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Joyoshish Saha



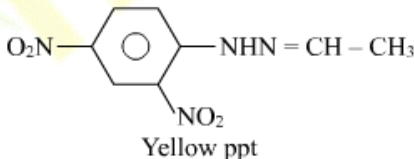
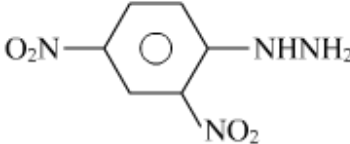
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COMMON DISTINCTION TESTS IN ORGANIC CHEMISTRY

I. R – Cl vs R – Br vs R – I (R ≡ alkyl or aryl)

SNo.	Test	R – Cl	R – Br	R – I
a)	Dil AgNO ₃	$R-Cl \xrightarrow{AgNO_3} AgCl$ (White ppt)	$R-Br \xrightarrow{AgNO_3} AgBr$ (Pale yellow ppt)	$R-I \xrightarrow{AgNO_3} AgI$ (Yellow ppt)
b)	NH ₄ OH test	above ppt of AgCl + liq. NH ₃ or NH ₄ OH ↓ ppt dissolves	above ppt of AgBr + liq. NH ₃ or NH ₄ OH ↓ ppt partially dissolves	above ppt + liq. NH ₃ or NH ₄ OH ↓ ppt remains insoluble

II. Ethylidene chloride (Geminal) vs Ethylene Dichloride (Vicinal)

SNo.	Test	$CH_3-CH \begin{matrix} \diagup Cl \\ \diagdown Cl \end{matrix}$ (Ethylidene chloride)	$Cl-CH_2-CH_2-Cl$ Ethylene dichloride
a)	Aq KOH test (Hydrolysis)	$CH_3-CH \begin{matrix} \diagup Cl \\ \diagdown Cl \end{matrix} \xrightarrow{aq\ KOH} [CH_3-CH \begin{matrix} \diagup OH \\ \diagdown OH \end{matrix}]$ $\xrightarrow{H_2O} CH_3-C \begin{matrix} \diagup H \\ \diagdown O \end{matrix}$ $\xrightarrow{-H_2O} \text{2, 4 dinitro phenyl hydrazine}$  Yellow ppt	$\begin{matrix} CH_2-CH_2 \\ \quad \\ Cl \quad Cl \end{matrix} \xrightarrow{aq\ KOH} \begin{matrix} CH_2-CH_2 \\ \quad \\ OH \quad OH \end{matrix}$  2, 4 dinitrophenyl hydrazine ↓ No reaction

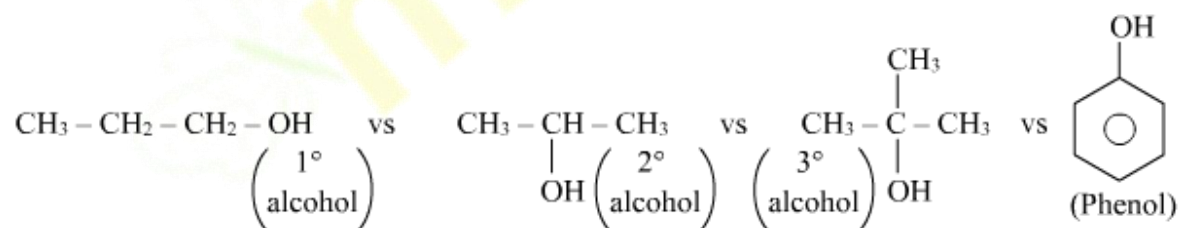
III. CHCl_3 vs $\text{CH}_3\text{Cl}/\text{CCl}_4/\text{CH}_3\text{OH}$

SNo.	Test	CHCl_3	$\text{CH}_3\text{Cl}/\text{CCl}_4/\text{CH}_3\text{OH}$
a)	Carbylamine test	$\begin{array}{c} \text{R-NH}_2 + 3\text{KOH} + \text{CHCl}_3 \\ \text{(1}^\circ \text{ amine)} \quad \downarrow \text{(aq)} \\ \text{R-NC} + 3\text{KCl} + 3\text{H}_2\text{O} \\ \text{alkyl} \\ \text{isocyanide} \\ \text{Pungent Smelling} \end{array}$	$\begin{array}{c} \text{No reaction} \end{array}$

