Department Of Chemistry

Faculty Of Science

Jazan University

IDENTIFICATION OF SOLID ORGANIC COMPOUNDS



Chem 232

2rd Year Students (4thLevel)

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General Safety Rules



- 1. Listen to or read instructions carefully before attempting to do anything.
- Wear safety goggles to protect your eyes from chemicals, heated materials, or things that might be able to shatter.
- 3. Notify your teacher if any spills or accidents occur.
- 4. After handling chemicals, always wash your hands with soap and water.
- 5. During lab work, keep your hands away from your face.







- 8. Know the location of the fire extinguisher, fire blanket, eyewash station, and first aid kit.
- Keep your work area uncluttered. Take to the lab station only what is necessary.
- 10. It is suggested that you wear glasses rather than contact lenses.
- 11. Never put anything into your mouth during a lab experiment.
- 12. Clean up your lab area at the conclusion of the laboratory period.
- 13. Never "horse around" or play practical jokes in the laboratory.





Glassware Safety



- 1. Chipped or cracked glassware should not be used. Show it to the teacher.
- Broken glassware should not be disposed of in a classroom trashcan.
 There is a special glass disposal container for it.
- When pouring liquids into glassware, make sure the container you are pouring into is resting on
 a table at least a hands breadth from the edge.
- 4. If a piece of glassware gets broken, do not try to clean it up by yourself. Notify the teacher.
- 5. Do not place hot glassware in water. Rapid cooling may make it shatter.

Chemical Safety



- 1. Wear protective goggles whenever heating or pouring hazardous chemicals
- Never mix chemicals together unless you are told to do so (and then only in the manner specified).
- 3. Never taste any chemicals (you should never taste anything in the lab).
- 4. If you need to smell the odor of a chemical, waft the fumes toward your nose with one hand. Do not put your nose over the container and inhale the fumes
- 5. Follow the instructions of your teacher when disposing of all chemicals.
- 6. Wash your hands after handling hazardous chemicals.

Heating Safety



- 1. Use tongs and/or protective gloves to handle hot objects.
- 2. Never reach across an open flame or burner.
- 3. Always point the top ends of test tubes that are being heated away from people.
- 4. When heating a test tube, move it around slowly over the flame to distribute the heat evenly.
- 5. Only glassware that is thoroughly dry should be heated.
- Heat glassware by placing it on a wire gauze platform on a ringstand.
 Do not hold it in your hand.

First Aid

Injury: Burns

To Do:

To Do:

To Do: Immediately flush with cold water until burning sensation is lessened.

Injury: Cuts, bruises

Do not touch an open wound without safety gloves.

Pressing directly on minor cuts will stop bleeding in a few minutes.

Apply cold compress to bruises to reduce swelling.

Injury: The eyes

Flush eyes immediately with plenty of water for several minutes.

If a foreign object is lodged in the eye, do not allow the eye to be rubbed.









Lab-Equipments



Beakers Test



Tubes in Rack



Tube & Holder in Action



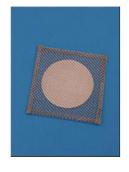
Test Tube Holder



Utility Clamp



Clamp in action



Wire Gauze



Combined for Heating



Watch Glasses



Wash Bottle



Scapula



Stirring Rods

Lab-Equipments



Goggles



Forceps



Funnels



Evaporating Dish



Dropper Pipets



Erlenmeyer Flasks



Graduated Cylinders



Ring Clamp & Stand



Thermometers



Buret



Balance (electronic)



Bunsen Burner

Lab-Equipments



Water bath



Ice bath



Oil bath



Oven



Desiccator



Water distillation



Hood



Water pump



Microscope

QUALITATIVE ANALYSIS OF ORGANIC COMPOUNDS

In this experiment the unknown will contain only one functional group, and this group will be limited to amines, carboxylic acids, phenols, alcohols, aldehydes and ketones.

The investigation of the unknown begins with the characterization of the functional group.

For this purpose the infrared spectrum of the unknown if available, is extremely helpful. The solubility property of the unknown also provides valuable information, of the groups that appear in this chapter, low-molecular weight compounds with up to four carbon atoms are water-soluble.

However, if the compound is not water soluble, its solubility in acid or base is significant in identifying the functional groups present.

PRELIMINARY EXAMINATION

1- Physical characteristics

A) Condition

A Knowledge as to whether a given compound is liquid or solid

Solid:

- i) Crystalline it has a definite shape may be : Needles, Prisms, Plates,Microcrystalline
- ii) Powder may be Fine or Coarse
- iii) Amorphous (has no definite shape)



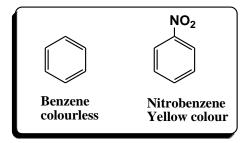
Liquid

- i) Mobile (such as : methanol, ethanol)
- ii) Viscous (such as lactic acid, glycerol)

B) Colour

Note and describe the color of the sample whatever it is liquid or solid.

Some compounds show colour due to impurities, which is frequently produced as a result of their slow oxidation by moist air (freshly distilled aniline is nearly colourless but goes reddish brown when kept for a longer time), while many others show colour due to the presence of chromophoric groups such as NO₂,



The group that increases the intensity of colour is called Auxochromophore (e.g. OH, NH₂)

A brief summary of the conclusions that can be drawn by the observation colour is given here.

Observation	Inference
Orange-red	Nitroanilines, azo compounds, naphthoquinone, alizarin
	naphthoqumone, anzarm
Brown	Higher aromatic amines, diamines
Pink	Naphthols
Greenish yellow	p-Nitroso compounds, quinhydrone
Yellow	Iodoform, nitro compounds, quinines, α-diketones

Colourless turns brown due to air oxidation	Phenols, aniline, aminophenols, α – and β-naphthylamines
Colourless turns to yellow	Anthracene, cinnamic acid, cresols
Colourless	Carbohydrate, aldehydes, ketones, acids, alcohols, ethers, many hydrocarbons

C) Odour

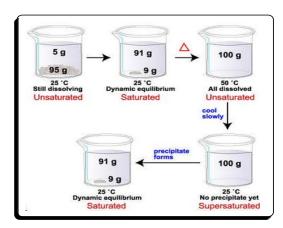
Many types of organic compounds have characteristic odour and so the ability to detect and remember an odour is very helpful in qualitatives analysis.

Some of the odoures characteristics of compounds are given here.

Observation	Inference
Bitter almond	Benzaldehyde, benzonitrile and
	nitrobenzene
Mouse-like	Acetamide, acetonitrile
Cinnamon-like	Cinnamic
Pleasant, fruity	Esters
Pleasant, sweet	Chloroform, and alcohols
Phenolic (Carbolic)	Many phenols
Pungent, irritating	Formaldehyde and lower acids, acid
	halides
Vingar-like	Acetic acid
Fish-like	Amines
Cucumber-like	Heterocyclic bases
Odourless	Carbohydrate, solid aliphatic acid,
	aromatic acids and glycerol

D) Solubility and Litmus paper

If a solid (liquid) is soluble (miscible) in (with) H_2O then you need to determine whether it's **acidic**, **basic or neutral** this can be achieved through the use of **litmus** paper.



When a blue litmus paper turns **red** then the compound is **acidic**

When a red litmus paper turns **blue** then the compound is **basic**

When the two litmus papers don't change in color then the compound is **neutral**

2- <u>Chemical Characteristic</u>

A) Elements Test (Lassaigne's Test)



This test is aiming to identify elements like N, X, S in organic substances. Where, X means halogens (Cl, Br and I)

Procedure

Fuse the organic substance with sodium metal in a dry and clean ignition tube, heating is then continued more strongly until the lower part of the tube becomes

red, then plunge the hot tube at once, into a beaker containing about 10 ml of distilled water, crush the tube well, boil the contents of the beaker, then filter.

Note:

Heat the tube gently, near the outer post of the flame. When any reaction sets in, remove the tube from the flame and wait till the reaction subsides.

i) Detection of Nitrogen:-

In a clean test tubes take about 1 ml of the filtrate and 1 ml of FeSO₄ solution followed by addition of 1-2 drops only of conc. H₂SO₄, if the color of the solution turns to green or blue this indicted to the presence of nitrogen.

ii) Detection of Sulfur:

In a clean test tube take about 1ml of the filtrate then add few drops of acetic acid followed by 3 drops lead acetate, then shake the tube, the black precipitate of lead sulfide indicates the presence of sulfur.

ii) Detection of Halogen:

In a test tube, take about 1 ml of the filtrate then added about 1-2 ml of dilute HNO₃ followed by the addition of about 1 ml of AgNO₃ solution and observe the results as described below.

