Qualitative analysis of organic mixture (Binary and Ternary) chart for M.Sc. organic students…

Experiment Findings · March 2019

DOI: 10.13140/RG.2.2.28446.18247

1 author:

Sushil Mathpati
S. M. P. College, Murum
24 PUBLICATIONS **15** CITATIONS

SEE PROFILE

Nagar Shikshan Vikas Mandal's
SHRI MADHAVRAO PATIL MAHAVIDYALAYA,
MURUM, TQ. OMERGA, DIST. OSMANABAD
ORGANIC QUALITATIVE ANALYSIS

The Systematic analysis of a two component/three component mixture involves the following points.

1) Nature of the mixture
2) Type of the mixture
3) Separation of the mixture into two/three component.
4) Systematic analysis of each component which involves following
   a) Preliminary Tests.
   b) Detection of elements.
   c) Detection of the functional group.
   d) Physical constants. (M.P. OR B.P.)
   e) Conformation with preparation of derivatives.
   f) Result.

Separation of Two Components from given Binary Mixture of Organic Compounds Qualitatively and Identification of its components

1. **Nature of binary mixture:-**
   The nature of the binary mixture may be of three types:-
   i) Solid – Solid
   ii) Solid – Liquid
   iii) Liquid – Liquid

- Each of these can be either homogeneous or heterogeneous.

The solid-solid mixture and liquid – liquid mixture is identified directly by observation of the physical state of the mixture.

- In order to identify the solid – liquid mixture, a small quantity of mixture is placed on a watch glass and is evaporated. If the liquid part gets evaporated and solid residue is left behind then the given mixture belongs to solid – liquid type.
  If no solid residue is left behind, it is liquid – liquid type.

2. **Determination of the Type**

I) Type determination of ***Water insoluble mixture***

Sr. No.	Test	Observation	Inference
1.	Mixture + 10% $NaHCO_3$ Solution (Shake well & Filter)	• One component is soluble with effervescences of CO_2 and reprecipitated by adding conc. HCl to the filtrate.	Acid Present.
		• Insoluble	Acid Absent
2.	Mixture or Residue + 10% NaOH Solution (Shake well & Filter)	• One component is soluble and reprecipitated by adding Conc.	Phenol Present.

		HCl to filtrate. • Insoluble	Phenol Absent
3.	Mixture or Residue + dil. HCl Solution (Shake well & Filter)	• One component is soluble and reprecipitated by adding 10% NaOH Solution to filtrate. • Insoluble	Base Present. Base Absent
4.	Mixture or Residue + 10% $NaHCO_3$ or 10% NaOH or dil. HCl Solution	Insoluble	Neutral Present

II) Type determination for ***water miscible*** (solution) substance.

Test	Observation	Inference
Litmus test A) Add few drops on litmus paper	a)Blue litmus turns red b) Red litmus turns blue c) No change on either litmus	Acid or Phenol present Base present Neutral present
Distinguish between acid and phenol Substance + 4 drops of 10 % $NaHCO_3$	Effervescence of CO_2 NO Effervescence of CO_2	Acid is present Phenol is present

Conclusion: - Type of the given Binary mixture is ---------- + ----------

3) **Separation of the mixture into two components**.

a) **Separation of solid – solid Binary mixture**.

- **<u>Acid + Phenol</u>**
  Take the given mixture in a beaker and add about 50 ml of 10% $NaHCO_3$ solution. Stir it with glass rod till the effervescence ceases. Filter the contents. Residue is Phenol, wash it with water and dry. Filtrate contains Acid. Add conc. HCl to the filtrate. Acid component reappears. Filter, wash it with water and dry.
  Reactions:- $R\text{-}COOH + NaHCO_3 \longrightarrow R\text{-}COONa + H_2O + CO_2\uparrow$
  $R\text{-}COONa + HCl \longrightarrow R\text{-}COOH + NaCl$
- **<u>Acid + Amine</u>**
  Take the given mixture in a beaker and add about 50 ml of 10% $NaHCO_3$ solution. Stir it with glass rod till the effervescence ceases. Filter the contents. Residue is Amine, wash it with water and dry. Filtrate contains Acid. Add conc. HCl to the filtrate. Acid component reappears. Filter, wash it with water and dry.
  Reactions:- $R\text{-}COOH + NaHCO_3 \longrightarrow R\text{-}COONa + H_2O + CO_2\uparrow$
  $R\text{-}COONa + HCl \longrightarrow R\text{-}COOH + NaCl$
- **<u>Acid + Neutral</u>**
  Take the given mixture in a beaker and add about 50 ml of 10% $NaHCO_3$ solution. Stir it with glass rod till the effervescence ceases. Filter the contents. Residue is Neutral, wash it with water and dry. Filtrate

contains Acid. Add conc. HCl to the filtrate. Acid component reappears. Filter, wash it with water and dry.

Reactions:- $R\text{-}COOH + NaHCO_3 \longrightarrow R\text{-}COONa + H_2O + CO_2\uparrow$

$R\text{-}COONa + HCl \longrightarrow R\text{-}COOH + NaCl$

- **Phenol + Amine**

Take the given mixture in a beaker and add about 50 ml of 10% NaOH solution. Stir it with glass rod. Filter the contents. Residue is Amine, wash it with water and dry. Filtrate contains Phenol. Add conc. HCl to the filtrate. Phenol component reappears. Filter, wash it with water and dry.

Reactions:- $Ar\text{-}OH + NaOH \longrightarrow Ar\text{-}ONa + H_2O$

$Ar\text{-}ONa + HCl \longrightarrow Ar\text{-}OH + NaCl$

- **Phenol + Neutral**

Take the given mixture in a beaker and add about 50 ml of 10% NaOH solution. Stir it with glass rod. Filter the contents. Residue is Neutral, wash it with water and dry. Filtrate contains Phenol. Add conc. HCl to the filtrate. Phenol component reappears. Filter, wash it with water and dry.

Reactions:- $Ar\text{-}OH + NaOH \longrightarrow Ar\text{-}ONa + H_2O$

$Ar\text{-}ONa + HCl \longrightarrow Ar\text{-}OH + NaCl$

- **Amine + Neutral**

Take the given mixture in a beaker and add about 50 ml of dil. HCl solution. Stir it with glass rod. Filter the contents. Residue is Neutral component, wash it with water and dry. Filtrate contains Amine. Add 10% NaOH solution till amine component reappears. Filter, wash it with water and dry.

Reactions:- $R\text{-}NH_2 + HCl \longrightarrow R\text{-}NH_2.HCl$

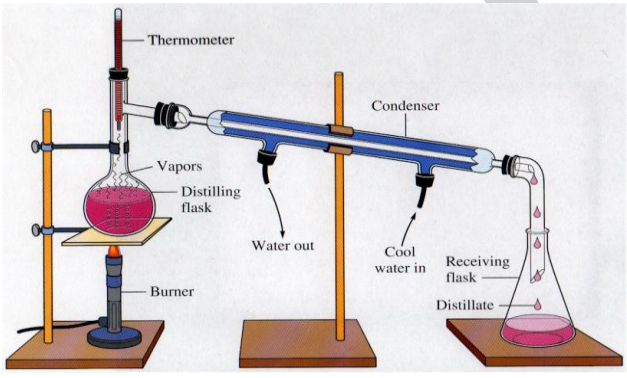
$R\text{-}NH_2.HCl + NaOH \longrightarrow R\text{-}NH_2 + NaCl + H_2O$

b) **Separation of Solid- Liquid mixture**:-

Take all the given mixture in a dry distillation flask and place one porcelain piece in it. Attach the flask to the water condenser. Then attach a thermometer to the flask in such a way that the bulb of the thermometer is near to the outlet of the flask.

Heat the flask on a boiling water bath. Start collecting the volatile (Boiling point below liquid in a dry test tube. Note down the Constant boiling point. After collecting one test tube component, stop heating and pour the remaining liquid on a dry watch glass or evaporating dish and with mouth; solid component will be obtained. Dry it on filter paper and find out its melting point.

c**) Separation of liquid-liquid mixture**



Take all the given mixture in a distillation flask, place one porcelain piece and attach the flask to the water condenser. To attach a thermometer to the flask and heat over a boiling water bath. The volatile component will come first. Collect one test tube volatile component. Note down constant boiling point. Then stop heating remove the water bath and dry the flask from outside and heat he flask on the wire gauge. This time some volatile component may come out. Discard the middle fraction up to 100 ^{0}c. After 100^{0}C start collecting the second pure non-volatile component in another dry test tube. Note down the highest temperature i.e. the boiling point of the second liquid

PURIFICATION OF THE COMPONENTS BY RECRYSTALLISATION/SUBLIMATION

- After the separation of compounds, it should purify before the Individual Analysis. Generally organic compounds are purified through recrystlisation and Sublimation method.

A. Recrystallisation: The separated components organic compounds may contain some soluble and insoluble impurities, which are removed by crystallization method. The insoluble impurities after crystallization remain on filter paper while soluble impurities are left behind in the mother liquid.

Selection of a solvent for crystallization:

1. The solvent should be such that the given compounds must be insoluble in that solvent at room temperature and completely soluble in it under hot condition.
2. The choice of the solvent is made in the following order.
   1) Water 2) Alcohol + Water mixture 3) Alcohol

- **From hot Water** :

Take about 0.5 g of the substance in a clean test tube. Add 5 ml distilled water and heat it using test tube holder. Shake the test tube during heating, till most of the compound dissolves. In this way prepare a saturated solution of the substance in water (Add more water if compound does not dissolve) remain on filter paper which should be discarded. The filtrate on natural cooling deposit fine crystals, [After cooling if crystals are not obtained, concentrate the filtrate by heating on wire gauge and then cool it again]

Now, filter these crystals on a hursh funnel, wash with distilled water to remove adhered mother liquor or remove the solvent from the test tube by using rubber teat pipette hold the test tube under hot air flow (using hair dryer) and collect dry crystals on paper find its melting point.

(II) From Alcohol :

- If the given substance is insoluble in hot water. Then water cannot be used for recrystallization.

Then ethyl alcohol is tried. Take about 0.5 g of the substance in a clean and dry test tube. Add about 5 ml ethyl alcohol and place one porcelain piece in it. Then hold the tube in hot water bath with constant shaking till most of the substance dissolves. Filter the hot solution through dry fluted filter paper into another test tube. The insoluble impurities remain on filter paper, which should be discarded the filtrate on natural cooling fine crystals. [If crystals are not obtained on cooling add little distilled water] Filter these crystals funnel or remove the solvent from the test tube by using rubber teat pipette. Hold the test tube air flow (Use hair dryer) and collect dry crystals on paper find its melting point.

(III)From Water-Alcohol :

If the given substance is insoluble in hot water but soluble in cold alcohol then pure water or pure Alcohol cannot be used for recrystallization in such cases combination of water alcohol in very high proportions is used.

The solvents used for the recrystallisation of components of various groups are summarized below.

Components	**Solvents**
• Acid	Hot water
• Phenol	Hot water or Aqueous alcohol
• Amines	Aqueous alcohol, Alcohol

• Neutral	Water, Alcohol, Acetic acid

B. Sublimation :

Sublimation is a process in which the substance on heating directly passes into vapors state without first passing into the liquid state. The vapors get collected on the cooler part and give pure crystals.

Note :- This method is used under following conditions.

i) If the given organic compound is insoluble in-hot water, hot alcohol, hot alcohol +water as solvent.

ii) It is used only for solid compound.

Procedure :-

1. Take the given substance in a dry evaporating dish, kept on a sand bath, supported on a tripod stand.
2. The dish is covered with a filter paper which has been perforated with a number of small holes.
3. An inverted funnel is placed over the filter paper is shown in fig.
4. The nozzle of the funnel is closed with cotton plug.
5. The dish is gently heated so that the vapors, which passes through the holes deposit as pure crystals on the inner side of the funnel.
6. The crystals are also collected on the filter paper.
7. Find out the melting point of crystalline substance.

Separation of Three Components from given Ternary Mixture of Organic Compounds Qualitatively and Identification of its components

- For the ternary mixture separation we have use physical method that depending on solubility of compounds in organic solvent (Ether or DCM).
- Ternary mixture also separated by using chemical method that can be describe above, but nature of all constituents in the mixture must different.
- If nature of two or three compounds are same then we can't separate by chemical method.

➢ **Choice of Extraction Solvent**

Although water is almost always one of the liquids in the liquid-liquid extraction process, the choice of organic solvent is quite wide. A good extraction solvent needs five essential features:

1) has high solubility for the organic compound.
2) be immiscible with the other solvent (usually water).
3) has a relatively low boiling point so as to be easily removed from the compound after extraction.
4) extract little or none of the impurities and other compounds present in the mixture.
5) be nontoxic, nonreactive, readily available, and inexpensive.

Table 1 below shows some organic solvents used in extraction.

Table 1: Some common extraction solvents.