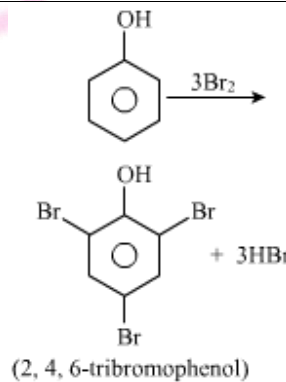
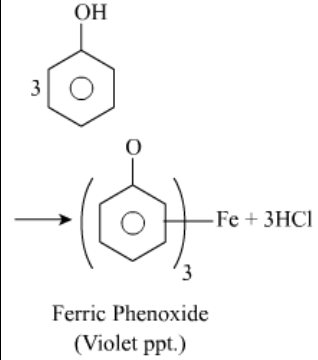
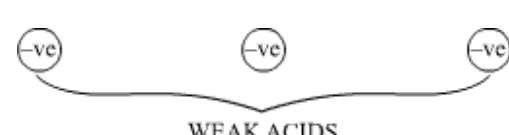
IV. $\text{CH}_3 - \text{CH}_2 - \text{OH}$ (Alcohol) vs $\text{CH}_3 - \text{O} - \text{CH}_3$ (Ether)

SNo.	Test	$\text{CH}_3 - \text{CH}_2 - \text{OH}$	$\text{CH}_3 - \text{O} - \text{CH}_3$
a)	Na metal test	$\text{CH}_3 - \text{CH}_2 - \text{OH} + \text{Na} \xrightarrow{+ve} \text{CH}_3 - \text{CH}_2 - \text{ONa} + \frac{1}{2} \text{H}_2 \uparrow$	$\text{No reaction} \quad (-ve)$
b)	Iodoform test (for alcohols having $\text{CH}_3 - \text{CH} - \text{OH}$)	$\text{CH}_3\text{CH}_2\text{OH} + 6\text{NaOH} + 4\text{I}_2 \xrightarrow{\Delta} \text{CHI}_3 \downarrow + \text{HCOONa} + 5\text{NaI} + 5\text{H}_2\text{O}$	$\text{No reaction} \quad (-ve)$

V.

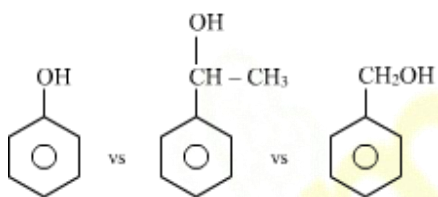


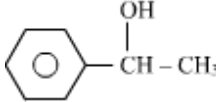
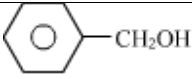
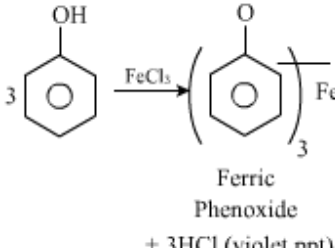
SNo.	Test	$\text{CH}_3 - \text{CH}_2 - \text{CH}_2 - \text{OH}$ (1° alcohol)	$\text{CH}_3 - \text{CH} - \text{CH}_3$ (2° alcohol)	$\text{CH}_3 - \text{C} - \text{CH}_3$ (3° alcohol)	$\text{C}_6\text{H}_5\text{OH}$ (Phenol)
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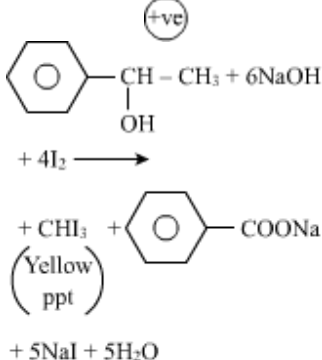
a)	Lucas Test (Conc. HCl + anhyd ZnCl₂)	Turbidity appears on heating	Turbidity appears within in 5 – 10 min.	Turbidity appears spontaneously	No appearance of turbidity (-ve)
b)	Iodoform test	(-ve)	$\text{CH}_3 - \underset{\text{OH}}{\text{CH}} - \text{CH}_3 + 6\text{NaOH} + 4\text{I}_2 \longrightarrow$ $\text{CHI}_3(\downarrow) + \text{HCOONa}$ Yellow $+ 5\text{NaI} + 5\text{H}_2\text{O}$	(-ve)	(-ve)
c)	Br₂ water test	(-ve)	(-ve)	(-ve)	 (2, 4, 6-tribromophenol)
d)	Neutral FeCl₃ Test	(-ve)	(-ve)	(-ve)	 Ferric Phenoxide (Violet ppt.)
e)	Litmus Test	 WEAK ACIDS			Turns blue litmus red