White precipitate formed in case of chloride (Cl).

Pale yellow precipitate formed in case of bromide (Br⁻).

Yellow precipitate formed in case of iodide (Γ).

Note:

If nitrogen and / or sulphur has been detected, the filtrate should be boiled with dilute suphuric acid for 30 min. before adding AgNO₃, to expel HCN and H₂S,

In the presence of nitrogen: suphuric acid, reacts with sod. cyanide and hence prevent its reaction with silver nitrate.

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In the presence of sulphur: suphuric acid, reacts with sod. sulphide and hence prevent its reaction with silver nitrate.

B) Action of Heat (Ignition Test)



Procedure

Place a little of the substance (0.1g) on a piece of porcelain and then heat it over a low flame, raising the temperature gradually. Observe whether the compound is volatile; inflammable (if so, nature of the flame); or melts, decomposes or a residue is left. If a residue is left, it is cooled and drop of distilled H₂O added to the residue and tested with litmus paper (or ph.ph. indicator). Then a little of dil. HCl is added to see whether any gas is evolved or not.

Observation	Inference
Burn with a smoky flame	Aromatic compounds, or
	chloralhydrates
Burn with a non-smoky flame	Aliphatic compounds
Melts, darkness, swells and then chars	Sugar
with odour of burnt sugar.	
Chars without melting with the odour of	Starch, inulin, tartaric, citric, or their
burnt sugar	salts, lactate
Residual ash	Organo metallic compounds or metallic
	salts of acids

C) Heating with Soda-lime



Procedure

Mix well the compound (0.1g) with powdered soda-lime (0.1g) in a dry test tube, cover with a layer of soda-lime and heat first gently and then strongly, notice any odour or change in colour.

Observation	Inference
Ammonia or ammonical vapours	Ammonium salts of acid, amides,
evolved	imides, nitriles, aliphatic amino acids or
	poly nitro-compounds

Chloroform produced (gives a	Chloral hydrates
characteristic odour while cold)	
Odour of burnt sugar	Carbohydrates or some aliphatic
	hydroxyl acid and their salts
Phenolic odour	Phenolic acids or phenyl esters of
	carboxylic acids
Benzene produced	Benzene carboxylic acid or their salts
Odour of aromatic amine	Amine salts, anilinides or aromatic
	amino-carboxylic acids
Colour changes yellow to brown and	Many aromatic nitro compounds
then black	

Ammonia Odour

Benzene Odour

Aniline Odour

Phenolic Odour

Chlorofrom Odour

D) Treatment with 20% NaOH solution



Procedure

Add about 5 ml of 20% NaOH solution to the compound (0.1g). Note the reaction while cold and then warm or heat if necessary.

Observation	Inference
Dissolves on cold (warm) but not	Some aromatic acids or water insoluble
soluble in water	phenols.
Colour deepens on standing	Some polyhydric phenols,
	aminophenones or benzoquinones
Ammonia evolves on cold	Mostly ammonium salts of acids
Chloroform produced as oil	Chloral or its hydrates
Oil or ppt. formed	Salts of aliphatic or aromatic amines
Yellow to brown resin on heating	Carbohydrates (sucrose and starch give
	only a faintly yellow coloured product)
	or aliphatic aldehydes (except HCHO)
Ammonia evolves on heating	Amides, imides, nitriles or urea.
Oil or ppt. is formed on heating	Anilides.

E) Treatment with conc. H_2SO_4 acid



Procedure

To a small quantity (0.1g) of the substances contained in a dry test tube, add about 1ml of conc. H_2SO_4 acid and note the reaction first while the mixture is cold and then after it has been gently warmed.

Observation	Inference
Evolution of CO and CO ₂ without	Citric acid and its salts.
charring but the mixture turns yellow.	
rapid charring with effervescence	Carbohydrates, tartarates, lactates
(evolution of CO and/or CO ₂ and SO ₂)	
Evolution of CO and CO2 but no	Oxalates
blackening	
evolution of pungent vapour but no	Many simple carboxylic acids and their
blackening and no marked effervescence	salts
blackening without effervescence	Phenols

Examples

HO-CH-COOH

HO-CHCOOH

Trataric acid

COOH

Conc.
$$H_2SO_4$$

COOH

COOH

Oxalic acid

CH2COOH

COC. H_2SO_4

COOH

Oxalic acid

CH2COOH

COC. H_2SO_4

COOH

COC. H_2SO_4

COOH

COC. H_2SO_4

COOH

F) Nitration Test



Procedure

Boil a portion of the solid with a mixture of equal volumes of conc. HNO_3 and H_2SO_4 acid in a dry test tube. When the brown fumes started to evolve then, pour the mixture into a beaker containing about 30 ml of water.

Observation	Inference
Yellow, orange or red coloured solution, oil or ppt	Aromatic compound
-ve	Aliphatic compound

G) Acidity Test



Procedure

A cold solution of NaHCO₃ is added to a cold solution of the substance in H_2O or alcohol or even to a suspension in H_2O .

Observation	Inference
Effervescence with evolution of CO ₂	A carboxylic acid, aniline salts, urea
	salts sulphonic acid or phenolic
	compounds activated by nitro groups.
R-COOH + NaHCO ₃	\rightarrow R-COONa + CO ₂ + H ₂ O
- Ve	Non acidic compound

H) Solubility and Reverse precipitation



If the substance soluble in water, then, no need for this test. But this test is carried out on substance which are insoluble in water. If the substance insoluble in water (substance soluble in Na₂CO₃/ NaOH/ Conc. HCl)

Observation	Inference
Soluble in 5% Na ₂ CO ₃ soln. and reprecipitated by	Aromatic carboxylic acid.
dil. HCl acid and not soluble in H ₂ O	
Soluble in 5% NaOH soln. (but insoluble in Na ₂ CO ₃	Water-insoluble phenol
soln. and H_2O) and reprecipitated by dil. HCl acid.	
Soluble in dil. HCl (not soluble in H ₂ O) and	Organic base
reprecipitated by NaOH solution.	

I) Treatment with neutral FeCl₃



Procedure

To obtain a neutral FeCl₃ soln., add a few drops of NH₄OH soln. to FeCl₃ soln. till a permanent ppt. is formed and filter. Add a few drops of this FeCl₃ soln. to dilute soln. of the substance in water or in alcohol or (neutral soln. in case of acids).

Observation	Inference
Intense purple, blue or red colour	Phenol, phenolic acids, esters and
	amides
Buff ppt. (cleared by dil. HCl but replaced by a	Aromatic acid and succinate.
white ppt. of free acid.	
Greenish colour of ppt.	Catechol, quinol or β- naphthol.
Red colour (discharges on addition of dil. HCl)	Amino acids, formic or acetic acids
Greenish colour (the substance in dil. HCl)	Some amines

Investigation of compound <u>Unknown ()</u>					Date
Physical properties					
Colour		Shape			Solubility
Chemical properties					
Test		Obser	vation		Result
1- Elements test	X	N	S		
2- Action of heat					
3- Heating with soda-lime					
4- Treatment with 20% NaOH					
5- Treatment with con. H ₂ SO ₄					
6- Nitration test					
7- Acidity test					
8- Solubility and reverse precipitation					
9- Treatment With neutra FeCl ₃ solution test	1				

Investigation of compo	<u>)</u>	Date			
Physical properties					
Colour		Shape			Solubility
Chemical properties					
Test		Obse	rvation	<u> </u>	Result
1- Elements test	X	N	S	-	
2- Action of heat					
3- Heating with soda-lime					
4- Treatment with 20% NaOH					
5- Treatment with con. H ₂ SO ₄					
6- Nitration test					
7- Acidity test					
8- Solubility and revers precipitation					
9. Treatment With neutra	1				

FeCl₃ solution test

Investigation of compound <u>Unknown (</u>						Date
Physical properties						
Colour			Shape			Solubility
Chemical properties						
Test			Obser	vation		Result
1- Elements test		X	N	S		
2- Action of heat						
3- Heating with soda-lime						
4- Treatment with 20% NaOH						
5- Treatment with con. H ₂ SO ₄						
6- Nitration test						
7- Acidity test						
8- Solubility and revers precipitation						
9- Treatment With neutra	1					