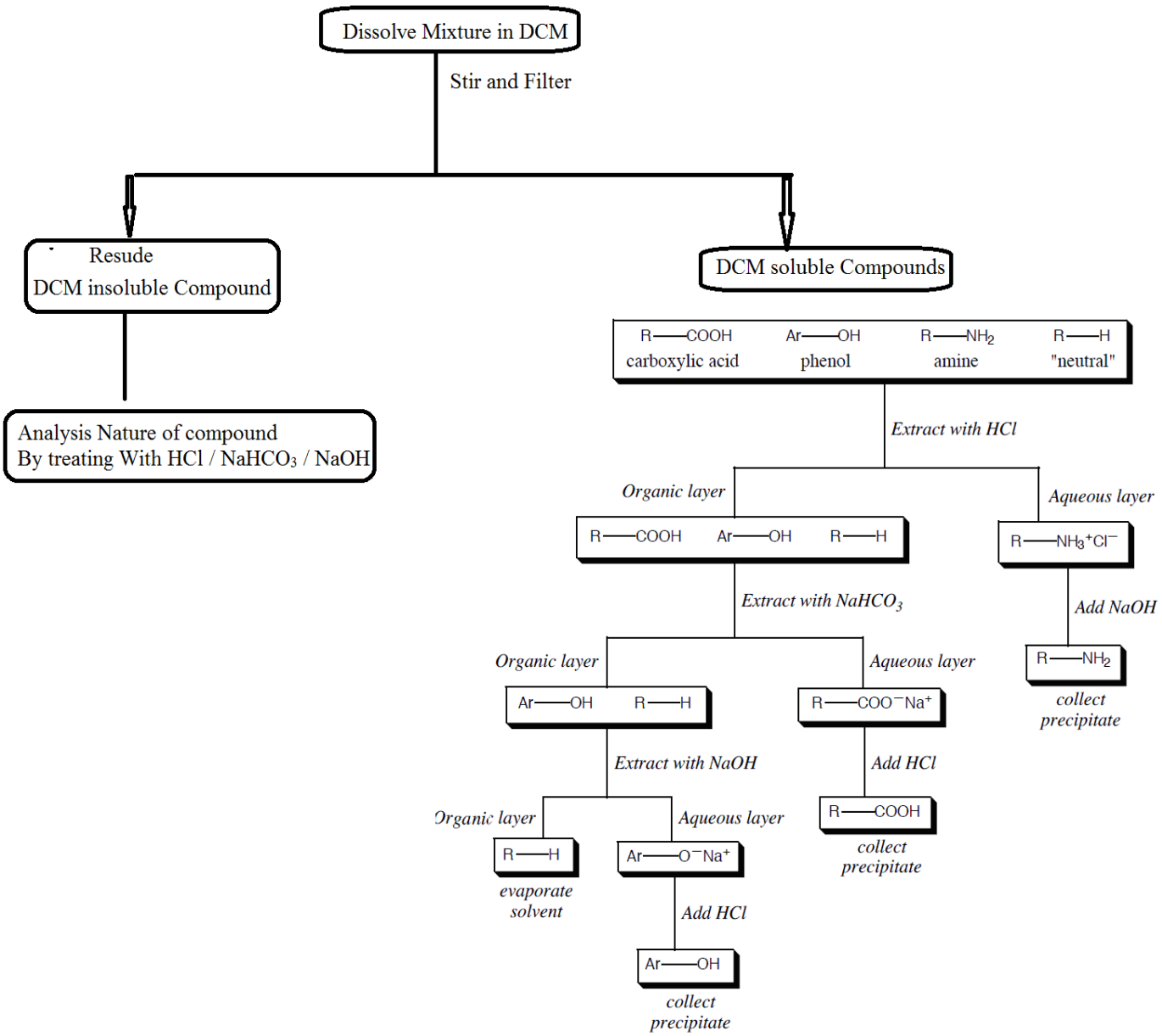
Solvent	Solubility in H_2O	Boiling point (°C)	Density (g/mL)	Safety information
Methylene chloride CH_2Cl_2	Very slightly soluble	40	1.3255	Narcotic in high concentrations; suspected carcinogen
Diethyl ether $(CH_3CH_2)_2O$	Slightly soluble	35	0.7134	Very flammable; forms peroxides
Ethyl acetate $CH_3CO_2CH_2CH_3$	Fairly soluble	77	0.902	Flammable
Hexane $CH_3(CH_2)_4CH_3$	Insoluble	69	0.660	Narcotic in high concentrations

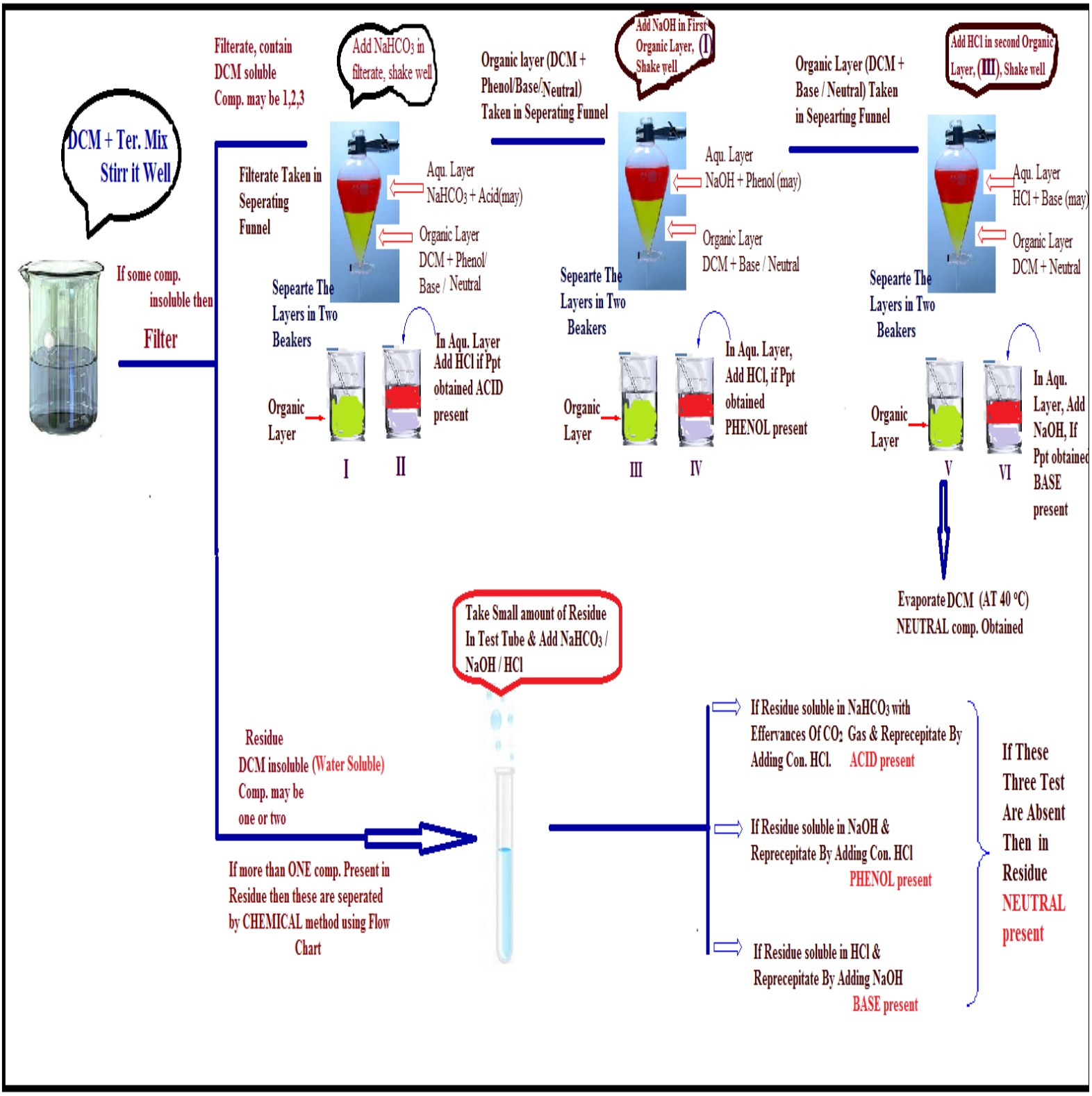
Thus **DCM** is the good solvent for ternary mixture separation, it has some advantages over other solvent like Diethyl ether these are :

1. It is inflammable, so safe for use in lab.
2. Very slight soluble in water, so avoid mixing in Aqu. layer
3. Somewhat cheaper than Diethyl ether.

Note: Density of DCM is higher than water, so organic layer is set down in separating funnel which is opposite in case of ether solvent.

Flow chart for separation of Ternary mixture by using DCM solvent


Dissolve Mixture in DCM
Stir and Filter
Resude
DCM insoluble Compound
Analysis Nature of compound
By treating With HCl / NaHCO3 / NaOH
DCM soluble Compounds
R—COOH carboxylic acid
Ar—OH phenol
R—NH2 amine
R—H "neutral"
Extract with HCl
Organic layer
Aqueous layer
R—COOH Ar—OH R—H
R—NH3+Cl−
Extract with NaHCO3
Add NaOH
Organic layer
Aqueous layer
Ar—OH R—H
R—COO−Na+
R—NH2
collect precipitate
Extract with NaOH
Add HCl
Organic layer
Aqueous layer
R—H
Ar—O−Na+
R—COOH
collect precipitate
evaporate solvent
Add HCl
Ar—OH
collect precipitate


DCM + Ter. Mix
Stirr it Well
If some comp. insoluble then
Filter
Filterate, contain DCM soluble Comp. may be 1,2,3
Add $NaHCO_3$ in filterate, shake well
Filterate Taken in Seperating Funnel
Aqu. Layer $NaHCO_3$ + Acid(may)
Organic Layer DCM + Phenol/ Base / Neutral
Sepearte The Layers in Two Beakers
Organic Layer
In Aqu. Layer Add HCl if Ppt obtained ACID present
I
II
Organic layer (DCM + Phenol/Base/Neutral) Taken in Seperating Funnel
Add NaOH in First Organic Layer, (I) Shake well
Aqu. Layer NaOH + Phenol (may)
Organic Layer DCM + Base / Neutral
Sepearte The Layers in Two Beakers
Organic Layer
In Aqu. Layer, Add HCl, if Ppt obtained PHENOL present
III
IV
Organic Layer (DCM + Base / Neutral) Taken in Sepearting Funnel
Add HCl in second Organic Layer, (III), Shake well
Aqu. Layer HCl + Base (may)
Organic Layer DCM + Neutral
Sepearte The Layers in Two Beakers
Organic Layer
In Aqu. Layer, Add NaOH, If Ppt obtained BASE present
V
VI
Evaporate DCM (AT 40 °C)
NEUTRAL comp. Obtained
Residue
DCM insoluble (Water Soluble)
Comp. may be one or two
If more than ONE comp. Present in Residue then these are seperated by CHEMICAL method using Flow Chart
Take Small amount of Residue In Test Tube & Add $NaHCO_3$ / NaOH / HCl
If Residue soluble in $NaHCO_3$ with Effervances Of CO_2 Gas & Reprecepitate By Adding Con. HCl. ACID present
If Residue soluble in NaOH & Reprecepitate By Adding Con. HCl PHENOL present
If Residue soluble in HCl & Reprecepitate By Adding NaOH BASE present
If These Three Test Are Absent Then in Residue NEUTRAL present

- **Individual Analysis**
  <u>Identification of Organic Compounds</u>
- **Preliminary Tests-**

Test	Observation	Inference
i. Physical State	Solid	Acids, Phenols, Amines, Anilides, Hydrocarbons may be Preesent.
ii. A. Colour (Solids)	White	Benzoic acid, Salicylic acid, Naphthalene, Acetanilide may be Present.
	Cream	Cinnamic acid may be Present.
	Light pink	α-Naphthol may be Present.
	Pink Brown	β-Naphthol may be Present.
	White buff / Pinkish	p-Toluidine, Resorcinol may be Present.
	Light buff	Diphenylamine may be Present.
	Yellow	p-Nitroaniline/Nitro Compounds may be Present.
	Light Yellow	m-Dinitrobenzene may be Present.
	Orange	O-Nitro aniline May be Present.
	Red	Azo compounds, β- Napthoquinone, Alizarine may be present.
B. Colour (Liquids)	Colourless (reddish-brown colour appears due to oxidation)	Acetone, Acetophenone, Methyl Ethyl Ketone, Methyl Acetate, Ethyl Acetate, Chloroform, Chlorobenzene May be Present
	Yellow	Aniline, Dimethylaniline, Nitro Benzene May be Present.
iii. Odour	Indistinct	Benzoic acid, Salicylic acid, p-Nitroaniline, Acetanilide m-Dinitrobenzene may be Present.
	Carbolic	α-Naphthol, β-Naphthol may be Present.
	Fishy	p-Toluidine, Aniline, Dimethyl Aniline may be Present.
	Pleasant (Alcoholic)	Alcohols, Ketones, Chloroform May be Present.
	Sweet	Aliphatic And aromatic Halogenated Compounds May be Present.
	Pungent irritating	Acetic acid, acetic anhydride, Lower acids, lower aldehydes, acid halides, thioacids may be present
	Mouse-like	Acetamide, acetonitrile
	Cinnamon like	Cinnamic acid may present
	Bitter Almond	Aromatic aldehyde like Benzaldehyde, Nitrobenzene, Nitrotoluenes May be Presents.
	Pleasant-fruity	Ester may be present
	Pleasant, sweet	Chloroform, diphenylamine, alcohols
	Garlic	Thiophenols, Thioalcohols May be presents.
	Benzene Like Odour	Benzene, Toluene, Xylenes May be Presents.
	Fragrant	Diphenylamine may be Present.
	Camphor-like	Pinacol, hexachloroethane
	Pyridine-like	Heterocyclic bases

	Naptha ball Like	Naphthalene may be Present.
	Odourless	Carbohydrates, aromatic acid, glycerol, solid aliphatic acid May be Present.
iv. Solubility in Water	Insoluble	Acids, Phenols, Amines, Anilides, Hydrocarbons may be Preesent.
v. Saturation Test- Action of $KMnO_4$ (Baeyer Test) Compound + $KmnO_4$(dil.)	Decolourisation	Unsaturated compound or easily oxidisable compounds, Exception Hydroxy acids, may be present
	No Decolourisation	Saturated compound is Present.
vi. Litmus Test – A small amount of the sub is shaken with water and a drop of the solution is tested for litmus action	a) Acidic	Carboxylic acids, Nitrophenols, Sulphonic acids, Acid chlorides, Acid anhydries May be presents.
	b) Faintly Acidic	Phenols, Cresols may be presents.
	c) Faintly Basic	Amines May present.
	d) Neutral	Alcohols, Aldehydes, Ketones, Hydrocarbons Carbohydrates May be Presents.
vii. Flame Test Heat the compound on copper wire	Sooty Flame	Aromatic compound is Present.
	Non sooty Flame	Aliphatic compound is Present.

- **Detection of Elements-**
  Preparation of Sodium Fusion Extract-
  Lassaignes Test:- Heat a small freshly cut piece of sodium metal in a dry fusion tube till sodium melts. Cool and add given compound to the molten sodium, heat the fusion tube to red hot and then drop it in about 15 ml of distilled water taken in china dish. Carry out three more fusions in the similar way. Concentrate the solution of the dish to half its volume by boiling. Cool and filter the solution. The filtrate, known as sodium fusion extrat is used for the detection of Elements.

  This test is aimed to identify the nitrogen, sulphur and halogen in organic compounds and it can be carried out by fusion of the organic substance with sodium metal in the presence of excess soda lime (NaOH/CaO). The following equations express the reaction of element after reacted with sodium:-

  $Na + C + N \rightarrow NaCN$ (nitrogen compounds)
  $2\ Na + S \rightarrow Na_2S$ (sulfur compounds)

  $Na + X \rightarrow NaX$ (halogen compounds, X = Cl, Br, ..)