f)	Victor Meyer Test	$\begin{array}{c} \text{CH}_3\text{CH}_2\text{CH}_2\text{OH} \\ \downarrow \text{P} + \text{I}_2 \\ \text{CH}_3\text{CH}_2\text{CH}_2\text{I} \\ \downarrow -\text{AgI} \quad \text{AgNO}_2 \\ \text{CH}_3\text{CH}_2\text{CH}_2\text{NO}_2 \\ \downarrow \text{HNO}_2 \\ \text{CH}_3 - \text{C} = \text{NO}_2 \\ \parallel \\ \text{NOH} \\ \text{Nitrolic Acid} \\ \downarrow \text{NaOH} \\ \text{Blood Red Colouration} \end{array}$	$\begin{array}{c} \text{CH}_3 - \text{CH} - \text{CH}_3 \\ \\ \text{OH} \\ \downarrow \text{P} + \text{I}_2 \\ \text{CH}_3 - \text{CH} - \text{CH}_3 \\ \\ \text{I} \\ \downarrow -\text{AgI} \quad \text{AgNO}_2 \\ \text{CH}_3 - \text{CH} - \text{CH}_3 \\ \\ \text{NO}_2 \\ \downarrow \text{HNO}_2 \\ \text{CH}_3 - \text{C} - \text{CH}_3 \\ \\ \text{N} = \text{O} \\ \text{Pseudonitrol} \\ \downarrow \text{NaOH} \\ \text{Blue Colouration} \end{array}$	$\begin{array}{c} \text{CH}_3 \\ \\ \text{CH}_3 - \text{C} - \text{OH} \\ \\ \text{CH}_3 \\ \downarrow \text{P} + \text{I}_2 \\ \text{CH}_3 \\ \\ \text{CH}_3 - \text{C} - \text{I} \\ \\ \text{CH}_3 \\ \downarrow -\text{AgI} \quad \text{AgNO}_2 \\ \text{CH}_3 \\ \\ \text{CH}_3 - \text{C} - \text{NO}_2 \\ \\ \text{CH}_3 \\ \downarrow \text{HNO}_2 \\ \text{No reaction} \\ \downarrow \text{NaOH} \\ \text{Colourless} \end{array}$	(-ve)
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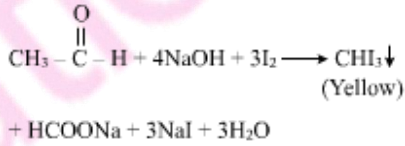
VI.