FeCl₃ solution test

Investigation of compo	ound				Date
	Unknov	wn ()	
Physical properties					
Colour		Shape			Solubility
Charainal managartian					
Chemical properties					
Test		Observ	vation		Result
1- Elements test	X	N	S		
2- Action of heat					
3- Heating with soda-lime					
4- Treatment with 20% NaOH					
5- Treatment with con. H ₂ SO ₄					
6- Nitration test					
7- Acidity test					
8- Solubility and reverse precipitation					
9- Treatment With neutra FeCl ₃ solution test	ıl				

Investigation of compo)	Date			
Physical properties					
Colour		Shape			Solubility
Chemical properties					
Test		Obser	vation		Result
1- Elements test	X	N	S		
2- Action of heat					
3- Heating with soda-lime	:				
4- Treatment with 20% NaOH					
5- Treatment with con. H ₂ SO ₄					
6- Nitration test					
7- Acidity test					
8- Solubility and revers precipitation					
9- Treatment With neutra FeCl ₃ solution test	ıl				

Investigation of compound Unknown ()					Date
Physical properties	СППО	<u> </u>		<u></u>	
Colour		Shape			Solubility
Chemical properties					
Test		Obser	vation		Result
1- Elements test	X	N	S	-	
2- Action of heat					
3- Heating with soda-lime					
4- Treatment with 20% NaOH					
5- Treatment with con. H ₂ SO ₄					
6- Nitration test					
7- Acidity test					
8- Solubility and revers precipitation					
9- Treatment With neutra FeCl ₃ solution test	1				

Identification of compound containing (C, H and O)



This class includes

- 1- Carbohydrates
- 2- Carboxylic acids
- 3- Hydroxy compounds
- 4- Aldehyde and ketones
- 5- Hydrocarbons

Carbohydrates



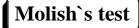
Classification of carbohydrate into:-

Monosaccharides (glucose, galactose and fructose)

Disaccharides (sucrose, maltose, and lactose)

Polysaccharides (starch and inulin)

Identification Of Carbohydrates:





Procedure

Place 1 ml of carbohydrates soln and 1 ml of α -naphthol in dry test tube then and 1-2 ml conc. H₂SO₄ down the side of the test tube, a violet ring spread on shaking is formed.

$$\begin{array}{c|c} CHO \\ (CH_2OH)_4 \\ - CH_2OH \\ \end{array} \begin{array}{c} Conc. \\ - CH_2OH \\ \end{array} \begin{array}{c} COH_2OH \\ - CH_2OH \\ \end{array} \begin{array}{c} CHO \\ - CH_2OH \\ \end{array} \begin{array}{c} CHO \\ - CH_2OH \\ \end{array} \begin{array}{c} CHO \\ - CH_2OH \\ - CH_2OH \\ \end{array} \begin{array}{c} CHO \\ - CH_2OH \\ - CH_2OH$$

Note

If the violet color disappears on shaking, the test is -ve and no carbohydrates are present

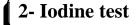
Differentiation between Mono, Di and Polysaccharides

1- Solubility test



If substance insoluble in water

(Polysaccharides, Starch)





Procedure

Place 0.2 ml of colloidal starch soln. and 5 ml water in test tube, then add one drop of iodine solution.

Observation	Inference
Blue color is developed	Starch

3- Barfoed`s test

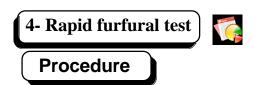


Procedure

Heat a test-tube containing 1ml of the Barfoed's reagent and 1ml of a dilute solution of the carbohydrate in a boiling water bath.

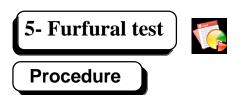
Observation	Inference			
Red Cu ₂ O ppt. within 2 minutes	Monosaccharides			
Red ppt. after 5 minutes boiling	Disaccharides			
CHO + Cu (II) - Aldose	$\begin{array}{c cccc} & & & & & \\ \hline & & & & & \\ \hline & & & & \\ \hline & & & &$			

<u>Differentiation between Monoaccharides (Glucose, Fructose and Galacose)</u>



Place 1 ml of sugar soln. and 1 ml of α -naphthol test tube, then add 5-7 ml of conc. HCl, boil.

Observation	Inference
Immediate violet color appears	Fructose
Violet color appears after boiling for 1-2 min.	Glucose
- Ve	Galactose



Place 0.2 g of carbohydrates and 6 ml dil. HCl in test tube, boil, then insert an aniline acetate paper at the mouth of the test tube, continue boiling,

Observation	Inference
The paper acquires a red color	Fructose

Differentiation between Disaccharides (Maltose, Sucrose and Lactose)

6- Fehling`s test



Fehling's solution:

(**Fehling 1**: CuSO₄. H₂O and **Fehling 2**: sod. Tartarate in NaOH soln.)

Procedure

Mix 3 ml of Fehling's solution(prepared by mixing equal volumes of Fehling's solution s and a solution of carbohydrate boil for 1-2 minutes.

Observation		Inference
A reddish brown Cu ₂ O ppt.		Lactose and Maltose
- Ve		Sucrose
	CHO CHOH Aldose	Reddish brown ppt.

7- Bendict's solution



Benedict's reagent

can be prepared from 100 g of anhydrous sodium carbonate, 173 g of sodium citrate and 17.3 g of copper(II) sulfate pentahydrate. It is often used in place of Fehling's solution.

Procedure

To 3 ml of Bendict's solution, add 2 ml of dil. soln. of carbohydrate, boil for 2 minutes and allow to cool.

Observation	Inference
A reddish brown Cu ₂ O ppt.	Lactose and Maltose
- Ve	Sucrose

Differentiation between Maltose and Lactose)

8- Osazone formation



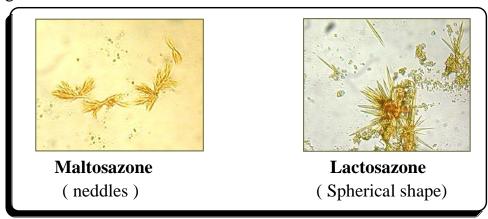
Carbohydrates with free hemiacetal group react with phenylhydrazine to give crystalline compounds known as osazone. Such compounds are used to identify the different types of carbohydrates by observing the crystalline form of the osazone under the microscope.

Procedure

Dissolve 0.2 g of carbohydrates, 0.4 g of phenyl hydrazine hydrochloride and 0.6 g of sod. acetate in 5 ml water, then heat on a water bath for 20 minutes, cool, the osazone separates a yellow crystalline ppt., transfer some of the wet crystals to a microscope slide and try to see the shape of the crystal under microscop.

Characteristics of osazones

- 1- Have a characteristic shape (Maltosazone → needles, Lactosazone → spherical shape)
- 2- Have a characteristic melting point
- 3- Specific time and whether the osazone is formed from hot solution or only on cooling.



Carbohydrate Date				
<u>Unknown ()</u> <u>Physical properties</u>				
Chemical properties		.l		
Test	Observation	Result		
Name:				
Structure:				

Carbohydrate Date <u>Unknown ()</u>				
Physical properties				
Colour	Shape	Solubility		
Chemical properties				
Test	Observation	Result		
Name: Structure:				

Carbohydrate Date				
Chemical properties				
Test	Observation	Result		
Name:				
Structure:				

Carboxylic acids



Carboxylic acids are organic compounds the presence of carboxyl group (COOH). They are classified as:

- 1- Mono basic carboxylic acid, which are organic compounds contain only one carboxyl group.
- 2- Di basic carboxylic acid, which are organic compounds contain two carboxyl group.
- 3- Tri basic carboxylic acid, which are organic compounds contain three carboxyl group.

Acidity Test



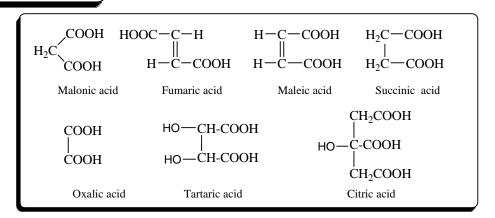
Procedure

A cold solution of NaHCO₃ is added to a cold solution of the substance in H_2O or alcohol or even to a suspension in H_2O .