Test	**Observation**	**Inference**
1. Test for Nitrogen		
A) Sodium Extract (2 ml) + Freshly Prepared Ferrous Sulphate solution Boil and Cool. Add dil. H_2SO_4.	Green or Blue Precipitate or Colour	Nitrogen is Present.
B) Sodium Extract (2 ml) + $FeCl_3$	Blood red colour	S And N Present.
2. Test for sulphur		
Sodium Extract (2 ml) + Sodium Nitroprusside.	Purple or Violet colour	Sulphur is Present
3. Test for Halogens		
Sodium Extract (2 ml) + Conc. HNO_3, Boil	Precipitate	Halogens are Present

and Cool. Add $AgNO_3$.		
If Halogen present proceed as follows		
Sodium Extract (2 ml)+ Conc. HNO_3 + Chlorine Water + 1 ml Chloroform + Shake well & Observe the Colour of Chloroform	A) Violet Colour B) Yellow Colour C) Colour less	Iodine Present. Bromine Present. Chlorine Present.

Conclusion: - The compounds contains C, H, (O) and ---- as the Elements.

- **Detection of Functional Group(s)-**

Test	**Observation**	**Inference**
1. Comp. + 10% $NaHCO_3$ Sol^n	Effervescence of CO_2 PPT By Adding Conc. HCl	-COOH group is Present.
2. Comp. + Water + Neutral $FeCl_3$ Solution.	Blue, Violet or Green Colour.	–OH group is Present.
3. Comp.+ NaOH	Soluble and PPt by adding Conc. HCl	Phenolic –OH group is Present.
4Comp. (if liquid) + Na metal	Soluble with effervescence	Alcoholic –OH present
5. Comp.+ Dil HCl	Soluble And PPT by adding NaOH	Amino $–NH_2$ group is present.
6.**a)** Comp. + Alcoho l+ 2,4 dinitrophenylhydrazine (Boil)	Yellow, Orange or Red PPT	Aldehydes or Ketones Present.
b)Comp. + Schiff's Reagent	Violet colour develops Pink colour slosly develops	Aliphatic aldehyde present Aromatic aldehyde present
7. Comp. + NaOH + Sodium nitroprusside(freshly prepare)	Red colouration	Ketone present
8. a) Comp.+NaOH + Zn Dust (Boil)	Black or Gray PPT	NO_2 group is present.
b) Comp. + Conc. HCl+ Zn dust + $NaNO_2$ freshly prepare β- Napthol in NaOH	Orange dye stuff	
9. Comp.+ NaOH (Boil)	Ammonia gas evolves turns moist turmeric paper brown	Amide $–CONH_2$ group Present.
10. Comp.+Conc. HCl (Boil) Cool and add Cold $NaNO_2$+**β**–Naphthol in NaOH.	Red dyestuff	Anilide –NHCO group present
11. Comp.+1 ml H_2O+2,3 drops 10% ά–Naphthol in alcohol+1 ml Conc. H_2So_4	Reddish Violet Colouration at the Junction of two layer	Carbohydrates present.
12. If all above test fails		HydroCarbons Present.

Conclusion: - The compound contains ---------- as the Functional Group(s).

- **Confirmatory Tests of respective Functional group**
- **Compounds containing C, H and (O) as the Elements-**
  C.T. for Acid

Test	**Observation**	**Inference**
10 mg substance + sat. $NaHCO_3$	Effervesces of CO_2	Acid is Confirmed.

Separation Of Acid Neutral Solution of Acid Substance + 2 drops of $FeCl_3$	a)Buff or Brown PPt Soluble in Dil. HCl	1)Benzoic Acid (Mp. 122^oC) 2) Cinnamic acid (Mp. 133^oC) 3) Phthalic Acid (Mp. 133^oC)
	b) Violet colour discharged by dil HCl	1) Salicylic Acid (Mp. 158^oC) 2) Aspirin (Mp. 135^oC)
	c) Red colour disappear in dil HCl	Acetic acid (Bp 118^oC)

Neutral Solution : 0.1 gm of given acid substance + 1 ml NH_4OH boil well till ammonia gets evolved (i.e. moist turmeric paper should not turn brown). Use this solution for separation of above acids.

Separation of acids

C.T. for Benzoic Acid –

Test	**Observation**	**Inference**
1. Comp. + Ethyl alcohol + 2-3 drops of conc. H_2SO_4 and Heat.	Pleasant smell of Ethyl benzoate	Benzoic Acid is Confirmed.
2. Comp. + Water + Neutral $FeCl_3$ Solution.	Buff ppt soluble in NH_4OH.	Benzoic Acid is Confirmed.

C.T for Cinnamic Acid-

Test	**Observation**	**Inference**
1. Comp. + Ethyl alcohol + $CaCl_2$ Solution.	White ppt insoluble in acetic acid.	Cinnamic Acid is Confirmed.
2. Comp. + 2 drops of 1% $KMnO_4$ solution + 1 ml of Na_2CO_3 Solution.	Decolourisation of $KMnO_4$ solution.	Cinnamic Acid is Confirmed.

C.T for Salicylic Acid-

Test	**Observation**	**Inference**
1. 0.5 gm of Compound + 5 drops of CH_3OH + 3 drops of conc. H_2SO_4 and Heat gently on Water bath. Cool and pour this into about 5 ml of water. Add solid Na_2CO_3.	Pleasant smell of methyl salicylate (Oil of Winter Green).	Salicylic acid is Confirmed.

C.T. for Oxalic Acid:-

Test	**Observation**	**Inference**
1.Neutral Solution of Acid Substance + 2 drops of $CaCl_2$ Solution	White PPT insoluble in dil. Acetic acid But Soluble in dil. HCl	Oxalic Acid is Confirmed. (water soluble)

- **Preparation of Derivative**

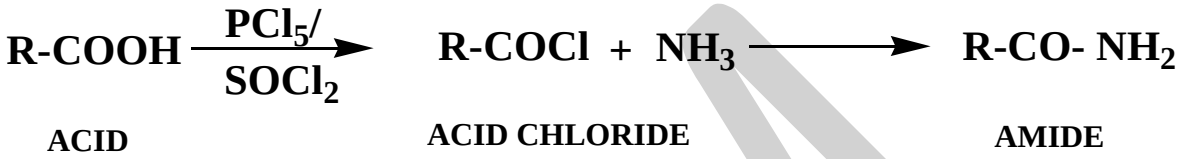
- **Amide Derivative**

  Heat 0.5 gm of Acid with 1 gm of PCl_5 or 2 ml of Thionyl chloride in a china dish, cool and add to it few drops of conc, ammonia. Filter the solid so formed, wash it with water, then with sodium bicarbonate solution and finally with water. Recrystallise from alcohol. Dry and determine its melting point.

  Amide derivative of Salicyaldehyde (Salicyamide) M.P.= 135^0C

  Amide derivative of Benzoic acid (Benzamide) M.P.= 128^0C

  Reactions -

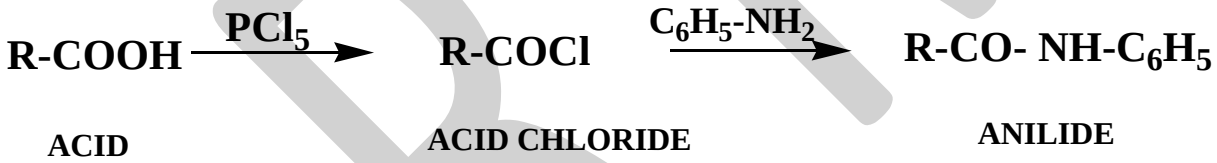


- **Anilide Derivative**

  Heat 0.5 gm of Acid with 1 gm of phosphorus pentachloride (PCl_5) or 2 ml of Thionyl chloride ($SOCl_2$) to prepare acid chloride in a test tube. The acid chloride is treated with 1 ml of aniline in benzene. The mixture is warmed carefully in a water bath. Cool and filter the solid, wash with dil. HCl to remove excess of aniline. Wash the solid with water. Recrystallise from alcohol. Dry and determine its melting point.

  Benzanilide - M.P. 164^0C.

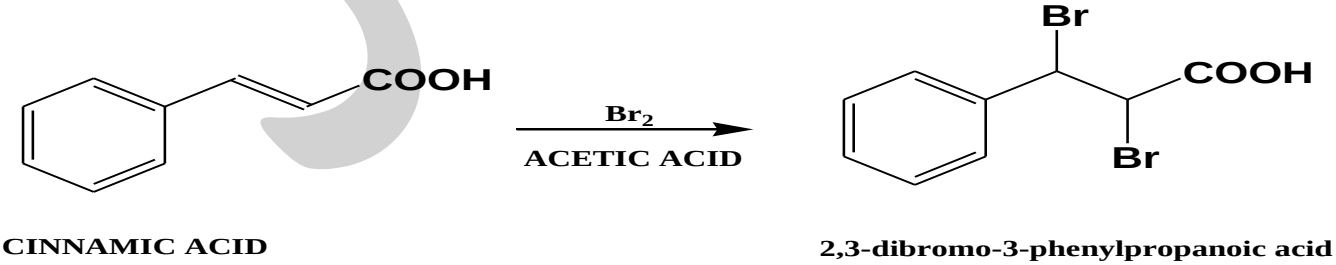
  Reactions-



- **Dibromo Derivative of Cinnamic acid (Cinnamic acid dibromide)-**

  Dissolve about 0.5 gm of Cinnamic Acid in 5 ml of glacial acetic acid. Add 5 ml of 5% bromine in acetic acid. Keep the reaction mixture for 10 minutes and pour this content into 20 ml of water. Filter the precipitate, wash it with water. Recrystallise from alcohol. Dry and determine its melting point. M.P. 195^0C.

  Reactions-

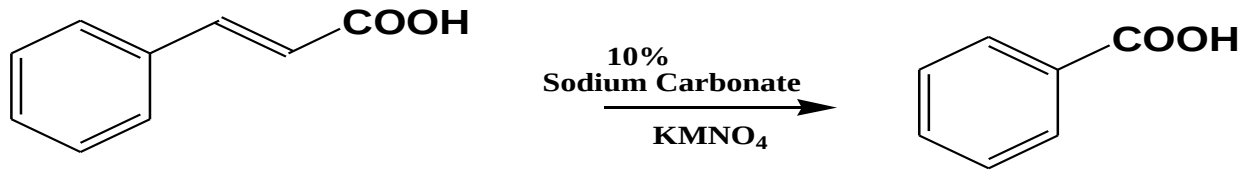


- **Acid Derivative of Cinnamic acid (Benzoic Acid)-**

  Take about 0.5 gm of Cinnamic Acid and add about 5 ml of 10% sodium carbonate solution. Boil the contents till Cinnamic acid dissolves. Cool and add about 20 ml of saturated $KMnO_4$ solution.

Reflux for 20 minutes and filter. Acidify the filtrate with conc. HCl, when benzoic acid precipitates. Recrystallise it from hot water. Dry and determine its melting point. M.P. 122^0C.

Reactions-

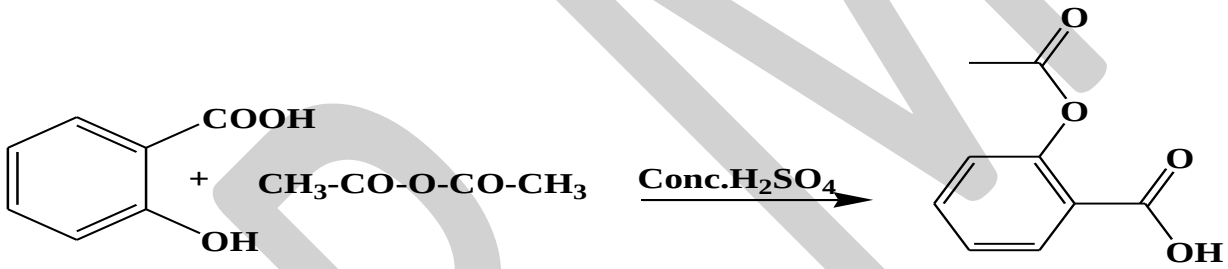


CINNAMIC ACID **Benzoic acid**

- **Acetyl Derivative (Acetyl Salicylic Acid or Aspirin)-**

Take about 0.5 gm of Acid; add 2 ml of acetic anhydride and 2 drops of conc. H_2SO_4. Heat the contents for 5 minutes and pour this into 20 ml cold water. Filter the solid, wash it with water. Recrystallise it from hot water. Dry and determine its melting point. M.P. 135^0C.

Reactions-

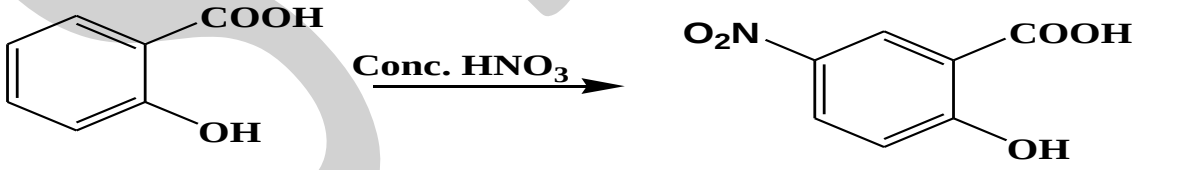


Salicyalic Acid **Acetic anhydride** **Aspirin**

- **5-Nitro Salicylic Acid-**

Take about 0.2 gm of Salicylic Acid. Add 5 ml of water. Boil and then add 0.5 ml of conc. HNO_3. Boil the yellow solution for 5 minutes and pour this into 20 ml of ice water. Filter the product and crystallise it from hot water. Dry and determine its melting point. M.P. 230^0C.

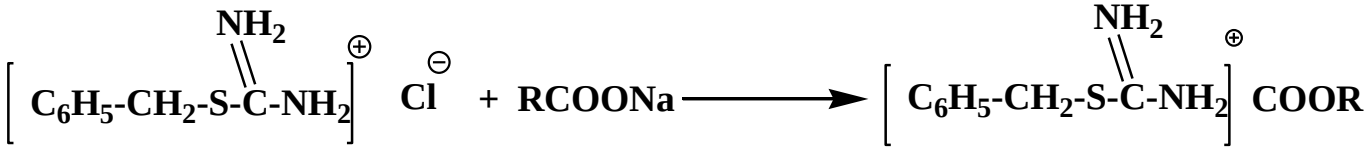
Reactions-



Salicyalic Acid **5-nitro Salicyalic Acid**

- **<u>S- Benzylthiouronium salt of Acids</u>**

Dissolve 0.2 gm of carboxylic acid in 2-3 ml of hot water, add to it one drop of Phenolpthalein and then dil. NaOH till just pink colour appears. Add to it very dil. (0.1N) HCl drop by drop till just pink colour disappers and solution becomes just neutral. Now add 2 ml of aqueous solution of S-benyl-iso-Thiouronium chloride and shake solution well. Solid separate out. Filter and recrystallize from hot water.