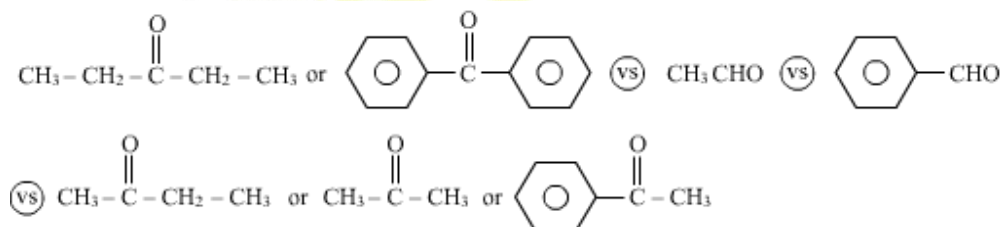
SNo.	Test			
a)	Litmus Test	Turns blue Litmus to red	(-ve)	(-ve)
b)	Neutral FeCl₃ test		(-ve)	(-ve)

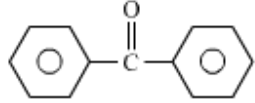
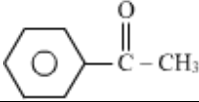
c)	Iodoform Test	(-ve)	<div style="text-align: center;">  </div>	(-ve)
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VII. HCHO vs CH₃CHO

SNo.	Test	HCHO	CH ₃ CHO
a)	Iodoform test	(-ve)	<div style="text-align: center;">  </div>
b)	Liquor Ammonia Test	$6\text{HCHO} + 4\text{NH}_3 \longrightarrow (\text{CH}_2)_6\text{N}_4 + 6\text{H}_2\text{O}$ Hexamethylene tetramine (urotropine)	$\text{CH}_3 - \text{C} \begin{matrix} \text{H} \\ \diagup \\ \text{O} \end{matrix} + \text{NH}_3 \longrightarrow \text{CH}_3 - \text{CH} = \text{NH}$ Addition product

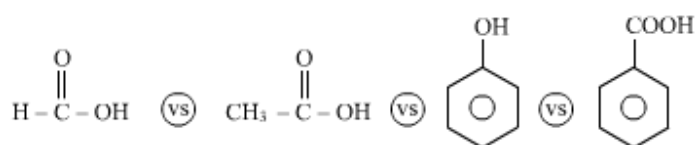
VIII.



SNo.	Test	$\text{CH}_3 - \text{CH}_2 - \overset{\text{O}}{\parallel} \text{C} - \text{CH}_2 - \text{CH}_3$ or 	CH ₃ CHO	$\text{CH}_3 - \overset{\text{O}}{\parallel} \text{C} - \text{CH}_2 - \text{CH}_3$ or $\text{CH}_3 - \overset{\text{O}}{\parallel} \text{C} - \text{CH}_3$ or 
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a)	Iodoform test	(-ve)	(+ve)	(-ve)	(+ve)
			$\text{CH}_3 - \text{CHO} + 4\text{NaOH} + 3\text{I}_2 \longrightarrow \text{CHI}_3 \downarrow + \text{HCOONa} + 3\text{NaI} + 3\text{H}_2\text{O}$ <p>(Yellow)</p>		$\begin{array}{c} \text{O} \\ \parallel \\ \text{CH}_3 - \text{C} - \text{CH}_2 - \text{CH}_3 \\ \text{or} \\ \text{O} \\ \parallel \\ \text{CH}_3 - \text{C} - \text{CH}_3 \\ \text{or} \\ \downarrow \\ \text{CHI}_3 + 3\text{NaI} + 3\text{H}_2\text{O} + \\ \text{CH}_3\text{CH}_2\text{COONa} \text{ or} \\ \text{CH}_3\text{COONa} \text{ or} \\ \text{C}_6\text{H}_5\text{COONa} \end{array}$
b)	Tollen's reagent (amm. silver nitrate)	(-ve)	(+ve)	(+ve)	(-ve)
			$\begin{array}{l} \text{CH}_3\text{CHO} + 2[\text{Ag}(\text{NH}_3)_2]^+ + 2\text{OH}^- \longrightarrow \\ \text{CH}_3\text{COO}^- + \text{NH}_4^+ + 2\text{Ag} \downarrow + \text{H}_2\text{O} + 3\text{NH}_3 \end{array}$	$\begin{array}{l} \text{C}_6\text{H}_5\text{CHO} + 2[\text{Ag}(\text{NH}_3)_2]^+ + 2\text{OH}^- \longrightarrow \\ \text{C}_6\text{H}_5\text{COO}^- + \text{NH}_4^+ + 2\text{Ag} \downarrow + \text{H}_2\text{O} + 3\text{NH}_3 \end{array}$	
c)	Fehling's solution (copper sulphate + sodium potassium tartarate)	(-ve)	(+ve)	(+ve)	(-ve)
			$\begin{array}{l} \text{CH}_3\text{CHO} + 2[\text{Cu}(\text{OH})_2] + \text{NaOH} \\ \downarrow \\ \text{CH}_3\text{COO}^- + \text{Na}^+ + \text{Cu}_2\text{O} + 3\text{H}_2\text{O} \\ \text{(Red ppt)} \end{array}$	Oxidation is very difficult	