Observation	Inference
Effervescence with evolution of CO ₂	carboxylic acids
R-COOH + NaHCO ₃	► R-COONa + CO ₂ + H ₂ O

Carboxylic acid can be classified into:

Aliphatic acids



1- Effect of heat on solid



Solid
$$\xrightarrow{\text{heat}}$$
 Odour of acetic acid \therefore Malonic acid $CH_2(COOH)_2 \xrightarrow{\text{heat}} CH_3COOH + CO_2$

Confirmation test

Solution of malonic acid + acetic anhydride

Observation	Inference
yellowish red solution with green fluorescence	Malonic acid

2- Neutral solution + FeCl₃ solution



Observation	Inference
Red colour turn brown ppt. by boiling	Maleic acid
Red brown ppt.	Fumaric acid
Buff ppt	Succinic acid
- Ve	Oxalic, tartaric or citric acid

3- Fluorescein test



Procedure

In a clean dry test tube, fuse carefully together, few crystals of resorcinol and an equal quantity of the solid acid, or its anhydride moistened with 2 drops of conc. H₂SO₄. Pour into excess NaOH.

Observation	Inference
Green fluorescence	Maleic acid and succinic acid
HO OH HO OH OH OH OOH OOH OOH OOH OOH OO	OH OOH OOOOOOOOOOOOOOOOOOOOOOOOOOOOOOO

4- Neutral solution + CaCl₂ solution



Observation	Inference
White ppt. immediately on cold insoluble in acetic acid.	Oxalic acid
White ppt. after scratching and warming, soluble in acetic acid.	Tartaric acid (Fenton's test)
White ppt. after boiling, insoluble in acetic acid	Citric acid (Deng's test)

Confirmation test of tartaric acid

Fenton's test

(Redox reaction)

Add 1 drop of $FeSO_4$ soln. to 2 ml of tartaric acid soln. then add drop wise H_2O_2 soln. till the solution acquires a green colouration. Add excess of NaOH soln. a violet colour is produced.

Observation	Inference
Violet colour is produced	Tartaric acid

Deng's test

(Redox reaction)

Add 1 ml of Deng's No. 1 to 3 ml of neutral citric acid and heat to boiling. Add 2 drops of Deng's No. 2

Observation	Inference
Colour of KMnO ₄ is discharged	Citric acid

Aromatic Acids

1- Neutral solution + FeCl₃ solution



Observation	Inference
Violet colour	Salicylic acid
Buff ppt.	Phthalic, Cinnamic, Phenylacetic or Benzoic acid
COONH ₄ + FeCl ₃ - Amm. Benzoate	Ferric benzoate COOFe(OH) ₂ H_2O Basic Ferric benzoate

Differentiate between Phthalic, Cinnamic and Phenyl acetic acid

2- Phthalein test



Procedure

In a clean and dry test tube, fuse carefully, few crystals of the acid and two drops of phenol, moistened with two drops of conc. H_2SO_4 . Pour into excess NaOH.

Observation	Inference
Red colour	Phthalic acid
HO OH HO OH Conc. H ₂ SO ₄ O C C O C O	OH OH COO

3- Fluorescein test



Procedure

In a clean and dry test tube, fuse carefully, few crystals of resorcinol and an equal quantity of the solid acid, or its anhydride moistened with 2 drops of conc. H₂SO₄. Pour into excess NaOH.

Observation	Inference
Green fluorescence	Phthalic acid
HO OH HO OH HO Conc. H ₂ SO ₄ O C C C C C C C C C C C C C C C C C C	OH OH O OH O OH OH OH OH OH OH OH OH OH

4-Unsaturation test



A) Bromine water test

In a test tube, put 1 ml of solution of the substance is sod.carbonate and 1 ml of bromine water

Observation	Inference
The orange color of bromine is disappears immediately	Cinnamic acid
CH=CH-COOH Br ₂	Br Br HC——C-COOH

B) KMnO₄ test

In a test tube, put 1 ml of solution of the substance and 1 ml of sod. carbonate , then a few drops of dilute $KMnO_4$

Observation		Inference
Violet color of the KMnO ₄ disappears immediately		Cinnamic acid
CH=CH-COOH KMnO ₄	OH	ОН

[5- Boiling test



In test tube put 0.1 g of the substance and 5 ml water

Observation	Inference
Oily drops are formed	Phenyl acetic acid

If all the above tests (phthalein, fluorescein, unsaturation and boiling with water) are negative, then the acid is benzoic acid.

Carboxylic acid Date		
•	Unknown ()	
Physical properties		
Colour	Shape	Solubility
Chemical properties		
Test	Observation	Result
Name:		
Structure:		

Carboxylic acid Date		
•	Unknown ()	
Physical properties		
Colour	Shape	Solubility
Chemical properties		
Test	Observation	Result
Name:		
Structure:		

Carboxylic acid Date			
	<u>Unknown (</u>)		
Physical properties			
Colour	Shape	Solubility	
Chemical properties			
Test	Observation	Result	
Name:			
Structure:			

Carboxylic acid Date		
Physical properties		
Colour	Shape	Solubility
Chemical properties		
Test	Observation	Result
Name: Structure:		

Hydroxy compounds



Phenols

Phenols are aromatic compounds in which a hydroxyl group is directly linked to the aromatic nucleus. The general formula of phenols is Ar-OH

Classification of phenols according solubility into:

1-Water-soluble phenols

2-Water-insoluble phenols

Acetyl chloride test



Procedure

A portion of the substance (solid or liquid) is added to 1 ml of acetyl chloride (CH₃COCl), in a dry test tube.

Observation	Inference
evolution of HCl gas	the presence of –OH group
ROH + CH ₃ COCl —	ROCOCH ₃ + HCl

Benzoyl chloride test



Benzoyl chloride may be used instead of CH₃COCl, but warming is necessary in this case.

$$ROH + C_6H_5COC1 \longrightarrow ROCOC_6H_5 + HC1$$

Identification of phenols

FeCl₃ solution test



Hydroxyl group of phenols and enolic compound gives colour (usually violet) with FeCl₃. This test is valid in presence of carboxylic group.

Add few drops of a 2% aqueous solution of ferric chloride to 1 ml of solution of phenol in water or alcohol.

Observation	Inference
Green turns red by NaOH	Catechol
Violet discharged by AcONa	Resorcinol
Green crystals	Hydroquinone (Quinol)
Red-turns violet by NaOH	Pyrogallol
Greenish turns to violet	α-Naphthol
Faint green	β-Naphthol

2-Chloroform and NaOH (Reimer-Timann reaction)



Dissolve the phenol in conc. NaOH (20%), add 1-2 ml of chloroform and heat gently. Notice the colouration produced.

Observation	Inference
Green	Catechol
Red with fluorecence	Resorcinol

- Ve	Hydroquinone
- Ve	Pyrogallol.
Deep blue fading to green	α-Naphthol.
Deep blue fading to green	β-Naphthol

3-Liebermann-nitroso reaction



Phenol reacts with nitrous acid to give *p*-nitrosophenols which condense with excess phenol to give indophenols (usually red). When solution of the latter is rendered alkaline, a blue or green anion is liberated.

Procedure

To a small amount of $NaNO_2$ in a clean and dry test tube, add 0.5g of phenol and heat gently for 1 min., allow to cool, and add 1 ml of conc. H_2SO_4 with shaking. A <u>deep green or blue</u> colouration develops (sometimes only after 1-2 min.). Dilute cautiously, the solution turns red. Now add an excess of NaOH soln., the green or blue colouration reappears.

Phenols	H ₂ SO ₄	Dilution H ₂ O	NaOH
Catechol	Deep green	Dirty brown	Red
Resorcinol	Deep blue	red	Brown
Pyrrogallol	Violet	blue	Brown
α-Naphthol.	Green	- Ve	- Ve
β-Naphthol.	Brownish back	- Ve	- Ve

$$HO \longrightarrow HOO_2 \longrightarrow HO \longrightarrow NO \longrightarrow O \longrightarrow NOOH$$
 $O \longrightarrow NOOH$
 $O \longrightarrow N$

4-Azo-dye test



Procedure

To 3 drops of aniline in a test tube, add with cooling 1 ml of conc. HCl and 3 ml of water. Cool the resulting solution in an ice-bath. Slowly add with shaking, an ice-cold solution of 20% sodium nitrite solution. Pour few drops of this solution (diazonium salt solution) to a second test tube containing a small cold amount of the unknown phenols dissolved in 10% NaOH.