- **PHENOLS**

Phenols containing C, H and (O) as the Elements-

Test	Observation	Inference
1. Compound + 10 drops of ethyl alcohol + 2-3 drops Neutral $FeCl_3$ Solution.	Blue, Violet or Green Colour.	Phenolic –OH group is Present.

- **Separation of Phenols:**

C.T for α-Naphthol -

Test	Observation	Inference
1. 1 ml aqueous sol^n of Compound + 2 ml Bromine water + 1 ml of 10% NaOH Solution.	Violet Colour	α-Naphthol is Confirmed
2. Compound + Phthalic anhydride + 1 drop of conc. H_2SO_4 and Heat, cool and pour this into little NaOH Solution	Green Colour	α-Naphthol is Confirmed
3. Compound + NaOH Solution + 1 drop of CCl_4. Add copper foils and warm	Blue Colour	α-Naphthol is Confirmed

C.T for β-Naphthol -

Test	Observation	Inference
1. 1 ml aqueous sol^n of Compound + 2 ml Bromine water + 1 ml of 2N NaOH Solution.	Yellow Colour	β-Naphthol is Confirmed
2. Compound + Phthalic anhydride + 1 drop of conc. H_2SO_4 and Heat, cool and pour this into little NaOH Solution	Faint Green Colour	β-Naphthol is Confirmed
3. Compound + NaOH Solution, heat to dissolve. Add $CHCl_3$ and warm	Blue Colour	β-Naphthol is Confirmed

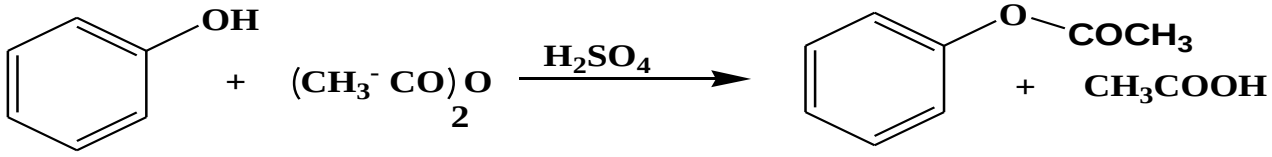
C.T. for Resorcinol –

Test	Observation	Inference
1. Compound + Phthalic anhydride + 1 drop of conc. H_2SO_4 and Heat, cool and pour this into little NaOH Solution	Yellowish red Solution with green fluorescence	Resorcinol is Confirmed

Preparation of Derivative-

- **Acetyl derivative:**

Take about 0.5 gm of phenol; add 2 ml of acetic anhydride and 2 drops of conc. H_2SO_4. Heat the contents for 5 minutes and pour this into 20 ml cold water. Filter the solid, wash it with water. Recrystallise it from minium amount of alcohol.



Phenol **Acetyl derivative of phenol**

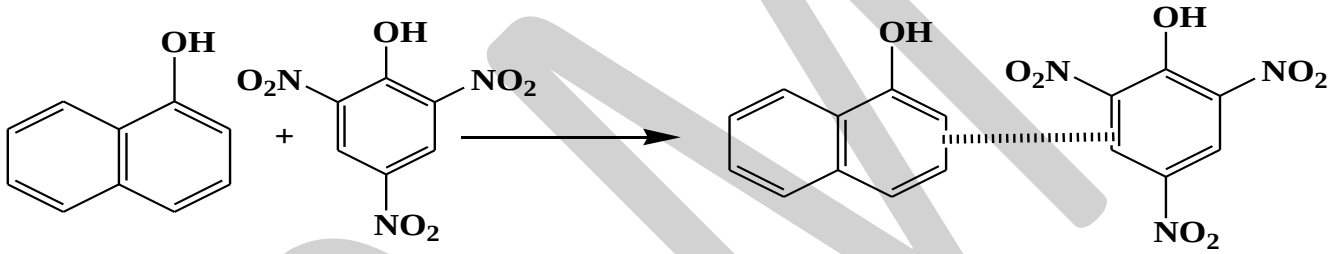
- **Picrate Derivative (Picrate of α-Naphthol / β-Naphthol)**

Take about 0.5 gm of phenol 10 ml of benzene or alcohol. Add to it saturated solution of picric acid in benzene or alcohol and shake well. The orange coloured precipitate separates out. Filter, dry and determine its melting point.

Picrate of α- Napthol M.P.= 189^0C.

Picrate of β- Napthol M.P.= 156^0C

Reactions-



Phenol **Picric Acid** **Picrate of Phenol**

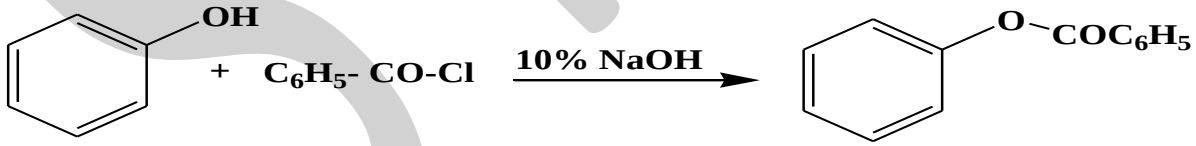
- **Benzoyl Derivative (α-Naphthyl benzoate / β-Naphthyl benzoate)-**

Dissolve about 1 gm of phenol in 10-15 ml of 10% NaOH solution in a small conical flask. Add about 2 ml of benzoyl chloride slowly and cork the conical flask immediately. Shake vigorously for 10 minutes. Cool and filter the precipitate, wash it first with dil. HCl and then with water. Recrystallise the product from alcohol. Dry and determine its melting point.

M.P. of α-Naphthyl benzoate = 56^0C.

M.P. of β-Naphthyl benzoate = 107^oC

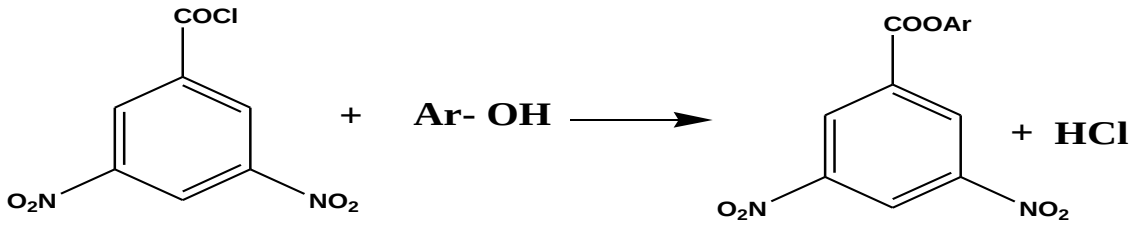
Reactions-



Phenol **phenyl benzoate**

- **3,5- Dinitrobenzoate Derivative (Chloro Phenol)**

Transfer the 3,3-dinitrobenzyl chloride to a test tube. Add 1 ml of phenol, cork the tube loosely and heat on boiling water bath for 20 min. Cool the mixture , add saturated solution of sodium hydrogen carbonate solution, break up the resulting solid ester with a stirring rod and filter the ppt. wash with water. Record the melting point.



- **AMINES**

Amines containing C, H, (O) and N as the Elements-

Test	Observation	Inference
Diazotisation Test 1. Compound + dil. HCl, and cool, and add $NaNO_2$ sol^n. Cool add this to the β-Naphthol NaOH Sol^n	Orange-red dyestuff	Aromatic $–NH_2$ group is Present. (Primary amine)
2. Compound + dil. HCl, boil and cool, and add ice cold $NaNO_2$ sol^n.	a)Yellow solid precipitate at top of tube b)Red colour solution and on addition NaOH green solute appears	Aromatic ›NH group is Present. (Secondary amine) Tertiary amine present
3. a) 10 mg substance + 1 ml of 50% alcohol + 6 drops of $CaCl_2$ + pinch of Zn dust. Heat to boil and filter into 1 ml tollen's reagent. b)Compound + $FeSO_4$ solution + NaOH Sol^n and boil	Black or Gray ppt Reddish-brown precipitate	Nitro aniline present $–NO_2$ group is Present.

- **Confirmatory Tests-**

C.T for p-Toluidine -

Test	Observation	Inference
1. Compound + 50% H_2SO_4 + HNO_3.	Blue Colour	p-Toluidine is Confirmed.
2. Compound + 50% H_2SO_4 + $K_2Cr_2O_7$ Solution.	Yellow Colour	p-Toluidine is Confirmed.
3. Compound + 1 drop of dil. HCl + 2 drops of aqueous $FeCl_3$	Pale yellow colour changes to blue	p-Toluidine is Confirmed

C.T for p-Nitroaniline -

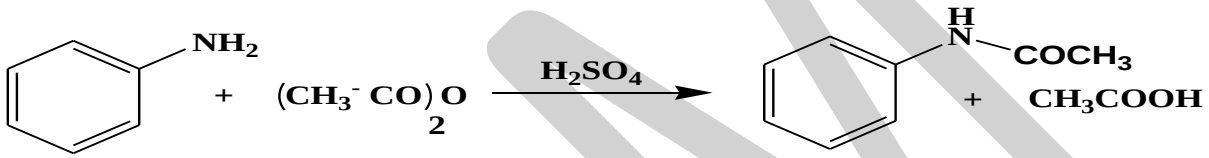
Test	Observation	Inference
1. Compound + NaOH Solution and Shake well.	Yellow or Brown Colour	p-Nitroaniline is Confirmed.
2. Compound + Zn dust + dil. HCl and shake. Allow to stand for 5 minutes. Filter and add $NaNO_2$ solution.	Green colour changes to reddish brown	p-Nitroaniline is Confirmed.

C.T for Diphenylamine -

Test	Observation	Inference
1. Compound + dil. HCl, cool and add	Yellow oil or solid	Diphenylamine is

$NaNO_2$ solution		Confirmed.
2. Compound + conc. H_2SO_4 + 1 drop of $NaNO_2$ Solution.	Deep blue colour	Diphenylamine is Confirmed.
3. Compound + conc. HCl + HNO_3.	Blue colour	Diphenylamine is Confirmed.

- **Preparation of Derivative-**
  - **Acetyl Derivative -**
    Heat 0.5 gm of aniline with 1 ml of acetic anhydride. Pour it into water. Filter the product, wash it with water. Recrystallise from alcohol. Dry and determine its melting point.
    Acetyl Derivative of p-Toluidine - M.P. 148^0C.
    Acetyl Derivative of Diphenylamine – M.P**.** 101^0C.
    Acetyl Derivative of nitroaniline - M.P. 215^0C
    Reactions-



Aniline *N*-phenylacetamide

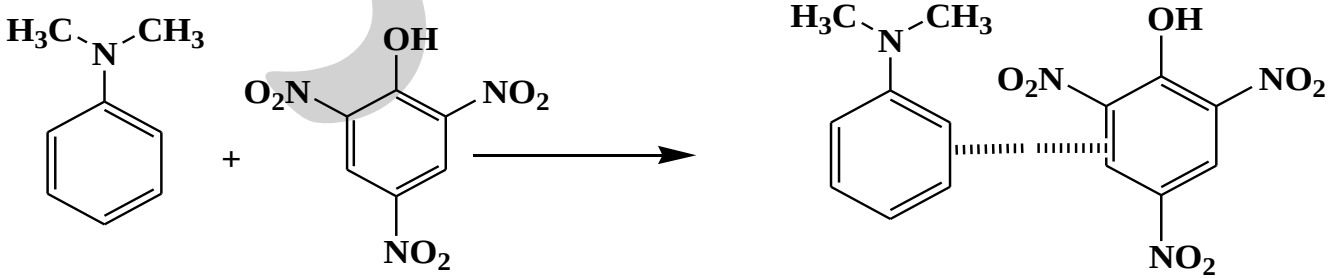
  - **Benzoyl Derivative -**
    Take 0.5 gm of aniline + 3 ml of acetone + 1 ml of benzoyl chloride shake well and pour into cold water. Filter the solid and crystallise it from aqueous alcohol. Dry and determine its melting point.
    Benzoate of p-Toluidine - M.P. 158^0C.
    Benzoate of Diphenylamine - M.P. 180^oC
    Benzoate of Nitroaniline - M.P. 199^oC

Aniline Benzoate Derivative

Reactions-

Picrate derivative for tertiary amines only

Take about 0.5 gm of substance in 10 ml of benzene. Add to it saturated solution of picric acid in benzene 2-3cc and shake well till precipitate separates out. Filter, dry and determine its melting point.