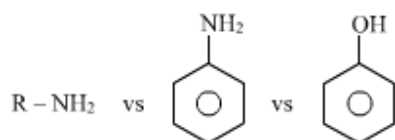
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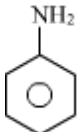
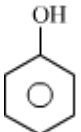


SNo.	Test	$\text{H}-\overset{\text{O}}{\parallel}{\text{C}}-\text{OH}$	$\text{CH}_3-\overset{\text{O}}{\parallel}{\text{C}}-\text{OH}$	$\text{C}_6\text{H}_5\text{OH}$	$\text{C}_6\text{H}_5\text{COOH}$
a)	Tollen's test	(+ve) $\text{HCOOH} + \text{Ag}_2\text{O} \rightarrow \text{CO}_2 + \text{H}_2\text{O} + 2\text{Ag}\downarrow$	(-ve)	(-ve)	(-ve)
b)	Fehling's Solution test	(+ve) $\text{HCOOH} + 2\text{CuO} \rightarrow \text{CO}_2 + \text{H}_2\text{O} + \text{Cu}_2\text{O}\downarrow$ (Reddish Brown ppt)	(-ve)	(-ve)	(-ve)
c)	NaHCO_3 test	(+ve) $\text{HCOOH} + \text{NaHCO}_3 \rightarrow \text{HCOONa} + \text{H}_2\text{O} + \text{CO}_2\uparrow$ (Brisk Effervescence)	(+ve) $\text{CH}_3-\text{COOH} + \text{NaHCO}_3 \rightarrow \text{CH}_3\text{COONa} + \text{H}_2\text{O} + \text{CO}_2\uparrow$ (Brisk Effervescence)	(-ve)	(+ve) $\text{C}_6\text{H}_5\text{COOH} + \text{NaHCO}_3 \rightarrow \text{C}_6\text{H}_5\text{COONa} + \text{H}_2\text{O} + \text{CO}_2\uparrow$ (Brisk Effervescence)

d)	Neutral FeCl_3 test	(-ve)	(-ve)	(+ve)	(+ve)
				$3 \text{ C}_6\text{H}_5\text{OH} + \text{FeCl}_3 \rightarrow \left(\text{C}_6\text{H}_5\text{O} \right)_3\text{Fe} + 3\text{HCl}$ <p>(Violet ppt of ferric phenoxide)</p>	$3 \text{ C}_6\text{H}_5\text{COOH} + \text{FeCl}_3 \rightarrow \left(\text{C}_6\text{H}_5\text{COO} \right)_3\text{Fe} + 3\text{HCl}$ <p>(Brown ppt of ferric benzoate)</p>

X.



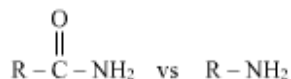
SNo.	Test	$\text{R}-\text{NH}_2$		
a)	Bromine water	(-ve)	<p>(+ve)</p> $\text{C}_6\text{H}_5\text{NH}_2 + 3\text{Br}_2 \rightarrow \text{2,4,6-tribromo aniline} + 3\text{HBr}$ <p>(White ppt)</p>	<p>(+ve)</p> $\text{C}_6\text{H}_5\text{OH} + 3\text{Br}_2 \rightarrow \text{2,4,6-tribromo phenol} + 3\text{HBr}$ <p>(White ppt)</p>
b)	Neutral FeCl_3	(-ve)	(-ve)	(+ve)