Observation	Inference
- Ve	Catechol
Red Color	Resorcinol
Red ppt	Hydroquinone
- Ve	Pyrogallol.
Brownishred-ppt	α-Naphthol.
Scarlet red ppt	β-Naphthol

Phenols Date		
	Unknown ()	
Physical properties		
Colour	Shape	Solubility
Chemical properties		
Test	Observation	Result
Test	Observation	Result
Name:		
Structure:		

Phenols	Date	•••••	
	Unknown ()		
Physical properties			
Colour	Shape	Solubility	
Chemical properties			
Test	Observation	Result	
Name:			
Structure:			

Phenols Date		
	Unknown ()	
Physical properties		
Colour	Shape	Solubility
Chemical properties		
Test	Observation	Result
Test	Observation	Result
Name:		
Structure:		

Aldehydes and Ketones



Aldehydes and ketones are organic compounds having carbonyl group

Identification of aldehydes and ketones



2,4-dinitrophenylhydrazine



Procedure

Place 2 g of 2,4-dinitrophenylhydrazine reagent in a clean test tube, and add to it 3-4 drops of the carbonyl compounds

Observation	Inference
yellow or orange precipitate	The presence of Carbonyl compounds
$C = O + H_2NNH$	O_2

Tests to distinguish between an Aldehydes and Ketones

Aldehydes can be distinguished from ketones by their reaction toward the following mild oxidizing agents

A- Tollen's test + Ve (Silver mirror) Aldehydes

 $B\text{-} \ Fehling`s \ test \\ \hspace{2.5cm} + \ Ve \ \ (Red \ ppt \ Cu_2O) \ Aldehydes$

Ketones

Boiling with water



In test tube put 0.01g of the substance and 5 ml water

Observation	Inference
Oily drop	Benzophenone
No. oily drop	p-Benzoquinone and Anthraquinone

Tollen's reagent



Add 1 ml of Tollen's reagent to a few drops of cold aqueous solution of ketone,

Observation	Inference
black ppt. or silver mirror	p-Benzoquinone.

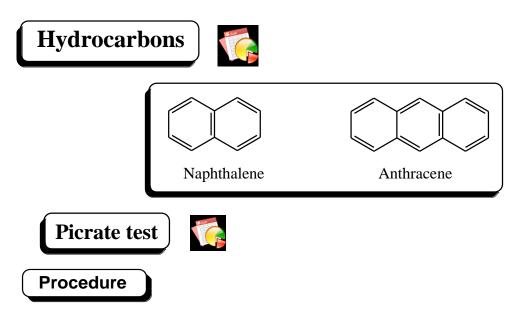
Confirmatory test (For p-benzoquinone)

Dissolve 0.2 g of benzoquinone in 1 ml of alcohol, add 2 drops of aniline and warm gently, a reddish ppt. of quinone-dianiline is formed.

Observation	Inference
black ppt. or silver mirror	p-Benzoquinone.
$O = O + 2 $ $NH_2 -2H$	$\begin{array}{c c} I_{2O} & \\ \hline \end{array} \longrightarrow N = \begin{array}{c c} N & \\ \hline \end{array}$

Ketones		••••••	
<u>Unknown ()</u> Physical properties			
Colour	Shape	Solubility	
Chemical properties			
Test	Observation	Result	
Name: Structure:			

Ketones	Date <u>Unknown (</u>)	••••••
Physical properties	CHKHOWH ()	
Colour	Shape	Solubility
Chemical properties		
Test	Observation	Result
Name: Structure:		



Dissolve 0.1 g of the hydrocarbon in acetone and 0.2 g of picric acid in acetone (about 2 ml), then heating mixture in water bath, allow the mixture to cool. Filter and wash with 2 ml of ethanol.

Observation	Inference
Yellow crystals	Naphthalene (150 °C)
Red crystals	Anthracene (138 °C)

Nitation test



Nitric acid reacts with naphthalene, in the presence of glacial acetic acid to give a nitronaphthalene while anthracene is not readily nitrated with nitric acid.

Procedure

Dissolve by heating, 0.5 g of naphthalene in 3 ml of glacial acetic acid, then cool and add 1ml of conc. HNO₃ and heat the mixture gently for 1 minute. Cool and pour the solution into a beaker which contains about 25 ml of cold H_2O and note the separation of dinitronaphthalene as a yellow solid.

Hydrocarbons Date		
Physical properties		
Colour	Shape	Solubility
Chemical properties		
Test	Observation	Result
Name: Structure:		

Hydrocarbons Date Unknown ()		
Physical properties		
Colour	Shape	Solubility
Chemical properties		
Test	Observation	Result
Name: Structure:		

Identification of compounds containing (C, H, O andmetallic)



Test for metallic residue (Action of heat)



Procedure

Heat a small portion of the substance on a piece of porcelain, leaves a residue, when dissolved in dil. HCl.

Observation	Inference
CO ₂ evolves with effervescence	Metallic salt of acid

Nitation test | Total



- Ve salt of aliphatic acid ex.(Sodium formate-acetate-succinate-oxalate-taratatecitrate)
 - Ve salt of aromatic acid ex.(Sodium salicylate-benzoate-phthalatecinnamate-phenylacetate)

Identification of metallic salt of aliphatic acid



Observation	Inference
Red colour change to brown on boiling	Formate and acetate
Buff ppt	Succinate
- Ve	Oxalate, tartarate, citrate

Differential between formate and acetate

Tollen's reagent



+ Ve (Silver mirror)

Formate

- Ve

Acetate

Differential between Oxalate, tartarate and citrate



White ppt. immediately

(Oxalate)

White ppt. after scratching

(Tartarate)

White ppt. after boiling

(Citrate)

Identification of metallic salt of aromatic acid



Observation	Inference
Violet colour	Formate and acetate
Buff ppt	Benzoate, phthalate, cinnamate, phenyl acetate

Differential between Benzoate, phthalate, cinnamate and phenyl acetate

Phthaline test + Ve Phthalate

<u>Unsaturated test</u> + Ve Cinnamate

Boiling test + Ve Phenyl acetate

If all the above tests (phthalein, fluorescein, unsaturation and boiling with water) are negative, then Benzoate

Metallic salts Date				
Physical properties				
Colour	Shape	Solubility		
Chemical properties				
Test	Observation	Result		
Name: Structure:				

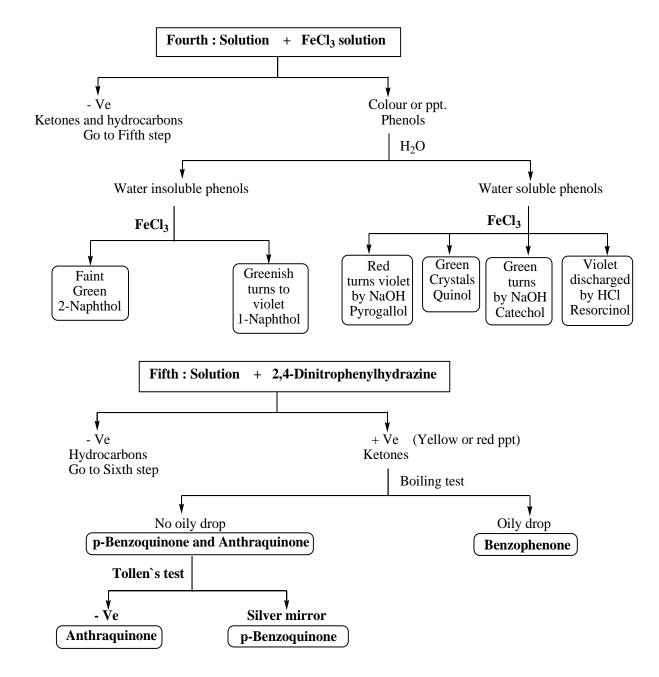
Metallic salts Date				
Physical properties				
Colour	Shape	Solubility		
Chemical properties				
Test	Observation	Result		
Name: Structure:				

