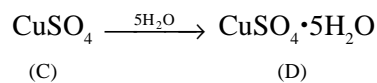
(i) $A \Rightarrow$ Period 4, Group 11 \Rightarrow Copper (Cu)

$B \Rightarrow$ Copper pyrite $\Rightarrow \text{CuFeS}_2$

(ii) $(A) + \text{dil. H}_2\text{SO}_4 + \text{Air} \longrightarrow (C)$



(iii) 'C' + water \longrightarrow D (Blue colour)

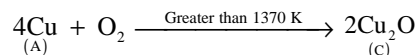
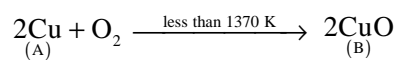


<i>Compounds</i>	<i>Structure</i>	<i>Name</i>
A	Copper	Cu
B	Copper pyrite	CuFeS_2
C	Copper sulphate	CuSO_4
D	Copper sulphate penta hydrate	$\text{CuSO}_4 \cdot 5\text{H}_2\text{O}$

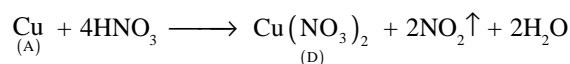
2. An element (A) belonging to Group No. 11 and period No. 4 is extracted from the pyrite ore. (A) reacts with oxygen at two different temperatures forming compounds (B) and (C). (A) also reacts with conc. HNO_3 to give (D) with the evolution of NO_2 . Find out (A), (B), (C) and (D). Explain the reactions.

(Sep-07, March-10, 13)

- (i) A is an element \Rightarrow Period 4 Group 11 \Rightarrow Copper (Cu)



- (ii) (A) + conc. $\text{HNO}_3 \longrightarrow$ (D) + NO_2

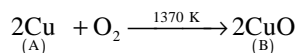


Compounds	Structure	Name
A	Copper	Cu
B	Cupric oxide	CuO
C	Cuprous oxide	Cu_2O
D	Copper (II) Nitrate	$\text{Cu}(\text{NO}_3)_2$

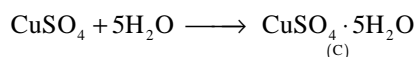
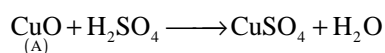
3. A reddish brown metal 'A' on heating to redness gives 'B' which is Black in colour. 'B' dissolves in dil.H₂SO₄ to give 'C' which is blue crystal. On heating to 230°C, 'C' gives 'D' which is white in colour, which on further heating to 720°C gives back 'B'. What are A, B, C, and D. Explain the reactions.

(Model Question Paper - II)

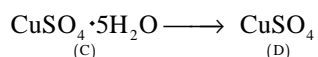
- (i) Reddish brown metal $\xrightarrow{1370\text{ K}}$ (B) Black colour
(A)



- (ii) (B) + dil H₂SO₄ \longrightarrow (C) Blue colour



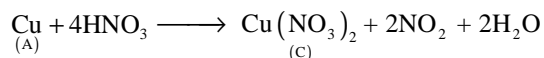
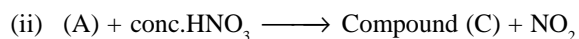
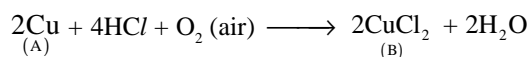
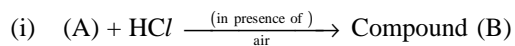
- (iii) (C) $\xrightarrow{230^\circ\text{C}}$ (D) white colour compound



Compounds	Structure	Name
A	Copper	Cu
B	Cupric oxide	CuO
C	Blue vitriol	CuSO ₄ ·5H ₂ O
D	Copper sulphate	CuSO ₄

4. An element (A) belongs to group number 11 and period number 4. (A) is a reddish brown metal. (A) reacts with HCl in the presence of air and gives compound (B). (A) also reacts with conc. HNO₃ to give compound (C) with the liberation of NO₂. Identify (A), (B) and (C), Explain the reactions.