Tertiary Amine **Picric Acid** **Picrate of Ter. Amine**

4. <u>NEUTRAL COMPOUNDS</u>

Neutral Compounds containing C, H and (O) as the Elements-

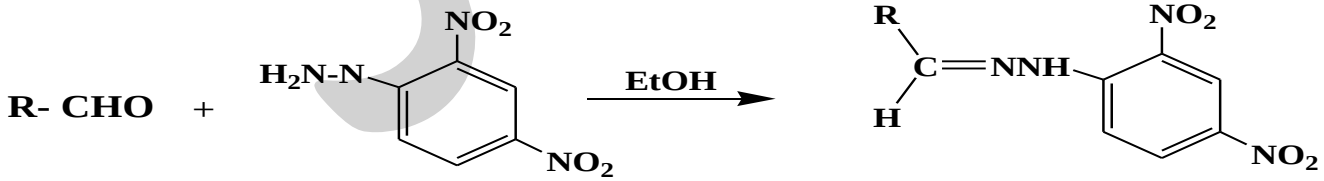
Test	Observation	Inference
1. Compound + Alcohol + 2, 4-DNP Solution.	No Orange precipitate	›C=O group is Present.
2. Take 2 ml schiff's reagents in a test tube & add 2, 3 drop of the substance & keep it.	Pink colour (at the bottom) slowly develops on standing	Aromatic aldehyde (Ar-CHO) present.
3. 2 ml tollen's reagent+ 2, 3 drop of substance shek well and then warm carefully	Silver gates deposited on the inner walls of the test tube (Silver mirror is formed)	Aldehyde group is present
4. 2 drops of substance+ 2 ml fehlings solution (A+B equal amount) & warm carefully	Red PPT of Cu_2O	Aldehyde group present
5. 2,3 drop of substance + 5 drop of sodium nitroprusside + NaOH Shake	Red Colour	Ketonic Group is present
6. 2, 3 drop of substance + 5 drop of 2,4 DNP reagent shake	Yellow or Red PPT	Ketonic group is present
7. 2, 3 drop of substance + 1 ml water + 1 drop of phenolphthalein + dil. NaOH till a pink colour appears then heat	Pink colour disappears after heating	Ester group is present
8. 2, 3 drop of substance + 1 ml of alcoholic hydroxylamine hydrochloride solution + NaOH (till alkaline) heat to boil cool and neutralized by dil. HCL then add 2, 3 drop of $FeCl_3$	Red violet colour	Ester group is present
9. 5, 6 drop of substance in a dry test tube + a piece of dry sodium metal and close the mouth of the thumb	Evolution of H_2 gas	Alcohol group is present

Conclusion: - The functional group present is ----------

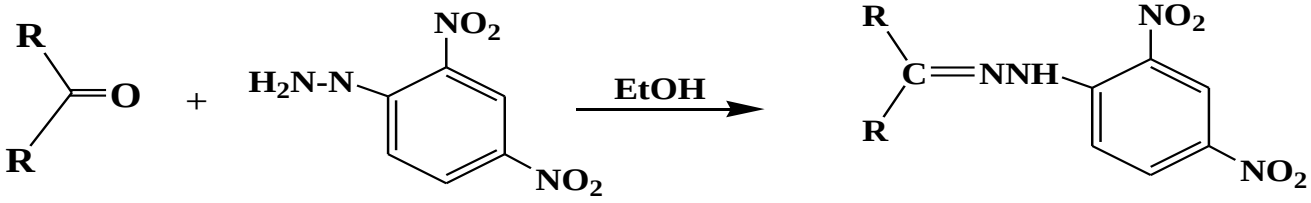
Preparation of Derivative

1) **2,4-dinitro phenyl hydrazine (DNP) for Aldehyde and Ketone**

Take 2 mg of substance in test tube and dissolve it in 2 ml of ethyl alcohol. Now add 2,4 dinitrophenyl hydrazine reagent about 2-3 cc and shake the reaction mixture for 10 minutes, solid separated out. Recrystilises product from ethanol or acetone or ethyl acetate.



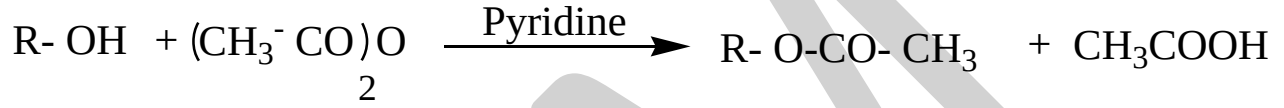
Aledehyde **2,4-DNP** **2,4-dinitro phenyl hydrazone**



Ketone **2,4-DNP** **2,4-dinitro phenyl hydrazone**

2) Acetyl derivative of Alcohol:

Take 0.5 gm of substance in dry test tube and add in it 1-2 ml of acetic anhydride. Then add 2-3 drop of pyridine and reflux for 2-3 min. Pour it into water. Filter the product, wash it with water. Recrystallise from alcohol. Dry and determine its melting point.



Alcohol Acetic anhydride Acetyl Derivative Acetic acid

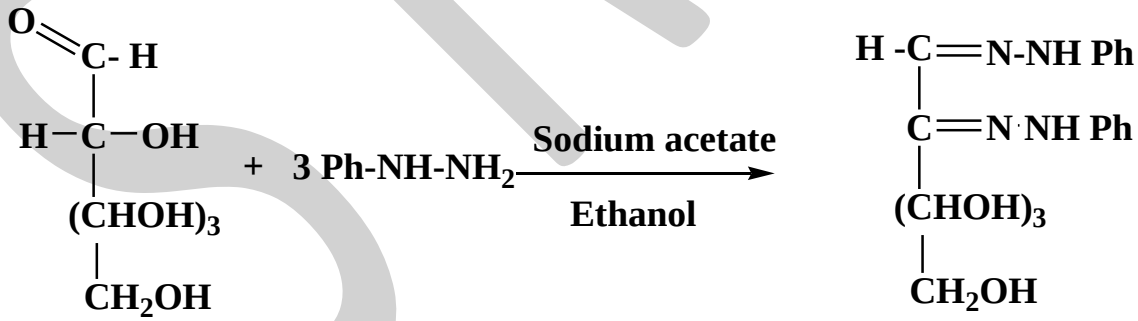
Carbohydrate

Test	Observation	Inferences
Comp.+1 ml H_2O+2,3 drops 10% ά–Naphthol in alcohol+1 ml Conc. H_2So_4	Reddish Violet Colouration at the Junction of two layer	Carbohydrates present.

Derivatives:

1) Osazone derivative: Take in test tube 0.2 gm carbohydrate and add to it one gram of crystalline sodium acetate and 1 gm of phenyl hydrazine hydro chloride dissolve in 5 cc of water. Now add one ml of saturated solution of sodium bisulphate, shake the solution and keep test tube in beaker of boiling water. The osazone derivative separate out. Filter the products and record the melting point.

Reaction:

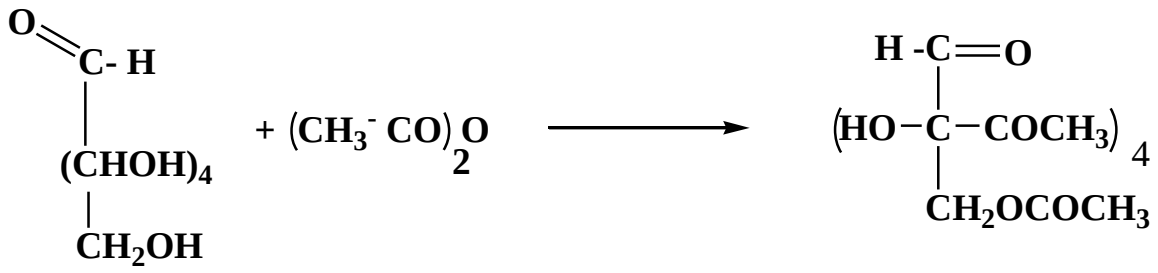


Glucose **Osazone**

2) Acetyl derivative:

Take 0.5 gm of carbohydrate in dry test tube and add to it 0.5 gm of fused sodium acetate and 5 ml of acetic anhydride. Then reflux for 5-10 min. and then Pour it into cold water. Filter the product, wash it with water. Recrystallise from alcohol. Dry and determine its melting point.

Reaction:



Glucose **Acetic anhydride** **Acetyl Derivative**

- **If all above test are absent then Hydrocarbon are present.**

Confirmatory Tests-

Test	**Observation**	**Inference**
1. Dissolve 0.5gm of Compound in 2ml of benzene + 1 ml picric acid in benzene and shake well.	a)Yellow precipitate b) orang precipitate	Naphthalene is Confirmed Anthracene is confirmed
2. Compound + $CHCl_3$ + $AlCl_3$ and Heat, cool and pour this into little NaOH Solution	Green Colour	Naphthalene is Confirmed
3. 0.5gm of Compound + 2 ml glacial acetic acid + 1 ml nitrating mixture. Warm, cool and pour this contents into the water	Yellow precipitate	Naphthalene is Confirmed

Preparation of Derivative

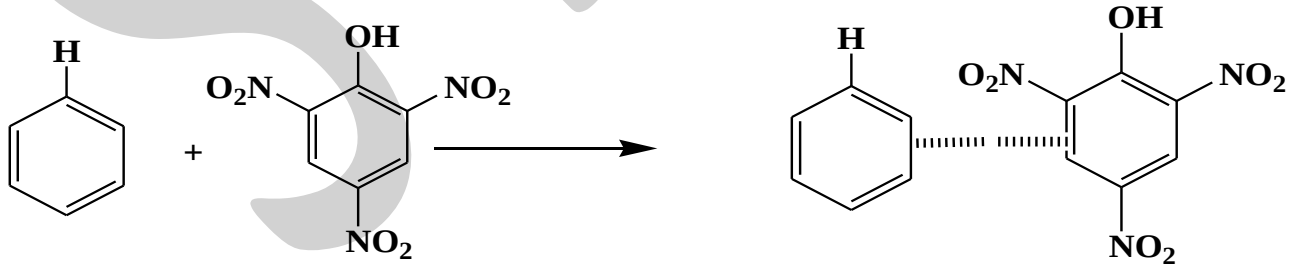
- **Picrate Derivative**

  In a dry test tube, dissolve about 1 gm of compound in 10 ml of benzene, add to it saturated solution of picric acid in benzene and shake well. The yellow coloured precipitate separates out. Filter the precipitate. Recrystallise the product from alcohol. Dry and determine its melting point..

  Picreate of Napthalene - M.P. 150^0C

  Picreate of Anthracene - M.P. 138^0C

Reaction-



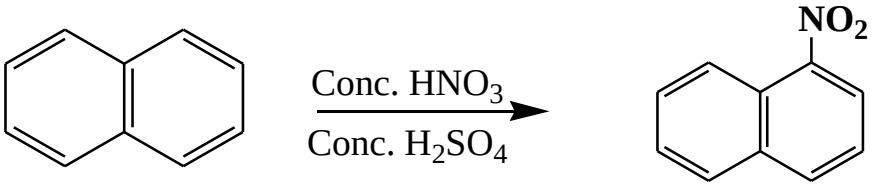
Hydrocarcons **Picric Acid** **Picrate of Hydrocarbons**

- **Nitro Derivative**

  In a 100 ml conical flask, take about 1 gm of compound and add to it 10 ml of fuming nitric acid. Heat the contents for 5 minutes. Cool and add 1 full test tube of cold water and shake vigorously. Filter and wash it with cold water. Dry and determine its melting point.

  Nitro derivative of Napthalene - M.P. 61^0C.

Reaction-



Hydrocarcons **1-Nitro napthalene**

- **Neutral Compounds containing C, H, (O) and N as the Elements-**

Test	**Observation**	**Inference**
1. Compound + dil. H_2SO_4, boil and cool + $NaNO_2$ sol^n. Cool add this to the β-Naphthol NaOH	Orange-red dyestuff	–NHCOR group is Present.
2. Compound + $FeSO_4$ solution + NaOH Sol^n and boil	Reddish-brown precipitate	$–NO_2$ group is Present.
3. Compound + Acetone + NaOH solution	Red or Violet Colouration	*m*-dinitro compound is present
4. Compound + 1 ml 50 % alcohol + 6 drop $CaCl_2$ + Pinch of Zinc Dust heat to boil and filter into 1 ml tollen's reagent	Black or Gray PPT	*NO_2 group is present*
5. Compound + 1 ml NaOH boil	Evolution of NH_3 gas which turns termaric paper red	*Amide is present*
6. Compound + 5 drop conc. HCl boil and Cool in ice water + excess of NaNO2 solution and above solution into 1 ml ice cold solution of of ß- naphthol in NaOH	Orange Dye Stuff	*Anilide group is present*

5. Confirmatory Tests-

C.T for *m*-Dinitrobenzene -

Test	**Observation**	**Inference**
1. 1 gm of Compound + 1 ml of NaOH solution and heat.	Red-brown colour	*m*-Dinitrobenzene is Confirmed
2. Compound + NaOH solution and boil. Add traces of $SnCl_2$	Violet Colour	*m*-Dinitrobenzene is Confirmed

C.T for Acetanilide -

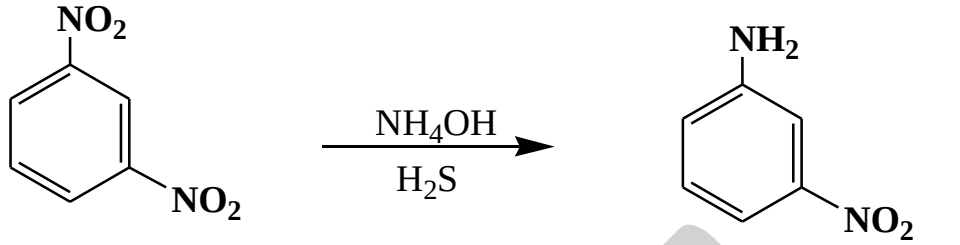
Test	**Observation**	**Inference**
1. 0.2 gm of Compound + 5 ml of conc. H_2SO_4 and shake to dissolve. Add solid $K_2Cr_2O_7$ and Shake well.	Rosy or Purple colour	Acetanilide is Confirmed

Preparation of Derivative-

- **Nitroaniline Derivative (*m*-Nitroaniline) by partial reduction -**
  Dissolve about 1 gm of *m*-Dinitrobenzene in 20 ml of ethyl alcohol. Add to it 1 ml of conc. Ammonia solution. Pass H_2S gas in it for 5 minutes. Heat the contents for 5 minutes, add dil. HCl, dilute with water and filter. Add ammonia solution or $NaHCO_3$ solution to the filtrate to make it

alkaline. Filter the precipitate, wash it with water. Recrystallise the product from hot water. Dry and determine its melting point. M.P. 114^0C.

Reactions-



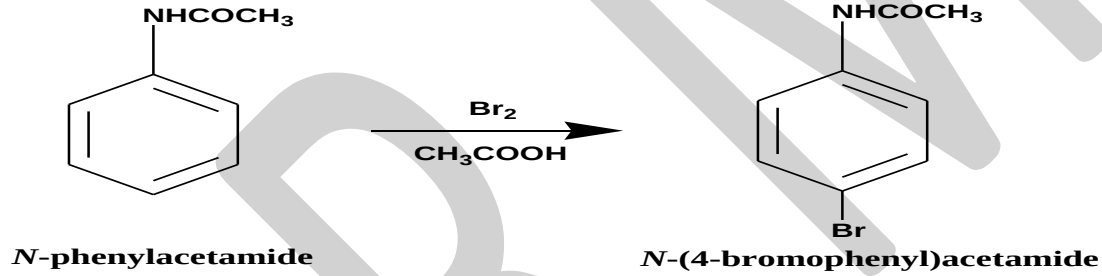
1,3-dinitrobenzene **3-nitrobenzenamine**

<u>Acetanilide-</u>

- **Bromo Derivative (*p*-Bromo Acetanilide) -**

Dissolve about 1 gm of Acetanilide in 5 ml of glacial acetic acid. Add 5 ml of 5% bromine in acetic acid. Keep the reaction mixture for 5 minutes and pour this content into 20 ml of water. Filter the precipitate, wash it with water. Recrystallise from alcohol. Dry and determine its melting point. M.P. 167^0C.