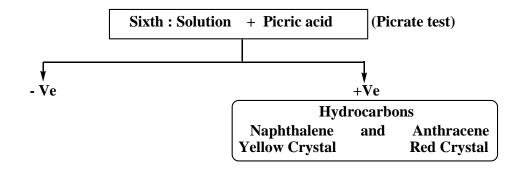
Scheme for soild organic compounds Combination of C, H, O First: Molisch's test Carbohydrate Unknown is not carboxylic acid, ketones, phenols Metallic salts and hydrocarbons Solubility Go to second step Insoluble Soluble (Strach) (Mono and Disaccharide) Barfoed's test Blue color Rerd ppt. within 2 min. Rerd ppt. after 5 min. Monosaccharide Disaccharide Rapid furfural test Fehling`s test Red ppt Violet after boiling - Ve Violet at one - Ve Lactose and Maltose **Sucrose** Fructose Glucose Galacose Osazone test Microscope Second : Acidity test - Ve +Ve Unknown is not ketones, phenols Carboxylic acid Metallic salts and hydrocarbons N.S. for acid + FeCl₃ Go to third step Buff ppt Violet colour - Ve $Red^{\frac{\Delta}{\longrightarrow}} brown$ Red colour Succinic, Phthalic, cinnamic Oxalic acid Salicylic acid Maleic acid Furmaric acid phenyl acetic and benzoic Tartaric acid Citric acid Nitration test N.S. for acid + CaCl₂ - Ve - Ve Phthalic, Cinnamic, Succinic acid White ppt White ppt White ppt Phenyl acetic and benzoid immediately after scratching after boiling Oxalic acid Citric acid Tartaric acid

Differential between Benzoate, phthalate, cinnamate and phenyl acetate

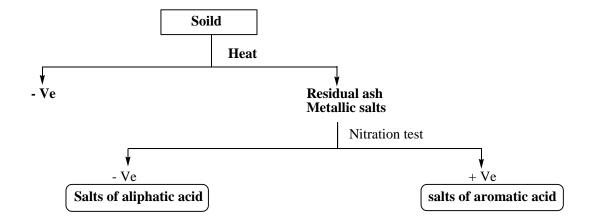
Phthaline test + Ve Phthalate
Unsaturated test + Ve Cinnamate
Boiling test + Ve Phenyl acetate

If all the above tests (phthalein, fluorescein, unsaturation and boiling with water) are negative, then Benzoic acid.





Combination of C, H, O and metallic



Investigation of compound				Date	
	<u>Unknov</u>	wn (<u>)</u>	
Physical properties					
Colour		Shape			Solubility
Chemical properties					
Test		Obser	vation		Result
1- Elements test	X	N	S		
2- Action of heat					
3- Heating with soda-lime					
4- Treatment with 20% NaOH					
5- Treatment with con. H ₂ SO ₄					
6- Nitration test					
7- Acidity test					
8- Solubility and reverse precipitation					
9- Treatment With neutra FeCl ₃ solution test	1				

Combination of compound containing (H,C and O)



Chemical properties

Test	Observation	Result			

	ama	•
T.4	ame	

Structure:

Investigation of compound				Date	
<u>Unknown (</u>					
Physical properties					
Colour		Shape			Solubility
Chemical properties				L	
Test		Obsei	rvation		Result
1- Elements test	X	N	S		
2- Action of heat					
3- Heating with soda-lime					
4- Treatment with 20% NaOH					
5- Treatment with con. H ₂ SO ₄					
6- Nitration test					
7- Acidity test					
8- Solubility and reverse precipitation					
9- Treatment With neutra FeCl ₃ solution test	1				

Combination of compound containing (H,C and O)



Chemical properties

Test	Observation	Result		

3 7		
	ame	•
Τ.4	ann	٠

Structure:

Investigation of compound <u>Unknown ()</u>					Date	
Physical properties						
Colour		Shape			Solubility	
Chemical properties						
Test		Obser	rvation		Result	
1- Elements test	X	N	S			
2- Action of heat						
3- Heating with soda-lime						
4- Treatment with 20% NaOH						
5- Treatment with con. H ₂ SO ₄						
6- Nitration test						
7- Acidity test						
8- Solubility and reverse precipitation						
9- Treatment With neutra FeCl ₃ solution test	1					

Combination of compound containing (C,H,O and metallic)



Chemical properties

Test	Observation	Result

	_			
	\sim	-	20	
17	17		ne	• •

Structure:

Investigation of compound <u>Unknown ()</u>				Date)
Physical properties				
Colour		Shape		Solubility
Chemical properties				
Test		Obser	vation	Result
1- Elements test	X	N	S	
2- Action of heat				
3- Heating with soda-lime	2			
4- Treatment with 20% NaOH				
5- Treatment with con. H ₂ SO ₄				
6- Nitration test				
7- Acidity test				
8- Solubility and reverse precipitation				
9- Treatment With neutral FeCl ₃ solution				

Combination of compound containing (C,H,O and metallic)



Chemical properties

Test	Observation	Result

	_			
	\sim	-	20	
17	17		ne	• •

Structure:

Investigation of compound			Date	
	<u>Unknov</u>	wn ()	<u>)</u>
Physical properties				
Colour		Shape		Solubility
Chemical properties				
Test		Obser	vation	Result
1- Elements test	X	N	S	
2- Action of heat				
3- Heating with soda-lime	:			
4- Treatment with 20% NaOH				
5- Treatment with con. H ₂ SO ₄				
6- Nitration test				
7- Acidity test				
8- Solubility and reverse precipitation				
9- Treatment With neutral FeCl ₃ solution				

Combination of compound containing (C,H,O and metallic)



Chemical properties

Test	Observation	Result

	a	n	n	^•
17	ล		ш	Π.

Structure:

Combination of compound containing (H,C, and N)



This class includes

1- ammonium salts of acids. ex. (Amm. Oxalate and Amm. Benzoate)

2- amides. ex. (Oxamide)

3- imides. ex. (Succinimide and Phthalimide)

4- amines. ex. (p-Toluidine and 2-naphthylamine)

5- anilides. ex. (Acetanilide and Benzanilide)(

6- nitro compounds. ex. (Nitro-phenols)

7- amino acids. ex. (Glycine)

8- Urea

Ammonium salts of acids

Ammonium salts into types R-COONH₄ Amm. Salts of aliphatic acid **A**) and Amm. salts of aromatic acid

1-Na₂CO₃ Test



Grind in a mortar, a portion of the substance with solid Na_2CO_3 , moisten with a few drops of H_2O

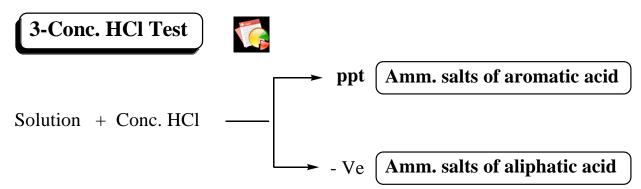
Observation	Inference
ammonia evolves	Ammonium salts

2-NaOH Test



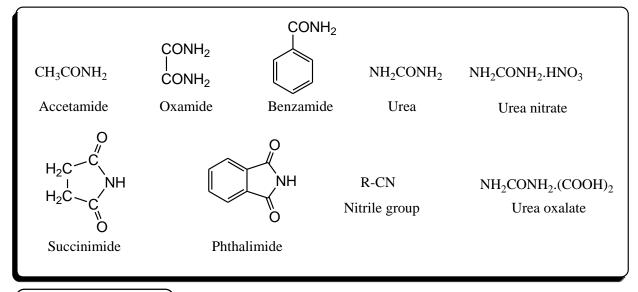
Add NaOH solution to the substance in a test tube

Observation	Inference
ammonia evolves on cold	Ammonium salts
RCOONH ₄ + NaOH	RCOONa + NH ₃ + H ₂ O



Identify of the ammonium salts as described carboxylic acid using salt solution instead of neutral solution.

Amide, Imide or Nitrile group



4- NaOH Test



Add NaOH solution to the substance in a test tube

Observation	Inference
ammonia evolves on hot	Amides, Imides and nitriles
2	RCOONa + NH ₃ RCOONa + NH ₃ RCOONa + NH ₃

4- Hydrolysis of amides, imides and nitriles



Place about 2g of the substance in a round bottom flask and 20 ml of 20% NaOH fit the flask with a reflux condenser and boil for about 0.5 h or more. Cool the flask and add excess dil. H_2SO_4 while cooling.