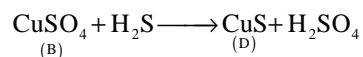
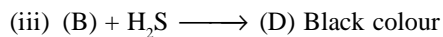
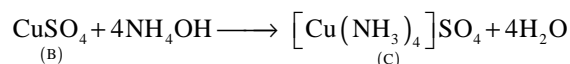
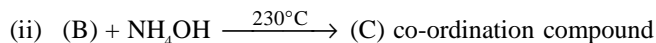
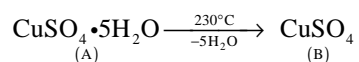
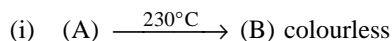
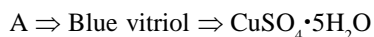
(Mar-06, July-10)



<i>Compound</i>	<i>Structure</i>	<i>Name</i>
A	Copper	Cu
B	Copper (II) Chloride	CuCl ₂
C	Copper Nitrate	Cu(NO ₃) ₂

5. Compound (A) also known as blue vitriol can be prepared by dissolving cupric oxide in dil H_2SO_4 . A on heating to $230^\circ C$ gives compound B which is white in colour. A reacts with excess of NH_4OH and gives C which is a complex salt. A also reacts with H_2S and gives compound D which is black in colour. Find out A, B, C and D. Explain the reactions.

(PTA)

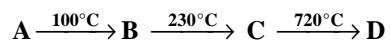


Compounds	Structure	Name
A	Blue vitriol	$CuSO_4 \cdot 5H_2O$
B	Copper sulphate	$CuSO_4$
C	Tetramine Copper (II) Sulphate	$[Cu(NH_3)_4]SO_4$
D	Copper sulphide	CuS

5 Mark Compulsory Problems with Solution

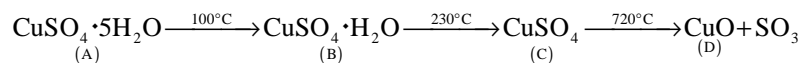
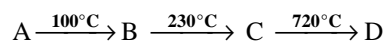
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6. Compound (A) is a sulphate compound of group 11 element. This compound is also called as Blue Vitriol. The compound undergoes decomposition at various temperatures.



What are (A), (B), (C) and (D). Explain the reactions.

(July-09)



Compounds	Structure	Name
A	Copper Sulphate Pentahydrate	$\text{CuSO}_4 \cdot 5\text{H}_2\text{O}$
B	Copper Sulphate Monohydrate	$\text{CuSO}_4 \cdot \text{H}_2\text{O}$
C	Copper Sulphate	CuSO_4
D	Cupric oxide	CuO

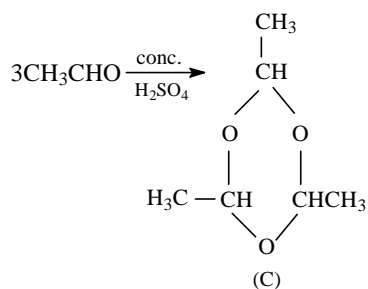
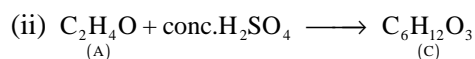
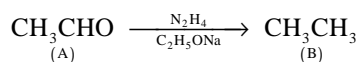
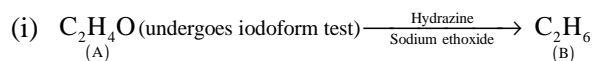
18. Carbonyl Compounds

Q.No.
70 c

I. Problems based on Acetaldehyde and Acetone

1. An organic compound A(C₂H₄O) undergoes iodoform test. With hydrazine and sodium ethoxide 'A' gives 'B' (C₂H₆), a hydrocarbon. 'A' with H₂SO₄ gives 'C' (C₆H₁₂O₃). What are A, B and C? Explain the reactions.

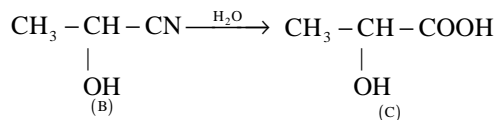
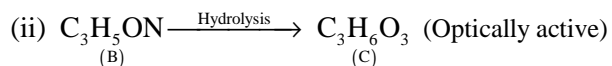
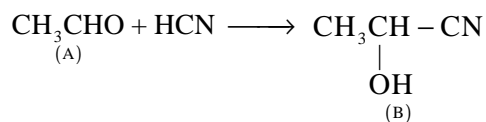
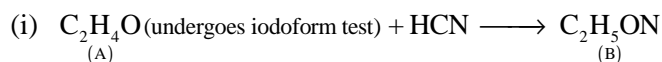
(PTA)



Compounds	Structure	Name
A	Acetaldehyde	CH ₃ CHO
B	Ethane	CH ₃ -CH ₃
C	Paraldehyde	$\begin{array}{c} \text{CH}_3 \\ \\ \text{CH} \\ / \quad \backslash \\ \text{O} \quad \text{O} \\ \quad \\ \text{CH}_3-\text{CH} \quad \text{CHCH}_3 \\ \backslash \quad / \\ \text{O} \end{array}$

2. An organic compound A (C_2H_4O) with HCN gives B(C_3H_5ON). B on hydrolysis gives C ($C_3H_6O_3$) which is an optically active compound. A also undergoes iodoform test. What are A, B and C? Explain the reactions.

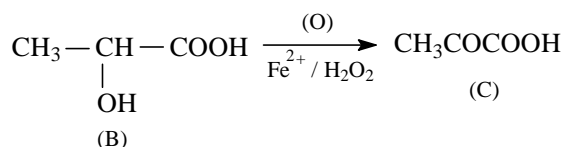
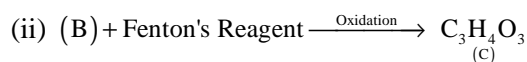
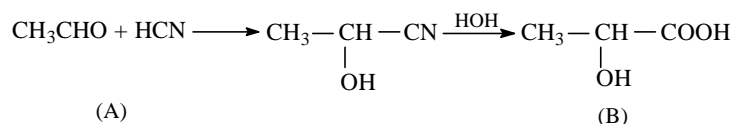
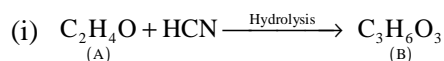
(PTA, Sep-11)



Compounds	Structure	Name
A	CH_3CHO	Acetaldehyde
B	$\begin{array}{c} CH_3 - CH - CN \\ \\ OH \end{array}$	Acetaldehyde cyano hydrin
C	$\begin{array}{c} CH_3 - CH - COOH \\ \\ OH \end{array}$	Lactic acid

3. Compound (A) having the molecular formula C_2H_4O reduces Tollen's reagent. (A) on treatment with HCN followed by hydrolysis gives the compound (B) with molecular formula $C_3H_6O_3$. Compound B on oxidation by Fenton's reagent gives the compound (C) with the molecular formula $C_3H_4O_3$. Find (A), (B) and (C). Explain the reactions.

(July-08, Oct-08, Mar-10)



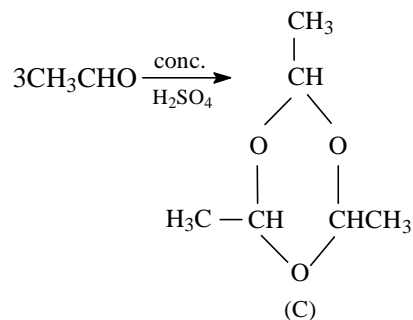
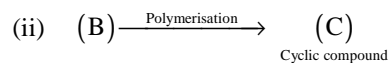
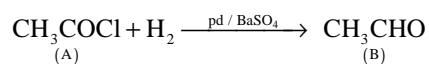
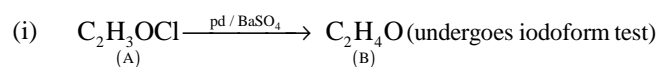
Compounds	Structure	Name
A	CH_3CHO	Acetaldehyde
B	$CH_3-\underset{\substack{ \\ OH}}{CH}-COOH$	Lactic acid
C	CH_3COCO_2H	Pyruvic acid

5 Mark Compulsory Problems with Solution

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4. An organic Compound (A) C_2H_3OCl on treatment with $Pd / BaSO_4$ gives (B) (C_2H_4O) which answers iodoform test. (B) When treated with conc. H_2SO_4 undergoes polymerisation to give (C) a cyclic compound. Identify (A), (B) and (C) and explain the reactions.

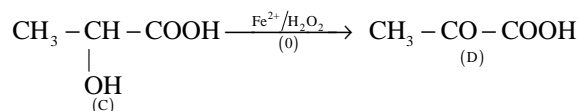
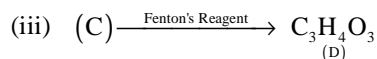
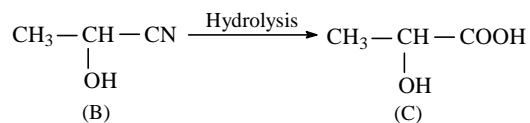
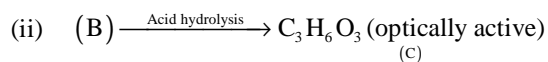
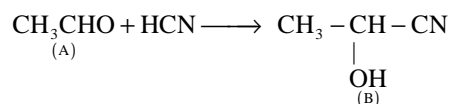
(Sep-09)



Compounds	Structure	Name
A	Acetyl chloride	CH_3COCl
B	Acetaldehyde	CH_3-CHO
C	Paraldehyde	$\begin{array}{c} \text{CH}_3 \\ \\ \text{CH} \\ / \quad \backslash \\ \text{O} \quad \text{O} \\ \quad \\ \text{CH}_3-\text{CH} \quad \text{CH}-\text{CH}_3 \\ \backslash \quad / \\ \text{O} \end{array}$

5. Compound (A) with molecular formula C_2H_4O reduces Tollen's reagent. (A) on treatment with HCN gives compound (B). Compound (B) on hydrolysis with an acid gives compound (C) with molecular formula $C_3H_6O_3$. Compound (C) is optically active. Compound (C) on treatment with Fenton's reagent gives compound (D) with molecular formula $C_3H_4O_3$. Compound (C) and (D) give effervescence with explain the reactions.

(March-10, Sep-11)



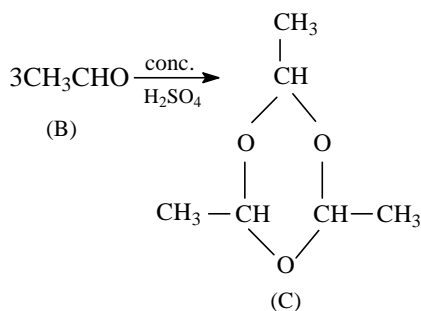
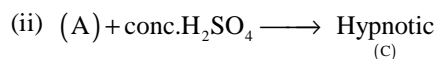
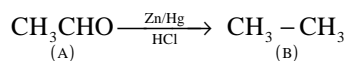
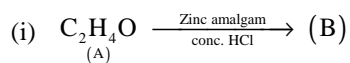
<i>Compounds</i>	<i>Structure</i>	<i>Name</i>
A	CH_3CHO	Acetaldehyde
B	$\begin{array}{c} \text{CH}_3 - \text{CH} - \text{CN} \\ \\ \text{OH} \end{array}$	Acetaldehyde Cyanohydrin
C	$\begin{array}{c} \text{CH}_3 - \text{CH} - \text{COOH} \\ \\ \text{OH} \end{array}$	Lactic acid
D	$\text{CH}_3\text{COCO}_2\text{H}$	Pyruvic acid

5 Mark Compulsory Problems with Solution

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6. Compound A (C_2H_4O) reduces Tollen's reagent. A on treatment with zinc amalgam and conc. HCl give compound B. In presence of conc. H_2SO_4 , A forms a cyclic structure C which is used as hypnotic. Identify A, B and C. Explain the reactions.

(July-11)



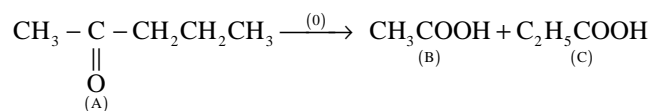
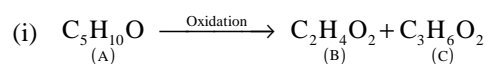
Compounds	Structure	Name
A	CH_3CHO	Acetaldehyde
B	CH_3CH_3	Ethane
C	$\begin{array}{c} CH_3 \\ \\ CH \\ / \quad \backslash \\ O \quad \quad O \\ \quad \quad \\ CH_3-CH \quad CH-CH_3 \\ \backslash \quad / \\ O \end{array}$	Paraldehyde

5 Mark Compulsory Problems with Solution

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7. An organic compound 'A' ($C_5H_{10}O$) does not reduce Tollen's reagent. It is a linear compound and undergoes iodoform test on oxidation 'A' gives 'B' ($C_2H_4O_2$) and 'C' ($C_3H_6O_2$) as the major product. Identify A, B and C. Explain the reactions.

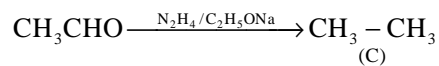
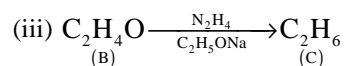
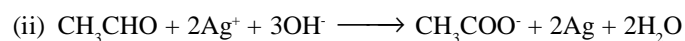
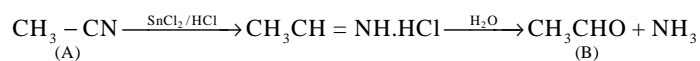
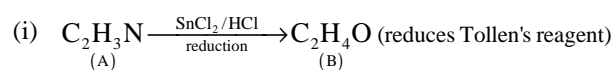
(PTA)



Compounds	Structure	Name
A	$CH_3 - \underset{\substack{\parallel \\ O}}{C} - CH_2CH_2CH_3$	Methyl propyl ketone
B	CH_3COOH	Acetic acid
C	C_2H_5COOH	Propionic acid

8. An organic compound A (C_2H_3N) on reduction with $SnCl_2/HCl$ gives B (C_2H_4O) which reduces Tollen's reagent. Compound B on reduction with N_2H_4/C_2H_5ONa gives C (C_2H_6). Identify the compounds A, B and C. Explain the reactions involved.

(Sep-12)



Compounds	Structure	Name
A	$CH_3 - CN$	Methyl cyanide
B	CH_3CHO	Acetaldehyde
C	$CH_3 - CH_3$	Ethane

13. Electro Chemistry-I

Q. No.
70 d

Hints

- * Quantity of current $Q = It$
- * Mass of substance liberated by passing current $m = ZIt$
- * Equivalent mass = $\frac{\text{Atomic mass}}{\text{Valency}}$
- * (Equivalent mass of Cu = 31.77, Ag = 108, I = 127, Al = 9)
- * Electro chemical equivalent = $\frac{\text{Equivalent mass}}{96495}$
- * 1 faraday = 96495 coulomb
- * Equivalent conductance $\lambda_c = \frac{\kappa \times 1000}{C} \text{ mho.cm}^2(\text{g.equiv.})^{-1}$
(or) $\frac{\kappa \times 10^{-3}}{N} \text{ mho.m}^2 (\text{g.equiv})^{-1}$
- * Molar conductance $\mu_c = \frac{\kappa \times 10^{-3}}{M} \text{ mho.m}^2.\text{mol}^{-1}$
- * Molar conductance = Cell constant \times Conductivity
(or) Cell constant / Resistance
- * Cell constant = $\frac{l}{a}$
- * Degree of dissociation $\alpha = \frac{\lambda_\alpha}{\lambda_c}$ (or) $\sqrt{\frac{K_a}{C}}$
- * For weak acids $[H^+] = C\alpha = \sqrt{K_a \times C}$
- * For weak bases $[OH^-] = C\alpha = \sqrt{K_b \times C}$
- * Dissociation constant for weak acid $K_a = \frac{\alpha^2 C}{1 - \alpha}$

5 Mark Compulsory Problems with Solution

- * $\text{pH} = -\log [\text{H}^+]$
- * $\text{pOH} = -\log [\text{OH}^-]$
- * $\text{pH} + \text{pOH} = 14$
- * $K_w = [\text{H}^+][\text{OH}^-] = 1 \times 10^{-14}$ at 298 K
- * $\text{p}K_w = 14$
- * $\text{p}K_a = -\log K_a$
- * $\text{p}K_b = -\log K_b$
- * Hendersons equation for acid buffer

$$\text{pH} = \text{p}K_a + \log \left[\frac{\text{Salt}}{\text{Acid}} \right]$$

- * Henderson equation for basic buffer

$$\text{pOH} = \text{p}K_b + \log \left[\frac{\text{Salt}}{\text{Base}} \right]$$