				$3 \text{ } \text{C}_6\text{H}_5\text{OH} + \text{FeCl}_3 \rightarrow$ $\left(\text{C}_6\text{H}_5\text{O} \right)_3\text{Fe} + 3\text{HCl}$ <p>(Violet ppt of ferric phenoxide)</p>
c)	Carbylamine test	$\text{R-NH}_2 + 3\text{KOH} + \text{CHCl}_3 \xrightarrow{\text{(aq)}} \text{RNC} + \text{alkyl isocyanide} + 3\text{KCl} + 3\text{H}_2\text{O}$ <p>(Pungent smelling)</p>	$\text{C}_6\text{H}_5\text{NH}_2 + 3\text{KOH} + \text{CHCl}_3 \xrightarrow{\text{(aq)}} \text{C}_6\text{H}_5\text{NCO} + 3\text{KCl} + 3\text{H}_2\text{O}$ <p>Phenyl Isocyanide (Pungent smelling)</p>	
d)	Azo Dye Text	Azo dye formed is unstable, so cannot be removed from solution	$\text{C}_6\text{H}_5\text{NH}_2 \xrightarrow[\text{HCl}]{\text{NaNO}_2} \text{C}_6\text{H}_5\text{N}_2\text{Cl} \xrightarrow[0^\circ\text{C}]{-\text{HCl}} \text{C}_6\text{H}_5\text{N}=\text{N}-\text{C}_6\text{H}_4\text{OH}$ <p>Azo dye</p>	

XI. R – NH₂ vs R₂NH vs R₃N

SNo.	Test	R – NH ₂ (1° amine)	R ₂ NH (2° amine)	R ₃ N
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a)	Carbylamine Test	$\text{R-NH}_2 + \text{CHCl}_3 + 3\text{KOH (aq)} \rightarrow \text{R-NC} + 3\text{KCl} + 3\text{H}_2\text{O}$ <p>alkyl isocyanide (Pungent smelling)</p>	(-ve)	(-ve)
b)	Nitrous Acid Test	$\text{R-NH}_2 + \text{HO-N=O} \rightarrow \text{R-OH} + \text{N}_2\uparrow + \text{H}_2\text{O}$ <p>Evolution of nitrogen</p>	$\text{R}_2\text{-N-H} + \text{HO-N=O} \rightarrow \text{R}_2\text{N-N=O}$ <p>N-nitroso dialkyl amine (Yellow oily liquid) + Phenol $\xrightarrow{\text{Warm}}$ Green colour</p>	$\text{R}_3\text{N} + \text{HNO}_2 \xrightarrow{\text{Warm}} \text{R}_3\text{NHNO}_2$ <p>(Water Soluble)</p>
c)	Hinsberg's Test [Hinsberg's Reagent is a mixture of (i) Benzene sulphonyl chloride, (ii) KOH, and (iii) HCl]	$\text{R-NH}_2 + \text{C}_6\text{H}_5\text{SO}_2\text{Cl} \xrightarrow{-\text{HCl}} \text{R-NH-SO}_2\text{C}_6\text{H}_5$ <p>N-alkylbenzene sulphonamide (Insoluble)</p> $\xrightarrow[-\text{H}_2\text{O}]{\text{KOH}} \left[\text{R-N} \begin{array}{c} \text{O} \\ \parallel \\ \text{S} \\ \parallel \\ \text{O} \end{array} \text{C}_6\text{H}_5 \right] \text{K}^+$ <p>Pot. Salt (Soluble in KOH)</p> $\xrightarrow[-\text{KCl}]{\text{HCl}} \text{R-NH-SO}_2\text{C}_6\text{H}_5$ <p>N-alkylbenzene sulphonamide (insoluble)</p>	$\text{H-N(R)-R} + \text{C}_6\text{H}_5\text{SO}_2\text{Cl} \xrightarrow{-\text{HCl}} \text{R}_2\text{N-SO}_2\text{C}_6\text{H}_5$ <p>N, N-dialkyl-benzene sulphonamide</p> $\xrightarrow{\text{KOH}} \text{No reaction (Insoluble)}$ $\xrightarrow{\text{HCl}} \text{No reaction (Insoluble)}$	$\text{R-N(R)-R} + \text{C}_6\text{H}_5\text{SO}_2\text{Cl} \xrightarrow{\text{No reaction (Insoluble)}} \xrightarrow{\text{HCl}} \text{R}_3\text{NHCl}^+$ <p>Trialkyl-ammonium chloride (Soluble in HCl)</p>



SNo.	Test	$\text{R}-\overset{\text{O}}{\parallel}{\text{C}}-\text{NH}_2$	$\text{R}-\text{NH}_2$
a)	Litmus Test	No response to litmus	Red litmus changes to Blue
b)	Carbylamine test	(-ve)	$\text{R}-\text{NH}_2 + \text{CHCl}_3 + 3\text{KOH (aq)} \longrightarrow \text{RNC} + 3\text{KCl} + 3\text{H}_2\text{O}$ <p style="text-align: center;">alkyl isocyanide Pungent Smelling</p>

XIII. RNO_2 vs RONO

SNo.	Test	$\text{R}-\text{NO}_2$	RONO
a)	Reduction (Sn/HCl)	$\text{R}-\text{NO}_2 + 6\text{H} \longrightarrow \text{RNH}_2 + 2\text{H}_2\text{O}$	$\text{RONO} + 6\text{H} \longrightarrow \text{ROH} + \text{NH}_3 + \text{H}_2\text{O}$
b)	NaOH	Form's soluble sodium salt. $\text{R}-\text{N} \begin{array}{l} \nearrow \text{O} \\ \searrow \text{O} \end{array} \xrightarrow{\text{NaOH}} \text{R}=\text{N} \begin{array}{l} \nearrow \text{ONa} \\ \searrow \text{O} \end{array}$	Readily hydrolysed to give corresponding alcohol and sodium nitrite. $\text{RONO} + \text{NaOH} \longrightarrow \text{ROH} + \text{NaNO}_2$

XIV. RCN vs RNC

SNo.	Test	$\text{R}-\text{NO}_2$	RONO
a)	Solubility in water	Soluble	Insoluble
b)	Reduction followed by nitrous acid treatment	$\text{RCN} + 4\text{H} \longrightarrow \text{RCH}_2\text{NH}_2$ <p style="text-align: center;">1° amine</p> $\downarrow \text{HNO}_2$ $\text{R}-\text{OH} + \text{N}_2 \uparrow + \text{H}_2\text{O}$ <p style="text-align: center;">Evolution of nitrogen</p>	$\text{RCN} + 4\text{H} \longrightarrow \text{R}-\text{N}-\text{CH}_3$ <p style="text-align: center;"> </p> <p style="text-align: center;">H</p> $\downarrow \text{HNO}_2$ $\text{R}-\text{N}-\text{N}=\text{O} + \text{H}_2\text{O}$ <p style="text-align: center;"> </p> <p style="text-align: center;">CH_3</p> <p style="text-align: center;">Yellow oily</p>

c)	Hydrolysis	$\begin{array}{c} \text{R} - \text{C} \equiv \text{N} \xrightarrow[\text{H}^+]{\text{H}_2\text{O}} \text{RCONH}_2 \\ \text{amide} \\ \downarrow \text{H}^+ \text{H}_2\text{O} \\ \text{H}_3\text{N}^+ + \text{RCOOH} \\ \text{Carboxylic} \\ \text{acid} \end{array}$	$\begin{array}{c} \text{R} - \text{N} = \text{C} + 2\text{H}_2\text{O} \xrightarrow{\text{H}^+} \\ \text{RNH}_2 + \text{HCOOH} \\ \text{1}^\circ \text{ amine} \quad \text{Formic acid} \end{array}$
d)	Heating	No effect	Alkyl cyanide is formed