Observation	Inference
A white ppt	Benzamide and Phthalimide
No ppt. is formed	Acetamide, Oxamide and Succinimide
A brisk evolution of CO ₂ occurs but no ppt	Urea or Urea salts

5- Biuret test



Procedure

Place 0.5 g urea in dry test tube, heat gently for 1-2 minutes and cool the residue, then dissolve the formed biuret in a few ml. of warm 10% NaOH, by cooling and adding 1 drop of very diluted CuSO₄ solution.

Observation	Inference
Purple or violet colour	Urea and Urea salts
$\begin{array}{c c} & & & \text{Heat} \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & \\ & & & \\ & &$	H ₂ NCONHCONH ₂ + NH ₃ Biuret HN,
$\begin{array}{c ccccccccccccccccccccccccccccccccccc$	CuSO ₄ HN Cu NaOH HN Purple colour

Differential between Urea and Urea salts



Observation	Inference
Effervescence and evolution of CO ₂	Urea salts (Oxalate or Nitrate)



Observation	Inference
White ppt. insoluble in AcOH	Urea salts (Oxalate or Nitrate)

6- Ntration



Observation	Inference
+ Ve	Benzamide and Phthalimide
- Ve	Acetamide, Oxamide and Succinimide

To differentiate between Benzamide and Phthalimide

A) Phthalin test + Ve

Phthalimide

Take about 1 g of Phthalimide, 1 g of phenol and 2 drops of con. H₂SO₄ into a dry test-tube and fuse all together very gently. Let it cool and add water. Then add NaOH solution in excess.

Observation	Inference
A red coloration is produced which is decolorized by acids.	Phthalimide
- Ve	Benzamide

B) Fluorescine test + Ve

Phthalimide

Repeat the above test, using resorcinol instead of phenol. **A green fluorescent solution** is produced on the addition of NaOH solution.

Differentiate between Acetamide, Oxamide and Succinimide

Fluorescein test



Take about 1 g of Succinimide, 1 g of resorcinol and 2 drops of con. H₂SO₄ into a dry test tube and fuse all of it together. Cool and add water. Then add NaOH solution in excess. A green fluorescent solution is produced.

Observation	Inference
A green fluorescent solution is produced	Succinimide
- Ve	Acetamide and Oxamide

Biuret test



shake 0.1 g of oxamide with 1 ml of 10% NaOH solution, add 1-2 drops of very dilute CuSO₄ soln. and mix well.

Observation	Inference
A pink colouration is produced	Oxamide
- Ve	Acetamide and Succinimide

Amines

Classification of amines

Primary amines (p-Toluidine, α -naphthylamine and β -naphthylamine).

Secondary amine (Diphenylamine)

Tertiary amine (Triphenylamine)

Differentiate between Primary, Secondary and Tertiary Amines

1- Azo dye test



Procedure

Dissolve 0.01 g amines in 1 ml of conc. HCl and add 3 ml of water , shake to dissolve any hydrochloride salt which may have separated and cool in ice . Slowly add with continuous shaking an ice cold solution of sodium nitrite . Add about 0.5 ml of this cold diazonium solution to a cold alkaline solution of β - naphthol .

Observation	Inference
Red dyes	Primary amine
- Ve	Secondary and tertiary amines

Differentiate between Primary, Secondary and Tertiary Amines

2- Boiling the solid substance with water



Observation	Inference
Oily drops	p-Toluidine or α-naphthylamine
No oil drops	β-naphthylamine

3- Amine in dil. HCl+FeCl₃



Observation	Inference
Blue colour	α-naphthylamine
-ve	P-toluidine

Differentiate between Secondary and Tertiary Amines

4- Solution + FeCl₃ test

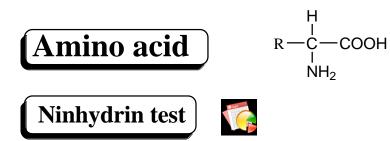


Observation	Inference
Green colour	Diphenylamine
-ve	Triphenylamine

Special test of Diphenylamine

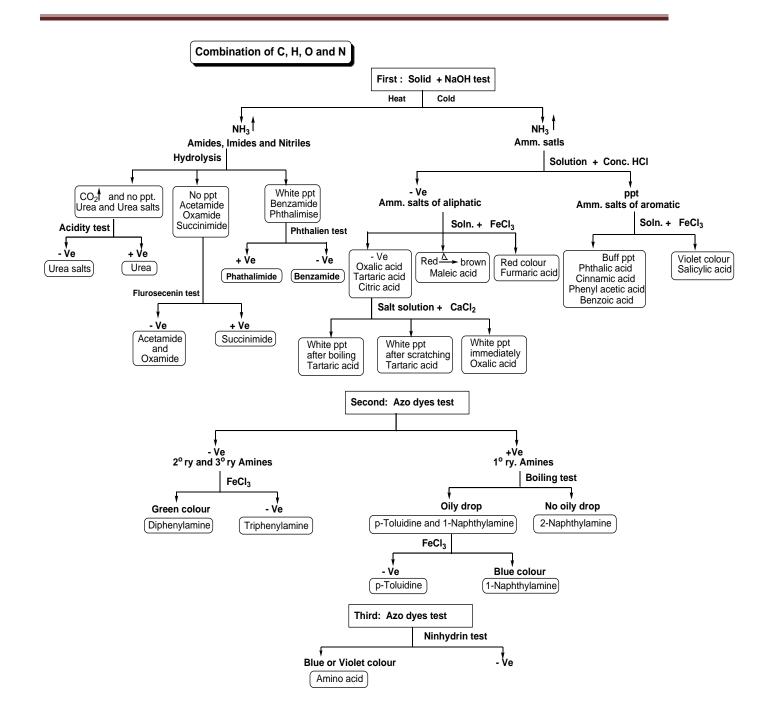
Reaction with Nitrous acid

Dissolve 0.5 g of diphenylamine in about 5 ml of warm alcohol, then add 0.5 ml HCl cool in ice and, drop by drop acold solution of 3 g of $NaNO_2$ in 10 ml H_2O leave the reaction in ice for 4 min. and then filter off the yellow crystsls which have separated, wash with water.



Place 2-3 drop of 0.2 % aq.soln. of ninhydrin on a piece of filter paper followed by drying it in air (or oven). Drop aq. Soln. of amino acid (1 drop) on this paper and redry it for a few minutes.

Observation	Inference
A blue (sometimes violet) spot or ring appears on the paper.	Amino acid
$\begin{array}{c ccccccccccccccccccccccccccccccccccc$	O O O O O O O O O O



Investigation of compound <u>Unknown (</u>)				Date	
Physical properties					
Colour		Shape			Solubility
Chemical properties					
Test		Obser	rvation		Result
1- Elements test	X	N	S		
2- Action of heat					
3- Heating with soda-lime					
4- Treatment with 20% NaOH					
5- Treatment with con. H ₂ SO ₄					
6- Nitration test					
7- Acidity test					
8- Solubility and reverse precipitation					
9- Treatment With neutra FeCl ₃ solution test	1				

Combination of compound containing (H,C , O and N)



Chemical properties

Test	Observation	Result

Structure:

Investigation of compound <u>Unknown (</u>)				<u>)</u>	Date	
Physical properties						
Colour		Shape			Solubility	
Chemical properties						
Test		Obser	vation		Result	
1- Elements test	X	N	S			
2- Action of heat						
3- Heating with soda-lin	ne					
4- Treatment with 20% NaOH						
5- Treatment with con. H ₂ SO ₄						
6- Nitration test						
7- Acidity test						
8- Solubility and reverse precipitation	2					
9- Treatment With neutral FeCl ₃ solution	1					

Combination of compound containing (H,C , O and N)



Chemical properties

Test	Observation	Result

N	ame:	
Τ.4	ann.	

Structure:

Investigation of compound			Date	
	Unknov	wn ()	
Physical properties				
Colour		Shape		Solubility
Chemical properties				
Test		Obser	vation	Result
1- Elements test	X	N	S	
2- Action of heat		I		
3- Heating with soda-lime				
4- Treatment with 20% NaOH				
5- Treatment with con. H ₂ SO ₄				
6- Nitration test				
7- Acidity test				
8- Solubility and reverse precipitation				
9- Treatment With neutral FeCl ₃ solution				

Combination of compound containing (H,C , O and N)



Chemical properties

Test	Observation	Result

N	ล	n	10	•
1 1	7			• .