Exercise Problems

1. Find the pH a buffer solution containing 0.20 mole per liter sodium acetate and 0.15 mole per litre acetic acid. K_a for acetic acid is 1.8×10^{-5} . (June-06, 11, Sep-06, 07, 11)

Solution:

$$[\text{CH}_3\text{COONa}] = 0.20 \text{ mole / litre}$$

$$[\text{CH}_3\text{COOH}] = 0.15 \text{ mole / litre}$$

$$K_a = 1.8 \times 10^{-5} \text{ mole / litre}$$

pH of Buffer solution = ?

$$\text{p}K_a = -\log K_a$$

$$= -\log_{10} 1.8 \times 10^{-5}$$

$$= -[\log_{10} 1.8 + \log_{10} 10^{-5}]$$

$$= -[0.2553 - 5] = -[-4.7447]$$

$$\text{p}K_a = 4.7447$$

Henderson equation

$$\text{pH} = \text{p}K_a + \log_{10} \frac{[\text{Salt}]}{[\text{acid}]}$$

$$= 4.7447 + \log \frac{[0.20]}{[0.15]}$$

$$= 4.7447 + \log \frac{20}{15}$$

$$= 4.7447 + \log \frac{4}{3}$$

$$= 4.7447 + \log 4 - \log 3$$

$$= 4.7447 + 0.6021 - 0.4771$$

$$= 4.7447 + 0.1250$$

$$\text{pH} = 4.8697$$

2. Find the pH of a buffer solution containing 0.3 mole per litre of CH_3COONa and 0.15 mole per litre CH_3COOH . K_a for acetic acid is 1.8×10^{-5} .

(Sep-08)

Solution:

$$[\text{CH}_3\text{COONa}] = 0.30 \text{ mole / litre}^{-1}$$

$$[\text{CH}_3\text{COOH}] = 0.15 \text{ mole / litre}^{-1}$$

$$K_a = 1.8 \times 10^{-5} \text{ mole / litre}^{-1}$$

pH of buffer solution = ?

$$\text{p}K_a = -\log K_a$$

$$= -\log_{10} [1.8 \times 10^{-5}]$$

$$\text{p}K_a = 4.7447$$

Henderson equation

$$\text{pH} = \text{p}k_a + \log_{10} \frac{[\text{Salt}]}{[\text{Acid}]}$$

$$= 4.7447 + \log \frac{[0.30]}{[0.15]}$$

$$= 4.7447 + \log \frac{30}{15}$$

$$= 4.7447 + 0.3010$$

$$\text{pH} = 5.0457$$

3. What is the pH of a solution containing 0.5 M propionic acid and 0.5 M sodium propionate? The K_a of propionic acid is 1.34×10^{-5} .

(March-06, July-10)

Solution:

$$\text{Propionic acid} = 0.5 \text{ M}$$

$$\text{Sodium propionate} = 0.5 \text{ M}$$

$$K_a = 1.34 \times 10^{-5}$$

pH of buffer solution = ?

$$\begin{aligned} \text{p}K_a &= -\log K_a \\ &= -\log_{10} [1.34 \times 10^{-5}] \\ &= -[\log_{10} 1.34 + \log_{10} 10^{-5}] \\ &= -[\log_{10} 0.1217 - 5] \end{aligned}$$

$$\text{p}K_a = 4.8729$$

Henderson Equation

$$\begin{aligned} \text{pH} &= \text{p}K_a + \log_{10} \frac{[\text{Salt}]}{[\text{Acid}]} \\ &= 4.8729 + \log \frac{0.5}{0.5} \\ &= 4.8729 + \log 1 \\ &= 4.8729 + 0 \\ \text{pH} &= 4.8729 \end{aligned}$$


When the volume of buffer solution is doubled, the pH of the solution does not change.

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For complete Material

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 90802-28421

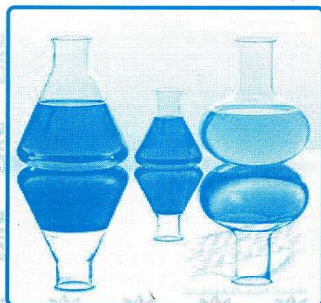
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