Reactions-

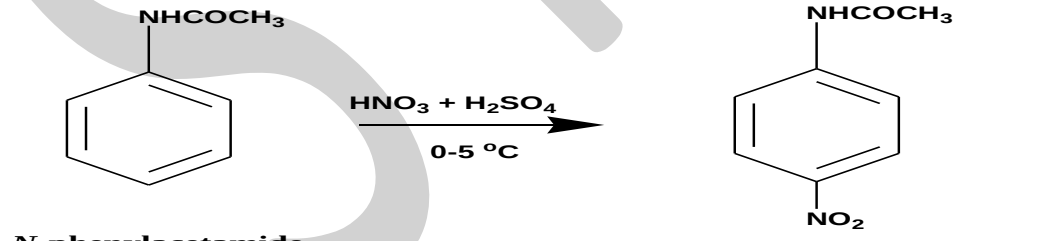


***N*-phenylacetamide** ***N*-(4-bromophenyl)acetamide**

- **Nitro Derivative (p-Nitro Acetanilide) -**

Take about 0.5 gm of Acetanilide, add 2 ml nitrating mixture at $0\text{-}5^0$C and shake carefully. Pour the contents in ice cold water. Filter the contents, wash it with cold water. Recrystallise from alcohol. Dry and determine its melting point. M.P. 216^0C.

Reactions-

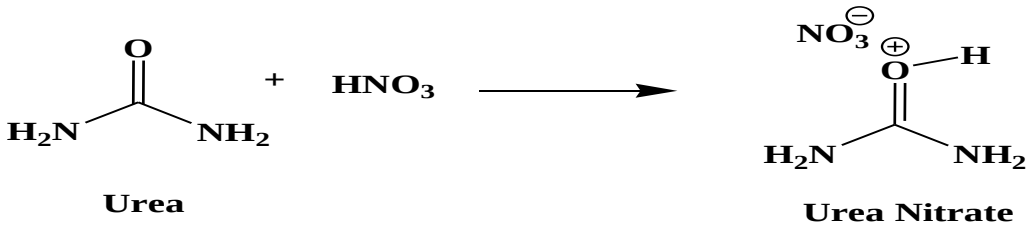


***N*-phenylacetamide** ***N*-(4-nitrophenyl)acetamide**

Derivative of Urea (Amide)

Nitrate of Urea: Dissolve (0.5 g) urea in water (4ml) & add Conc. HNO_3 (1ml) with stirring filter the urea nitrate and determine the M.P.

Reaction:



Urea **Urea Nitrate**

Oxalate of Urea: Dissolve (0.5 g) urea in water (4ml) & add sol^{n} of oxalic acid (0.6 g in 8 ml water) mix well. Filter the urea oxalate & determine the M.P.

Substance containing C, H, (O), N and S element

Test	Observation	Inference
1. Compound fuse in a test tube cool + 1 ml water + 2 drop FeCl3	Blood Red Colour	Thiourea present

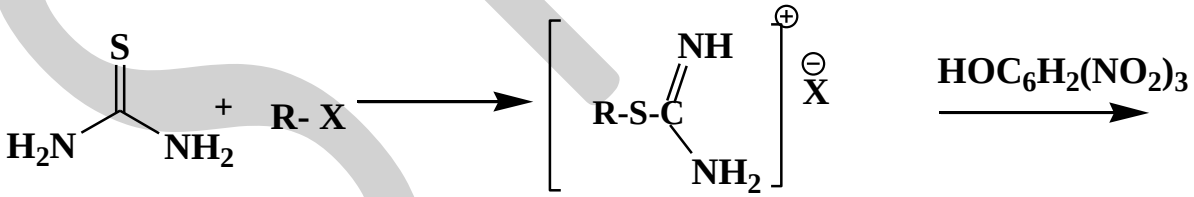
Substance contaning C, H, (O) and Halogen elements

Test	Observation	Inference
1. Compound + 1 ml NaOH boil and Cool add 5, 6 drop of conc. HNO3 + 2 drop AgNO3 Shake well	a) White PPT settles at the bottom b) No White PPT	Aliphatic halide present Aromatic Halide present

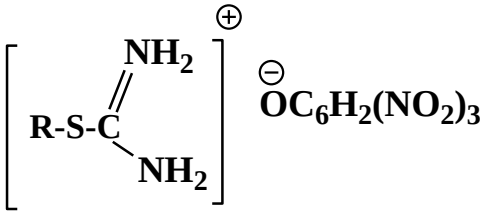
Conclusion: - The compound contains ---------- as the Functional Group(S).

Derivative of Thiourea and aliphatic or aromatic halide

S-Benzylsothiouronium Chloride: Place a mix. Of 0.5 g of finely powdered thiourea and 0.5 g of alkyl halide and 5 ml of ethanol in test tube and reflux 10-20 min. Then add 0.5 g of picric acid, boil until a clear solution is obtained and cool. If ppt not form then add water. Recrystallise the resulting S-alkyl isothiouronium picrate from ethanol. M.P. 188^{o}C



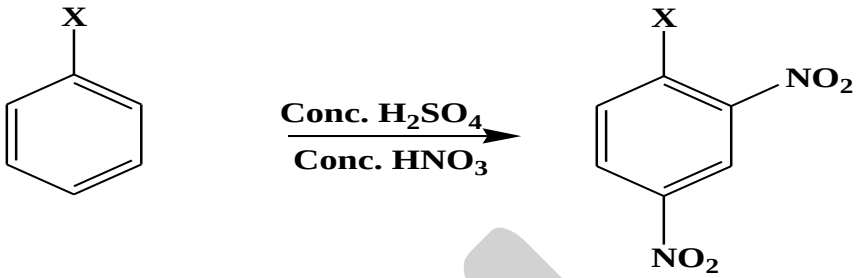
Thiourea **Alkyl halide** **S-alkylisothorium halide salt**



S-alkylisothorium Picrate

Nitro Derivative of Aromatic halide:

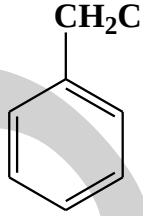
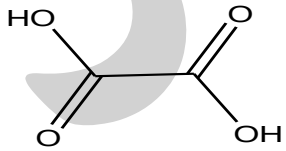
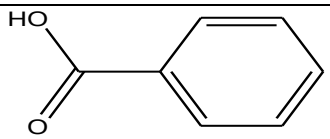
Add 1 g of compound to 4 ml conc. H_2SO_4 and cautiously introduce drop by drop 4 ml conc. HNO_3. Warm the mix on water bath for 10 min. then pour it on crushed ice. Collect the ppt recrestlises from ethanol. Determine the M.P.

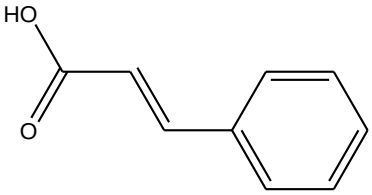
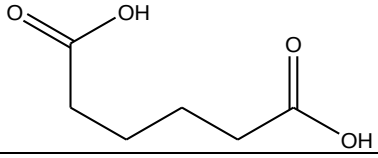
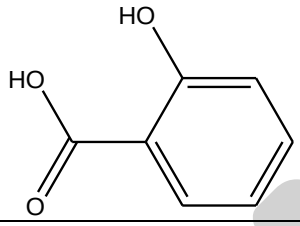
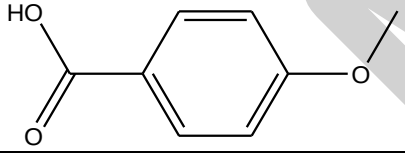
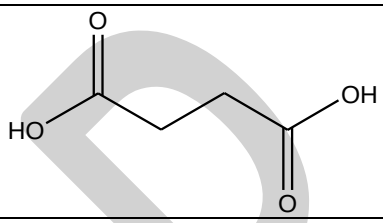
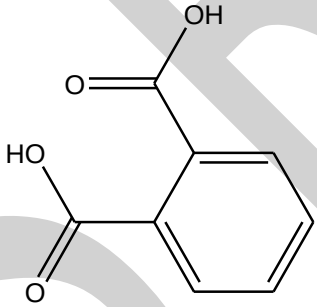
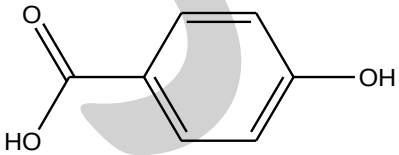
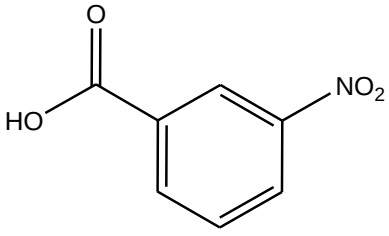


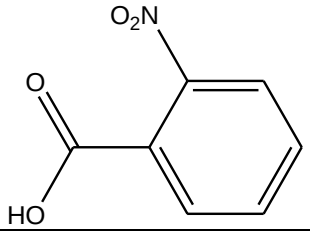
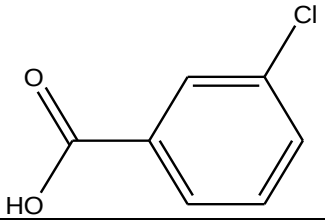
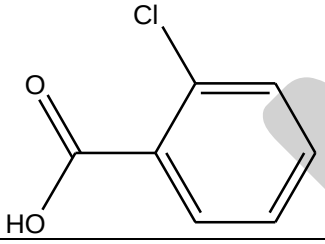
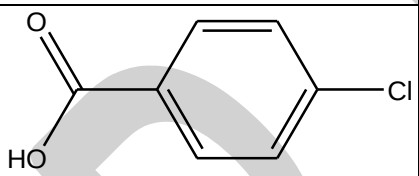
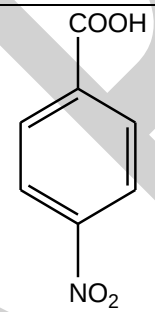
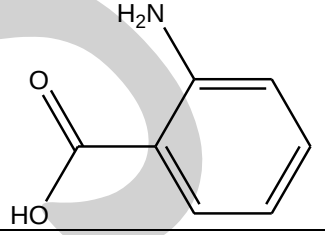
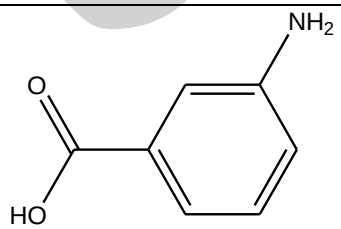
- **Result: Binary / Ternary Mixture-**

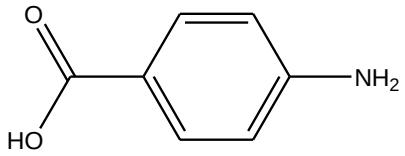
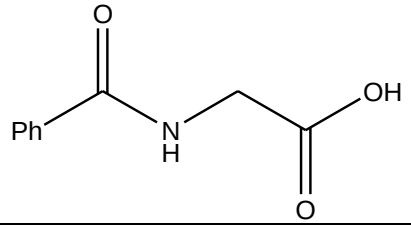
Steps	**Component I**	**Component II**	**(Or) Component III**
• Nature			
• Type			
• Elements			
• Functional group(s)			
• Physical Constant			
• Name of Compound			
• Molecular formula Of Compound			
• Structure Of Compound			
• Derivative Of Compound			
• Physical constant of derivative			
• Structure of derivative			

Compounds for Reference

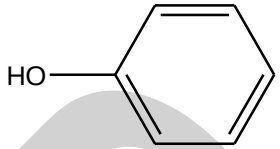
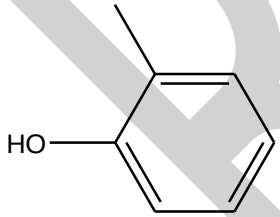
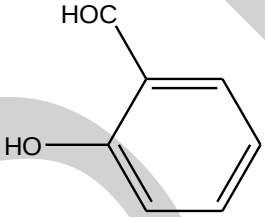
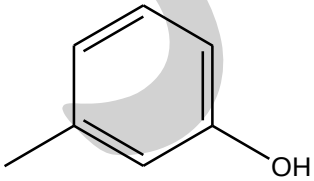
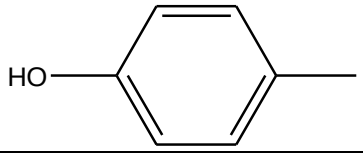
COMPOUND	STRUCTURE	CHARACTERISTICS	DERIVATIVE
Carboxylic acids Phenyl acetic acid M.P. 76 ^{0}C		White Crystalline Solid Perfume like Smell Sparingly Soluble in water	Anilide 118 ^{0}C S-Benzyl 160 ^{0}C
Oxalic acid (Dihydrate) 102 ^{0}C		Soluble in water, insoluble in either, white crystalline	Anilide 245 ^{0}C S-Benzyl 195 ^{0}C
Benzoic acid M.P. 101 ^{0}C		White crystalline solid, soluble in hot water, alcohol Benzene etc.	Anilide 162 ^{0}C B-Benzyl 166 ^{0}C

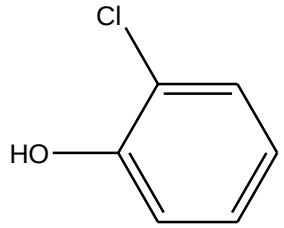
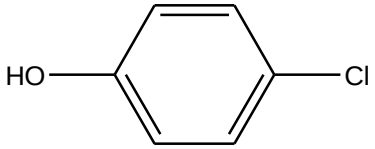
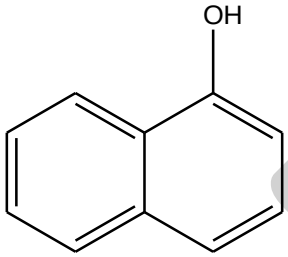
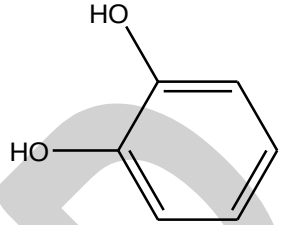
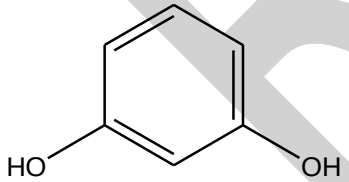
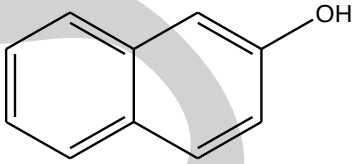
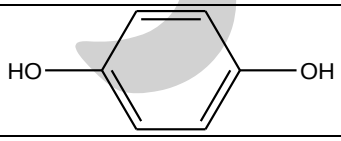
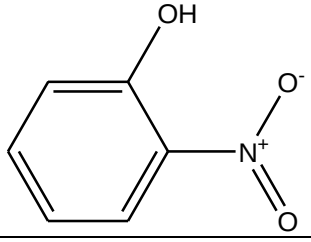
Cinnamic Acid M.P. 133 ^{0}C		Cream coloured shining crystals sparingly soluble in water soluble in alcohol	Dibromoderivative 195 ^{0}C S-Benzyl 175 ^{0}C
Adipic acid M.P. 151 ^{0}C		Colourless crystalline solid soluble in water	Anilide 239 ^{0}C S-Benzyl 159 ^{0}C
Sallicylic acid M.P. 158 ^{0}C		Colorless needle shaped crystals soluble in hot water, gives violet colour with aq. Ferric chloride solution	Aspirin 135^{o}C Nitro derivative 230^{o}C
Anisic acid M.P. 184 ^{0}C		Crystalline colourless solid, soluble in cold water, soluble in hot water	Anilide 171 ^{0}C S-Benzyl 185 ^{0}C
Succinic acid M.P. 185 ^{0}C		Colourless crystalline solid, soluble in water and alcohol, insoluble in either (gives phthalein test)	Anhydride 119 ^{0}C S-Benzyl 149 ^{0}C
Phthalic acid M.P. 195-235 ^{0}C		White crystalline solide, soluble in hot water, sparingly soluble in ether, mix 0.2 gm of acid with 0.4 gm of resorcinol and 0.5 ml of Conc. H_2SO_4. Heat gently until mixture turns red brown, cool & Pour in water and add 1 ml of NaOH Orange green fluorescence is formed (Phthalein test)	Anhydride 135 ^{0}C S-Benzyl 157 ^{0}C
P-Hydroxy Benzoic acid M.P. 219 ^{0}C		White needle shaped crystals sparingly soluble in water no colour with aq. $FeCl_3$	Anulide 197 ^{0}C Acetate 187 ^{0}C S-Benzyl 143 ^{0}C
M-Nitrobenzoic acid M.P. 141 ^{0}C		Pale yellow, crystalline solid sparingly soluble in cold water soluble in hot water	Anilide 151 ^{0}C S-Benzyl 159 ^{0}C

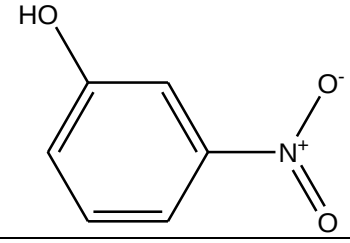
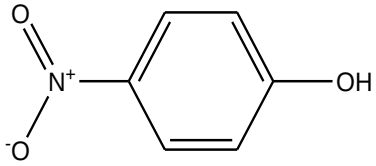
O-Nitrobenzoic acid		Pale yellow crystalline solid soluble in hot water, when heated with solalie form Nitro-benzene with odour of bittle almonds.	Anilide 155 ^{0}C S-Benzyl 159 ^{0}C
M-Chlorobenzoic acid M.P. 158 ^{0}C		White crystalline solid soluble in hot water	Amide 134 ^{0}C S-Benzyl
O-Chlorobenzoic acid M. P. 140 ^{0}C		White crystalline solid soluble in hot water	Anilide 114 ^{0}C S-Benzyl
P-Chlorobenzoic acid M.P.230 ^{0}C		White crystalline solid, Sparingly soluble in wter soluble in hot water	Anilide 114 ^{0}C S-Benzyl 186 ^{0}C
P-Nitrobenzoic acid M.P. 240 ^{0}C		Pale yellow crystalline solid sparingly solule in cold water and benzene . When heated with sodalime forms Nitrobenzene with smell of bitter almonds.	Anilide 211 ^{0}C S-Benzyl 180 ^{0}C
O-Aminobenzoic acid M.P. 144 ^{0}C		Crystalline solid, Soluble in water, with bromine in acetic acid yields 3;5 dibromo derivative.	Bromo 227 ^{0}C Acetyl 185 ^{0}C
M-Amino benzoic acid M.P. 174 ^{0}C		Soluble in hot water, crystalline solid fusion with Zink chloride, yields violet product giving brown solution in alcohol	Acetyl 250 ^{0}C Benzal 119 ^{0}C

P-Aminobenzoic acid M.P. 186 ^{0}C		Crystalline solid, soluble in hot water	Acetyl 252 ^{0}C Benzal 193 ^{0}C
Hippuric acid M.P. 190 ^{0}C		Crystalline solid, soluble in hot water on boiling with HCL yields benzoic acid M.P. 121 ^{0}C	Benzoic acid 121 ^{0}C

PHENOLS

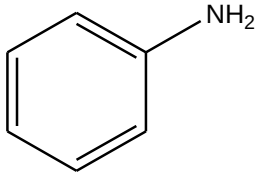
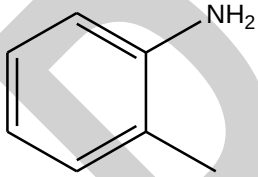
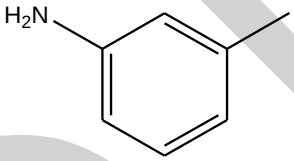
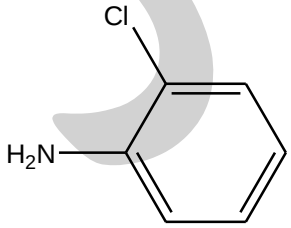
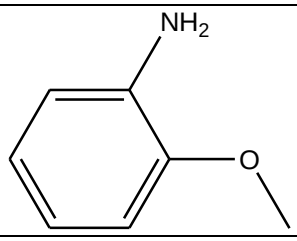
COMPOUND	STRUCTURE	CHARACTERISTICS	DERIVATIVE
Phenol B.P. 181 ^{0}C		Colourless solid or slightly pinkish solid violet colour with aq. $FeCl_3$, in water. Warmed with phthalic anhydride & a drop of conc. H_2SO_4, when solution made slightly alkaline give red colour (Phthali test)	Benzoate 68 ^{0}C
O-Cresol B.P. 196 ^{0}C		Colourless liquid violet color with aq. $FeCl_3$ with aq. Bromine in excess gives bromo derivative Warmed with phthalic anhydride and a drop of conc. H_2SO_4, Yield red colour with alkaline solution	Bromo 56 ^{0}C
Salicylaldehyde B.P. 196 ^{0}C		Colourless liquid insoluble in water, soluble in organic solvents, gives violet colour with $FeCl_3$ (alcoholic)	2,4 DNP 252 ^{0}C
M-Cresol B.P. 202 ^{0}C		Colourless liquid, Blue-Violet colour with aq. $FeCl_3$	Benzoate 54 ^{0}C Bromo 84 ^{0}C
P-Cresol B.P.202 ^{0}C		Colourless liquid, Blue colour with $FeCl_3$ in water, with excess of bromine water yields bromo derivative.	Benzoate 71 ^{0}C

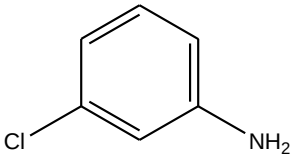
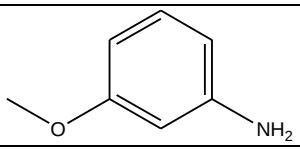
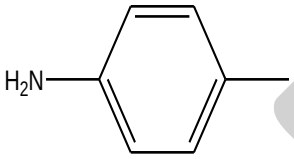
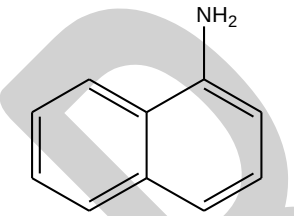
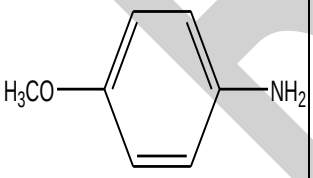
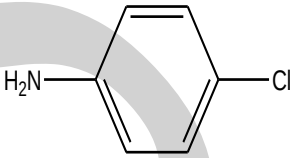
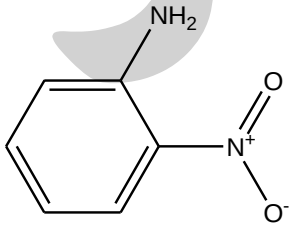
O-Chlorophenol B.P. 175 ^{0}C		With Nitric acid in acetic acid, yield Dinitro derivative M.P. 111 ^{0}C	3,5- Dinito benzoate 143^{0}C
P-Chlorophenol B.P. 217 ^{0}C		On adding conc. Nitric acid,yield dintroderivative M.P. 81 ^{0}C	3,5- Dinito benz ate 186^{0}C
ȁ-Naphthol M.P.94 ^{0}C		Pale brown colour, very faint pink colour when pure no colour with $FeCl_3$ in Water but white ppt Wrmed with CCl_4 + Cu powder gives jblue colour.	Benzoate 56 ^{0}C
Catechol M.P. 104 ^{0}C		White crystalline solid gives green colour with $FeCl_3$	Dibenzoate 84 ^{0}C
Resorcinol M.P. 110 ^{0}C		Pinkish white crystalline solid soluble in water, ether alcohols Gives blue violet colour with $FeCl_3$ substance and phthalic acid in 2:1 ratio & one ml of conc. H_2SO_4 heat gently and then strongly pour content in very dil NaOH solution. Gives yellow green fluorescence	Benzoate 117 ^{0}C
ß-Naphthol M.P. 122 ^{0}C		Pale pink, solid White crystalline when pure state. Insoluble in water	Benzoate 107 ^{0}C
Hydroquinone M.P. 169 ^{0}C		Soluble in water, insoluble in benzene transtent blue colour with $FeCl_3$ in water.	Diacetate 133 ^{0}C
O-Nitrophenol M.P. 45 ^{0}C		Bright yellow solid, sweet smell, sparingly soluble in cold water giving yellow colour soluble in hot water soluble in NaOH giving orange red colour	Dibromo 117 ^{0}C

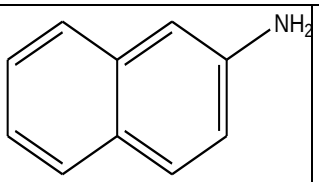
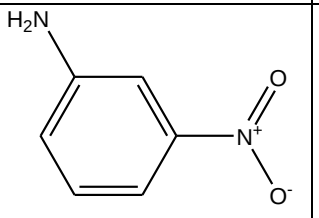
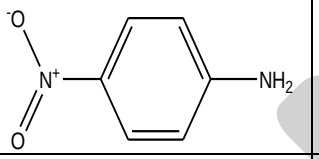
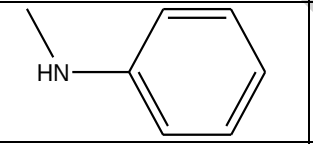
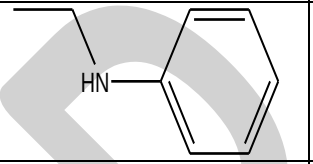
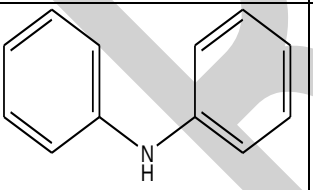
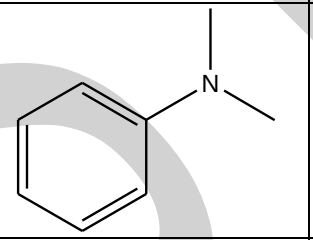
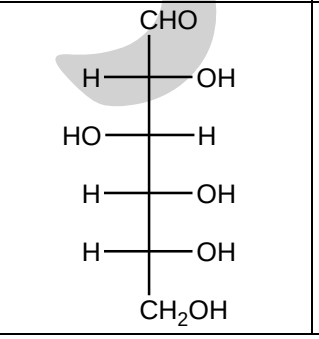
M-Nitrophenol M.P. 97 ^{0}C		Pale yellow crystalline solid odourless, soluble in hot water, soluble in NaOH to produce orange yellow colour	Bromo 91 ^{0}C Bebziate 95 ^{0}C
P-Nitrophenol M.P. 114 ^{0}C		Colourless crystalline solid, soluble in NaOH giving bright yellow colour	Dibromo 142 ^{0}C Benzoate 142 ^{0}C

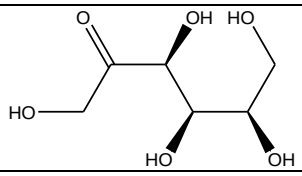
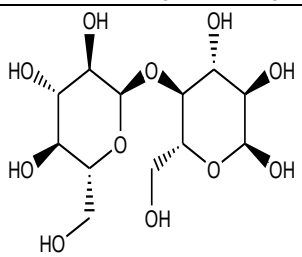
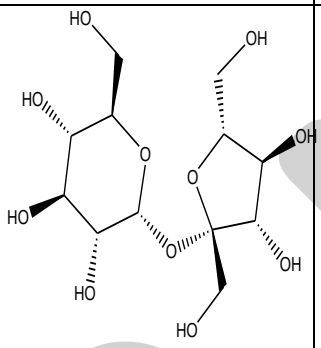
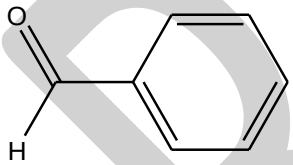
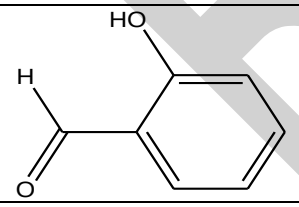
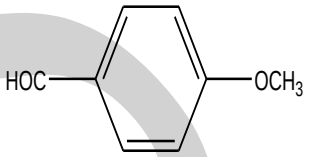
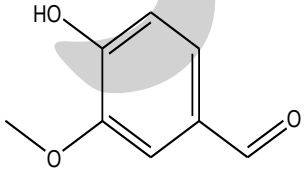
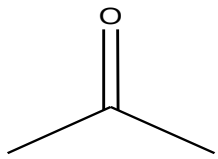
AMINES

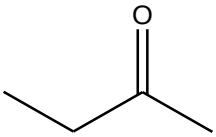
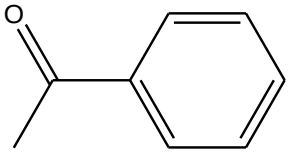
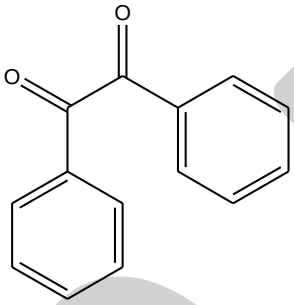
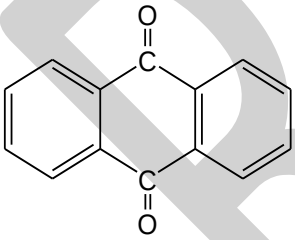
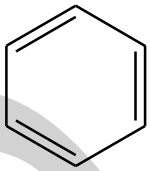
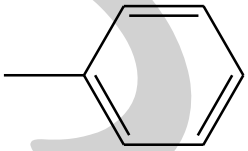
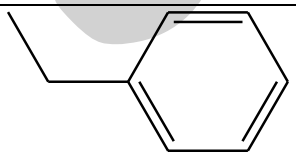
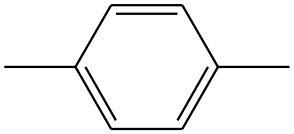
Primary amines

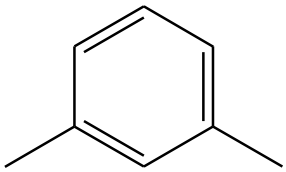
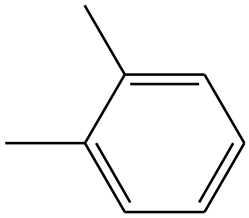
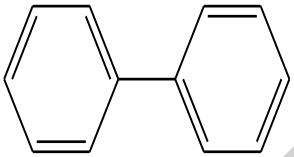
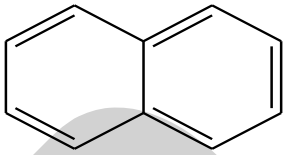
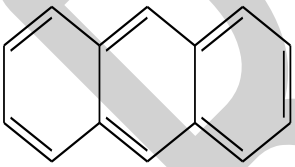
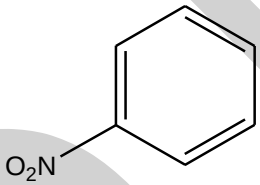
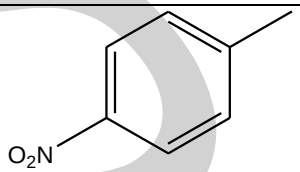
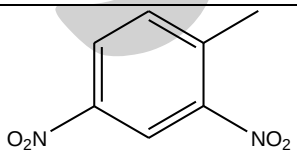
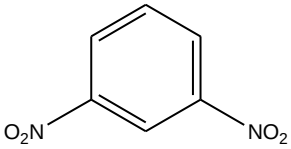
COMPOUND	STRUCTURE	CHARACTERISTICS	DERIVATIVE
Aniline B.P. 184 ^{0}C		Light straw colour soluble in ethyl alcohol-potassium dichromate (0.2 gm) and conc. H_2SO_4 about 1 ml add one drop of aniline a blue or black colour is obtained	Acetate 114 ^{0}C Benzoate 164 ^{0}C
O-Toludine B.P. 200 ^{0}C		Colourless liquid red brown colour on exposure to air and light dissolve small amount of substance in H_2SO_4 and add pinch of K_2 Cr_2 O_7. A blue colour is obtained which changes to purple on dilution with water	Acetate 112 ^{0}C Benzoate 114 ^{0}C
M-Toludine B. P. 203 ^{0}C		Colourless liquids, develops pink kbrown colour on exposure to air. Dissolve small amount of substance in conc. H_2SO_4 and & add to it pinch of K_2 Cr_2 O_7., a yellow brown colour is obtained which change to red on addition of HNO_3	Acetate 66^{0}C Benzoate 125^{0}C
O-Chloroaniline B.P. 209^{0}C		Colourless liquid, soluble in organic solvents.	Acetate 88^{0}C Benzoate 99^{0}C
O_Anisidine B.P. 225^{0}C		Colourless liquid on exposure to air develops dark coloured liquid	Acetate 88^{0}C

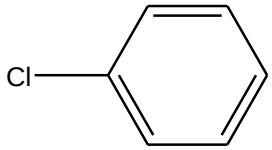
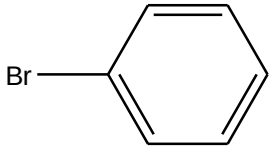
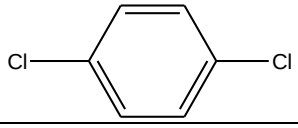
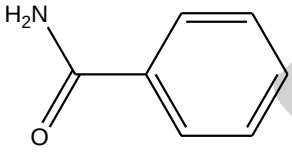
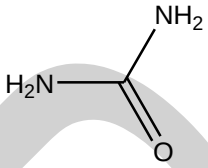
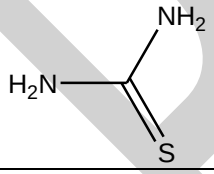
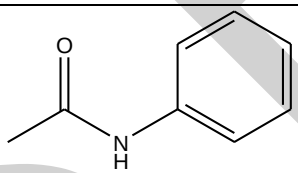
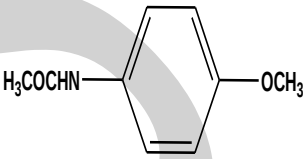
M-Chloro aniline B.P. 230^0C		Colourless liquid soluble in organic solvents	Benzoate 122^0C
M-Anisidine B.P. 251^0C		Colorrless liquid soluble in organic solvents	Acetate 80^0C
P-Toludine B.P. 48 ^{0}C		Colorless solid, it has characteristic odour, sparingly soluble in water, soluble in organic solvents. Dissolve substance in 1 ml of H_2SO_4 Divide solution in two parts to one part add a pinch of K_2 Cr_2 O_7 & Shake yellow colour formed to second portion add dil HNO_3 Blue colour changes to violet to red to brown is formed.	Acetate 154 ^{0}C Benzoate 158 ^{0}C
α- Naphthyl Amine M.P. 50^{o}C		Crystalline dark brown black colour solid, unpleasant odour insoluble in water, soluble in organic solvents.	Acetate 160 ^{0}C Benzoate 161 ^{0}C
P-Anisidine M.P. 57 ^{0}C		Crystalline colourless solid develops dark colour on keeping sparingly soluble in hot water little substance add 2-3 ml of dil HCl & two drops of aq $FeCl_3$ violet colour is formed	Acetate 130 ^{0}C Benzoate 154 ^{0}C
P-Chloro aniline M.P. 70^0C		Colourless crystalline solid, soluble in organic solvents	Acetate 179^0C Benzoate 193^0C
O-Nitro Aniline M.P. 71^0C		Golden yellow or orange coloured solid, soluble in hot water gives pale yellow colour to water	Acetate 94^0C Benzoate 98^0C

ß-Naphthyl amine M.P. 113^{0}C		Pink colour crystalline solid sparingly soluble in hot water gives no colour to FeCl3 solution	Acetate 134^{0}C Benzoate 162^{0}C
M-Nitro Aniline M.P. 114^{0}C		Yellow crystalline solid soluble in hot water gives pale yellow colour to water	Acetate 155^{0}C Benzoate 199^{0}C
P-Nitro Aniline M. P. 148^{0}C		Yellow solid soluble in hot water & organic solvents gives pale yellow colour to water	Acetate 216^{0}C Benzoate 199^{0}C
Secondary Amines N-Methyl Aniline B.P. 148^{0}C		Colourless liquid insoluble in water, soluble in organic solvent	Acetate 103^{0}C
N-Ethyl Aniline B.P. 205^{0}C		Colourless liquid insoluble in water, but soluble in organic solvent	Acetyl 55^{0}C Benzoate 60^{0}C
Diphenyl Amine M.P. 54^{0}C		Pale pink crystalline solid, insoluble in water soluble in alcohol	Acetyl 103^{0}C Benzoate 180^{0}C
Tertiary Amine N.N-Dimethyl Aniline B.P. 193^{0}C		Colourless liquid insoluble in water but soluble in organic solvents.	Picreate M.P. 164^{o}C
CARBOHYDRATES D-Glucose M.P. 146^{0}C		White crystalline solid soluble in water and hot alcohol insoluble in benzeneand either	Osazone 205^{0}C Penta acetate 112^{0}C

D-Fructose M.P. 146^0C		White crystalline solid, soluble in water, insoluble in alcohol, benzene and ether	Osazone 205^0C
Maltose (Hydrated) M.P. 100^0C		White crystalline solid soluble in water Insoluble in alcohole benzene and ether	Osazone 250^0C Octa acetate 158^0C
Sucrose Cane sugar $C_{12}H_{22}O_{11}$		White crystalline solid soluble in cold water Insoluble in benzene & ether, sparingly soluble in alcohol on reaction ppt with phenyl hydrazine of fehling solution after hydrolysis (i.e. wanning with HCl) it reduces fehling solution & react with phenyl hydrazine	Octa acetate 69^0C
CARBONYL COMPOUNDS **ALDEHYDES** Benzaldehyde B.P. 179^0C		Colorless liquid, has smell of bitter almonds, insoluble & heavier than water, soluble in organic solvents. It does not reduce fehling's solution	2,4 –DNP M.P. 237^0C
Salicylaldehyde B.P. 197^0C		Colorless liquid, Sparingly soluble in water, gives violet colour with aqueous FeCl3	2,4 DNP 231^0C
Anisaldehyde B.P. 248^0C		Colourless liquid insoluble in water	2,4 DNP 254^0C
Vanillin M.P. 81^0C		Colorless crystalline solid sparingly soluble in water, vamlla smell	2,4 DNF 269^0C
Ketones **Acetone** M.P. 56^0C		Colourless liquid has characteristic pleasant smell gives iodoform test. Compound +3,4 drops of iodine, then NaOH drop to solution & on warming the brown colour of iodine disappears	2,4-DNP $128\ ^0$C

		& yellow ppt of iodoform forms & have characteristic smell of iodoform	
Ethyl Methy Ketone B.P.. 80^0C	CH_3 CO C_2 H_5 	Colourless liquid soluble in water alcohol &ether has pleasant smell give iodoform test	2,4- DNP 115^0C
Acetophenone B.P.202^0C		Colourless liquid has characteristic sweet smell sparingly soluble in water soluble in organic solyentsgives iodoforn test	2.4-DNP M.P. 238^0C
Benzil M.P. 95^0C		Pale yellow crystalline solid very sparingly soluble in water	2,4- DNP M.P. 189^{o}C
Anthraquinone M.P. 289^{o}C		Pale yellow crystalline solid very sparingly soluble in ether & Benzene	Diacetate M.P. 260^0C
HYDROCARBONS Benzene B.P.80^0C		Colourless Mobile liquid with characteristic aromatic odour, insoluble in water miscible with alcohol etc.	M- dinitro benzene 89 ^{0}C
Toluene B.P.110^0C		Colourless mobile liquid with benzene like odour, insoluble in water but miscible with organic solvents.	2.4- Dinitro 71^0C
Ethyl benzene B.P.136^0C		Colourless mobile liquids with benzene like odour insoluble in water miscible with organic solvents.	2,4,6- Trinitro 37^{o}C
P-Xylene B.P.138^0C		Colourless liquid with characteristics aromatic odour insoluble in water but soluble in alcohol and ether.	2,3,5- Trinitro 139^{o}C

M-Xylene B.P.139^{0}C		Colourless liquid with benzene like odour insoluble in water but miscible with orgnic solvents.	2,4,6- Trinitro 182^{o}C
O-Xylene B.P.144^{0}C		Colourless mobile liquid with benzene like odour insoluble in water but soluble in organic solvents.	4,5- Dinitro M.P. 71^{o}C
Biphenyl M.P.70^{0}C		White crystalline solid with characteristic aromatic odour insoluble in water but soluble in alcohol and ether.	4,4'- Dibromo M.P. 164^{o}C Dinitro M.P. 164^{o}C
Naphthalene M.P.80^{0}C		White crystalline solid with aromatic odour insoluble in water but soluble in organic solvents . dissolve 0.019 ml of substance in CHCl3 & few crystals of anhydrous AlCl3 a green colour develops	Picrate M.P. 150^{o}C
Anthracene M.P.217^{0}C		Colourless solid with faint aromatic odour insoluble in water but soluble in organic solvents	Picrate 138^{0}C
NITRO HYDROCARBONS Nitro benzene B.P.209^{0}C		Pale yellow liquid with odour of bitter almonds insoluble in water but miscible in organic solvents.	M-dinitrobenzene 90^{0}C
P-Nitrotoluene M.P.54^{0}C		Pale yellow crystalline solid insoluble in water but soluble in organic solvents.	Nitro derivative 54^{0}C
2,4-Dinitrotoluene M.P.71^{0}C		Yellow coloured solids sparingly soluble in cold alcohol and ether soluble in benzene.	Nitro derivative 71^{0}C
M-Dinitrobenzene M.P.90 ^{0}C		Pale yellow crystalline solid insoluble in water but soluble in organic solvents.	M-nitroaniline 114^{0}C

HALOGEN HYDROCARBONS Clorobenzene B.P. 132^0C		Colourless liquid with pleasant smell insoluble in water but soluble in organic solvents.	2,4- Dinitro 52^0C
Bromo Benzene B.P. 155^0C		Yellow colour liquid with pleasant smell. Soluble in organic solvent but insoluble in water	2,4- Dinitro 75^0C
P-Dichlorobenzene M.P. 52^0C		White crystalline solid with chacteristic smell insoluble in water soluble in organic solvent.	2-Nitro derivative 52^0C
ANILIDES AND AMIDES Benzamide M.P. 129^0C		White Crystal and solid soluble in hot water, alcohol and benzene, sparingly soluble in ether. Boil 0.1 gm substance in test tube add to it 1 ml NaOH Boil add HCL till solution acidic white ppt of a benzoic acid formed.	Benzoic acid M.P. 121^0C
Urea M.P. 132^0C		Colour less crystalline solid soluble in water insoluble in ether	Urea Nitrate 164^0C
Thiourea M.P.180^0C		Colour less crystalline and solid soluble in water insoluble in ether with aq. $FeCl_3$ gives blood red colour	S-benzylisothorium salt M.P. 188^0C Hydrochloride
Acetanilide M.P. 114^0C		White Shining Crystals Soluble in hot water.	Bromo 167^0C
Phenacetine Or 4-methoxyphenyl-acetamide M.P. 134^0C		White Crystalline Solid Slightly Soluble in Boiling Water Soluble in alcohol.	3-Nitro 103^0C