Structure:

Combination of compound containing (C, H, N and S)

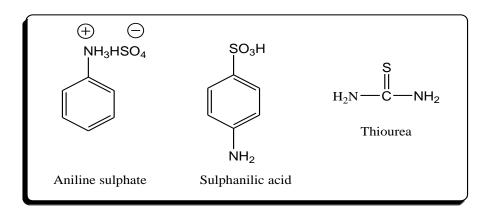


This class includes

1- Ionisable sulphate ex. Aniline suphate

2- Non-hydrolysable Sulphur ex. Sulphanilic acid

3- Hydrolsable Sulphur ex. Thiourea



Differentiate between Aniline sulphate, Sulphanilic acid and Thiourea

1- Acidity test



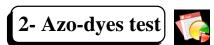
Observation	Inference
Effervescence and CO ₂ is evolved	Aniline sulphate, Sulphanilic acid
-ve	Thiourea

Differentiate between Aniline sulphate and Sulphanilic acid.

2- Solution + BaCl₂



Observation	Inference
White ppt. insoluble in dil. acids	Aniline sulphate
-ve	Sulphanilic acid



Dissolve 0.1 g substance in 1 ml of conc. HCl and add 3 ml of water , shake to dissolve any hydrochloride salt which may have separated and cool in ice . Slowly add with continuous shaking an ice cold solution of sodium nitrite . Add about 0.5 ml of this cold diazonium solution to a cold alkaline solution of β - naphthol .

Observation	Inference
A scarlet red ppt	Aniline sulphate
Deep yellow orange ppt	Sulphanilic acid

Special test of Thiourea









Oxidation of thiourea in presence of alkaline / $KMnO_4$

Observation	Inference
Discharge of KMnO ₄ and yellow ppt (S)	Thiourea
(NH ₂) ₂ C=S + KMnO ₄	\rightarrow (NH ₂) ₂ C=O + S \downarrow

Investigation of compo	ound				Date
<u>Unknown (</u>)					
Physical properties					
Colour		Shape			Solubility
Chemical properties					
Test		Obsei	rvation		Result
1- Elements test	X	N	S		
2- Action of heat					
3- Heating with soda-lin	ne				
4- Treatment with 20% NaOH					
5- Treatment with con. H ₂ SO ₄					
6- Nitration test					
7- Acidity test					
8- Solubility and reverse precipitation	2				
9- Treatment With neutral FeCl ₃ solution	ı				

Combination of compound containing (C, H , N and S)



Chemical properties

Test	Observation	Result

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Structure:

Investigation of compound <u>Unknown (</u>)				Date
Physical properties				
Colour		Shape		Solubility
Chemical properties				
Test		Obser	vation	Result
1- Elements test	X	N	S	
2- Action of heat				
3- Heating with soda-lin	ne			
4- Treatment with 20% NaOH				
5- Treatment with con. H ₂ SO ₄				
6- Nitration test				
7- Acidity test				
8- Solubility and reverse precipitation	?			
9- Treatment With neutral FeCl ₃ solution	1			

Combination of compound containing (C, H , N and S)



Chemical properties

Test	Observation	Result

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	ame	•
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Structure:

Combination of compound containing (C, H, N and Halogen)

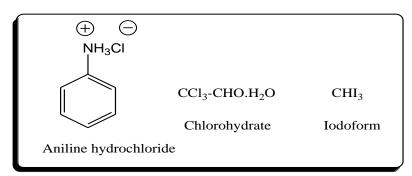


This class includes

ex. Aniline hydrochloride 1- Ionisable halogen

2- Non-hydrolysable halogen ex. p-Chlorobenzene and Iodoform

3- Hydrolsable halogen ex. Chloralhydrate



Differentiate between Aniline hydrochloride, Chlorohydrate and Iodoform

1- Acidity test



Observation	Inference
Effervescence and CO ₂ is evolved	Aniline hydrochloride
-ve	Chlorohydrate and Iodoform

2- Azo-dyes test



Observation	Inference
A scarlet red ppt	Aniline hydrochloride
- Ve	Chlorohydrate and Iodoform

3- Solution + AgNO₃ test



Observation	Inference
White ppt	Aniline hydrochloride
- Ve	Chlorohydrate and Iodoform

Differentiate between Chlorohydrate and Iodoform

1- Tollen's reagent



Take about $0.1~\mathrm{g}$ of chlorohydrate and $1\mathrm{ml}$ of Tollen's reagent in test tube , then heating.

	Observation	Inference
Bl	ack ppt. or silver mirror	Chlorohydrate
	- Ve	Iodoform.
	CCl ₃ CHO. H ₂ O Tollen`s reagt	CCl ₃ COOH + Ag ↓ + H ₂ O

2-Fehling test



Take about 0.1~g of chlorohydrate and (1ml of Fehling 1+1ml of Fehling 2) in a test tube , then heating.

Observation	Inference
Red ppt. of Cu ₂ O	Chlorohydrate
- Ve	Iodoform.
CCl ₃ CHO. H ₂ O Fhling`s reagt	$ ightharpoonup$ CCl ₃ COOH + Cu ₂ O \downarrow + H ₂ O

4- Action of heat



Violet fume

:. Iodoform

Investigation of compound				Date
	<u>Unkno</u>	wn ()	
Physical properties				
Colour		Shape		Solubility
Chemical properties				
Test		Obser	vation	Result
1- Elements test	X	N	S	
2- Action of heat				
3- Heating with soda-lime	e			
4- Treatment with 20% NaOH				
5- Treatment with con. H ₂ SO ₄				
6- Nitration test				
7- Acidity test				
8- Solubility and reverse precipitation				
9- Treatment With neutral FeCl ₃ solution				

Combination of compound containing (H,C, N and Halogen)



Chemical properties

Test	Observation	Result

TA T	
Name	
Name:	

Structure:

Investigation of compound			Date		
	<u>Unkno</u>	wn (<u>)</u>	
Physical properties					
Colour		Shape			Solubility
Chemical properties					
Test		Obser	vation		Result
1- Elements test	X	N	S		
2- Action of heat					
3- Heating with soda-lim	e				
4- Treatment with 20% NaOH					
5- Treatment with con. H ₂ SO ₄					
6- Nitration test					
7- Acidity test					
8- Solubility and reverse precipitation					
9- Treatment With neutral FeCl ₃ solution					

Combination of compound containing (H,C, N and Halogen)



Chemical properties

Test	Observation	Result

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Structure:

Investigation of compou				`	Date
	<u>Unknov</u>	wn (<u>)</u>	
Physical properties					
Colour		Shape			Solubility
Chemical properties					
Test		Obser	vation		Result
1- Elements test	X	N	S		
2- Action of heat					
3- Heating with soda-lime					
4- Treatment with 20% NaOH					
5- Treatment with con. H ₂ SO ₄					
6- Nitration test					
7- Acidity test					
8- Solubility and reverse precipitation					
9- Treatment With neutral FeCl ₃ solution test	I				

Combination of compound containing (H,C,

Chemical properties

Test	Observation	Result

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	ame	•
Τ.	ame	•

Structure:

Investigation of compound <u>Unknown (</u>)				Date	
Physical properties					
Colour		Shape			Solubility
Chemical properties					
Test		Obser	vation		Result
1- Elements test	X	N	S		
2- Action of heat					
3- Heating with soda-lime	e				
4- Treatment with 20% NaOH					
5- Treatment with con. H ₂ SO ₄					
6- Nitration test					
7- Acidity test					
8- Solubility and reverse precipitation					
9- Treatment With neutral FeCl ₃ solution					

Combination of compound containing (H,C,

Chemical properties

Test	Observation	Result

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Structure:

Investigation of compo	und				Date
	<u>Unkno</u>	wn (<u>)</u>	
Physical properties					
Colour		Shape			Solubility
Chemical properties					
Test		Obser	vation		Result
1- Elements test	X	N	S		
2- Action of heat					
3- Heating with soda-lime	e				
4- Treatment with 20% NaOH					
5- Treatment with con. H ₂ SO ₄					
6- Nitration test					
7- Acidity test					
8- Solubility and reverse precipitation					
9- Treatment With neutral FeCl ₃ solution					

Combination of compound containing (H,C,

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Chemical properties

Test	Observation	Result

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	ame.
Τ.	ame:

Structure: