جامعة الملك سعود
King Saud University
CHEMISTRY DEPARTMENT

IDENTIFICATION OF ORGANIC COMPOUNDS (CHEM-247)

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2025

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Instruction, Equipment and Safety

Safety in the laboratory you should read it well

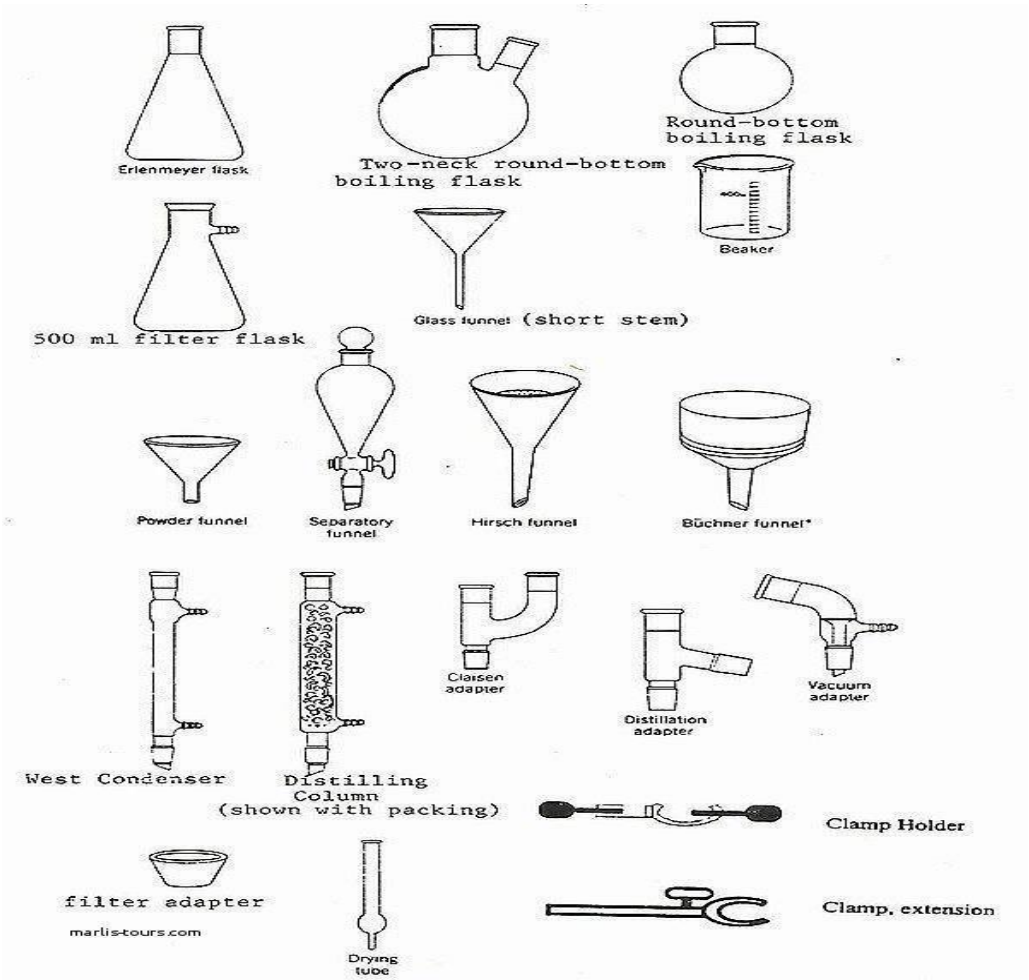
1. Wear a lab coat when you enter the lab and no student will allow me to work unless they wear a coat.
2. Glasses and gloves should be worn before starting work.
3. Clean your glass test tubes before and at the end of work.
4. It is strictly forbidden to eat and drink in the laboratory.
5. Read each test before you start working on it.
6. Write down your results in the report.
7. Before adding any particular detector, you must make sure of the name of the detector by reading the label on it.
8. Do not conduct any experiment that was not asked of you.
9. Flammable materials such as alcohol and acetone should not be heated on direct flames, but a water bath should be used.
10. A special dropper should be used for the same reagent bottle [wash with water if similar].
11. No reagent or solid salt should be returned to the original bottle from which it was taken, and if it is not used, it is preferable to dispose of it in the correct way.
12. Do not place the caps of reagent bottles on the surface of the bench so as not to be contaminated with other substances.
13. Experiments accompanied by the rise of toxic or smelly gases or vapors must be carried out in the gas cabinet.
14. If substances with acidic or alkaline properties fall or any substances come into contact with your hands, wash them several times with water.

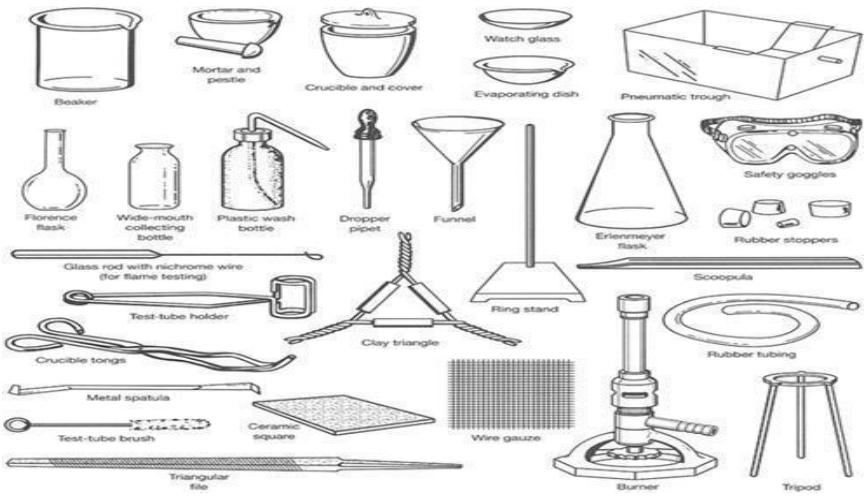
15. When heating the tube on a direct flame, constantly move the tube with the pipe opening pointing to the opposite side away from your colleague's face.
16. It is forbidden to work during the preparation of derivatives except in the presence of the professor of the subject or the laboratory report.
17. In the event of any emergency Allah inform your classmates and the course instructor or call the university emergency in the event of a fire or explosion.
18. Shoes should be worn on the practical date due to the danger of chemicals to the body.
19. Wash hands thoroughly before leaving the laboratory.

Distribution	Marks
Attendance	10
Reports	30
Quizes	20
Final Exam	40
Total	100

University Emergency Number From any fixed line within the university: 950 From any other line: 0114670950
University Civil Defense Number: 955

Laboratory Equipment



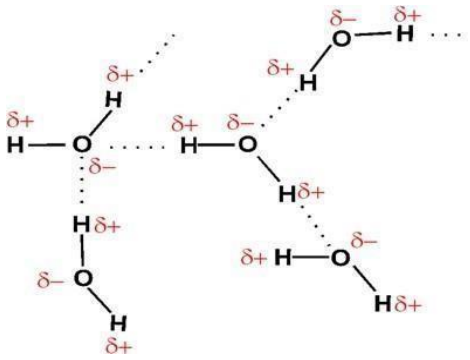


List of Glassware and Equipment

1) Condenser
2) Round-bottomed flask (50 mL and 100 mL) 3) Distilling head.
4) Adaptors.
5) Stoppers.
6) Separating funnels.
7) Beaker (50 mL, 100 mL, 250 mL and 400 mL).
8) Conical flask (100 mL and 250 mL).
9) Buchner funnel.
10) Buchner flask.
11) Funnel.
12) Glass rod.
13) Capillary tubes.
14) Test tubes.
15) Washing bottles.
16) Test tube rack.
17) Stand.
18) Clamps.
19) Test tube holder.
20) Heating Mantel 50 mL.
21) Watch glass.
22) Brush.

Solubility

General Rule: Like dissolve like



Water is:
Polar
H-bond donor and acceptor
Solvates ions

Test-tube 1

- Place 1 mL of distilled water in the test tube.
- Add 0.5 ml of hexane ($CH_3CH_2CH_2CH_2CH_2CH_3$)
- Shake

Hexane is:

1) non-polar.

2) non- H- bonding.

3) does not solvate ions.

Test-tube 2

- Place 1 mL of distilled water in the test tube.
- Add 0.5 mL of ethanol (CH_3CH_2OH).
- Shake.

Test-tube 3

- Place 1 mL of distilled water in the test tube.
- Add 5 drops of 1-hexanol ($CH_3CH_2CH_2CH_2CH_2CH_2OH$)
- Shake.

In hexanol, the ratio of water insoluble "part" to water soluble "part" is high.

Test-tube 4

- Place 1 mL of distilled water in the test tube.
- Add 1 mL of diethylether ($CH_3CH_2OCH_2CH_3$).
- Shake.
- In the same tube add 1 drop of ($KMnO_4$).
- Add 1 mL of ethanol.
- Shake well.

Test-tube 5

- Place 1 mL of distilled water in the test tube.
- Add 1 mL of chloroform ($CHCl_3$).
- Shake.

Ether and chloroform are good solvents for extraction from aqueous solutions.

Test-tube 6

- Place 1 mL of chloroform in the test tube.
- Add 1 mL of water.
- Add 1 mL of methyl red solution (in water).
- Shake.

Therefore, the methyl red is preferentially soluble in ……..

- Add 3 drops of 5% NaOH solution to the methyl red/$CHCl_3$/H_2O mixture and shake well.

HA = methyl red

$$HA + NaOH \rightleftharpoons Na^+A^- + H_2O$$

water

Schedule Number 1

Test	Observation	Result
H_2O + Hexane		
H_2O + Ethanol		
H_2O + Hexanol		
H_2O + Ether		
H_2O + Ether + Ethanol		
H_2O + Chloroform		
H_2O + Chloroform + methyl red		
5% NaOH solution to the mixture		

Questions:

1) Which of these organic solvents will form one layer with water:

a) Benzene.

b) Propanol.

c) Methanol.

d) Dipropylether.

e) Octanol.

Extraction

It is evident from the test-tube reactions that a compound dissolved in one solvent can be extracted into another solvent if:

a) It is more soluble in the second solvent; and
b) The two solvents are immiscible.

On a preparative scale these extractions are carried out in a "separating funnel", which is constructed to allow easy separation of two immiscible solutions.

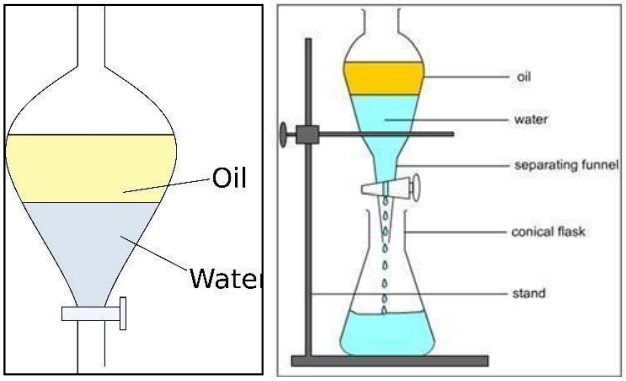


Figure 1: Diagram of separating funnel apparatus.

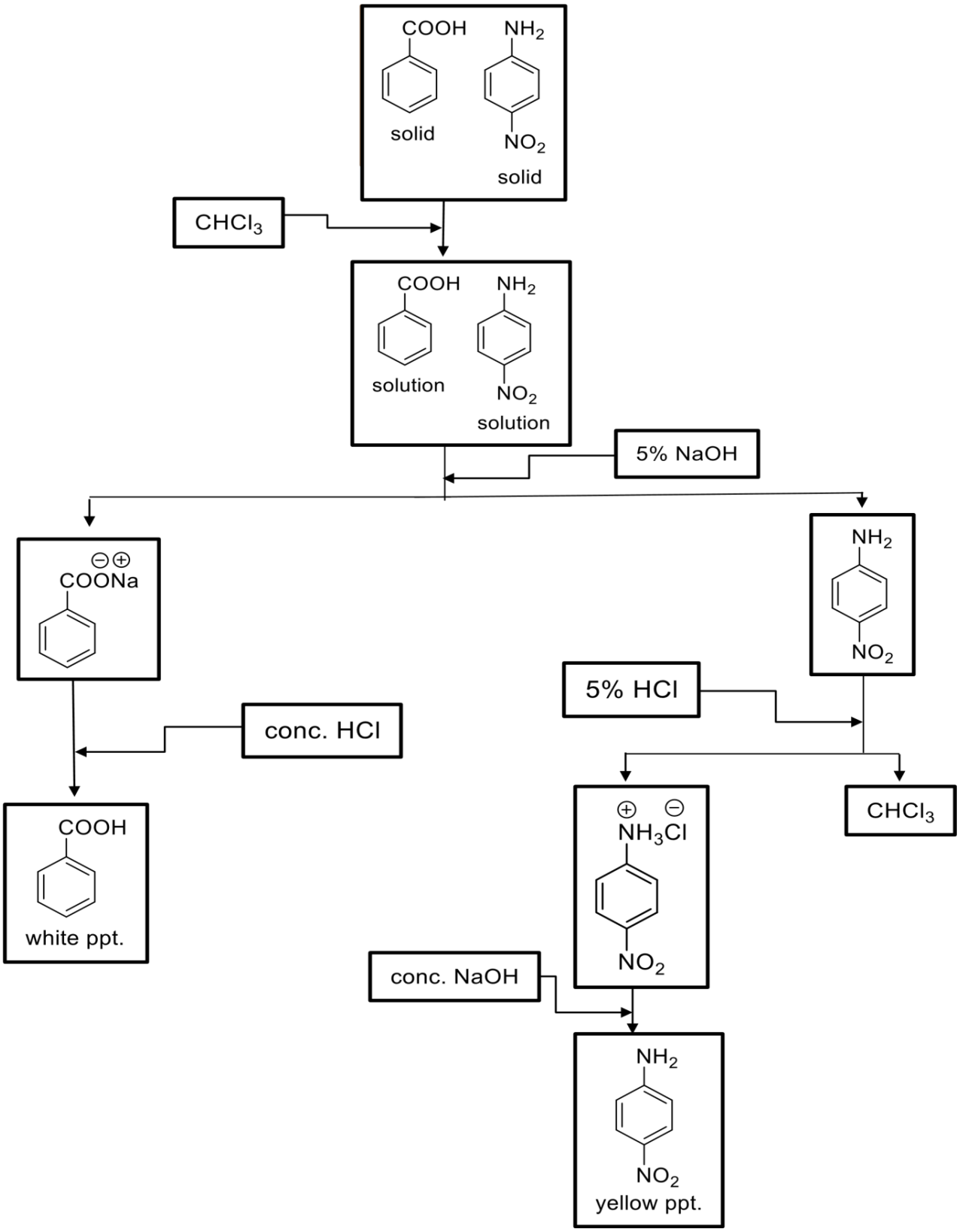
The objective of this experiment is to make you familiar with this technique.

Table 1: List of common solvents that can be used for extraction from water.

Solvent	**Formula**
Hexane (light petrol)	C_6H_{14}
Benzene	C_6H_6
Diethyl ether (ether)	$(C_2H_5)_2O$
Ethyl acetate	$CH_3COOC_2H_5$
Chloroform	$CHCl_3$
Carbon tetrachloride	CCl_4

NOTE that methanol, ethanol, and acetone are miscible with water and cannot be used for extraction from water.

Separation of Mixture of Basic and Acidic Compounds



Caution (Before you start)

- Since most organic chemicals are hazardous in some way (e.g. inflammable, poisonous vapor or poisoning through skin) take care not to get any on your hand.
- The *m*-nitroaniline is highly colored and toxic so you will be able to observe any contamination. ○ If you get any, on your skin wash your skin with soap and water. Do not wash with an organic solvent, this would assist passage of the contaminant through your skin.

Procedure

- In a 50 mL conical flask weigh approximately 2 g of a mixture of benzoic acid (C_6H_5COOH), HA and *m*-nitroaniline.
- Add 25 mL of chloroform.
- Transfer the solution to a 50 mL separating funnel, using a funnel (Figure 1).

Solvent Extraction General Procedure

- Clamp the separatory funnel securely with the tap lubricated with Vaseline and closed.
- Pour in the chloroform solution through a funnel and use in a little extra chloroform to wash in the last traces of a powder sticking to the walls of the flask and to the funnel.
- Add 20 mL of 10% sodium hydroxide solution to the separatory funnel through the funnel.
- Insert the stopper (lubricated with Vaseline) and shake the separating funnel to mix the layers thoroughly, releasing the pressure via the top at frequently intervals.
- Allow the layers to separate.
- Remove the stopper. Run off the lower layer into a 50 mL conical flask; not to fast or you will create a vortex. Close the tap when the bore of the tap contains the last of the lower layer.

  The chloroform layer contains ……

  The aqueous layer contains ……..

- Run the upper (aqueous) layer into a 100 mL conical flask.

- Add to upper layer conc. HCl until no whiter precipitate forms. It may be necessary to cool the solution. The precipitate is …….....

Allow the solution to cool and then suction filter off the solid, wash it with a little cold water and dry in an oven. **Suction Filtration**

Apparatus: Buchner funnel, flasks and filter paper (Figure 2).

1) Choose the correct size of filter paper, wet it all over with water and place it centrally in the funnel.
2) Briefly apply suction to secure the paper firmly in place.
3) Pour in the slurry of crystals. Do not fill to more than 2/3.
4) Use filtrate (mother-liquor) to wash in any crystals which remains stuck to the walls of the flask.
5) To wash the crystals with cold water, first release the vacuum slurry the crystals taking care not to damage the filter paper then reapply the suction.

To dry, place the crystals on a clean filter paper, and cover with another piece of filter paper.

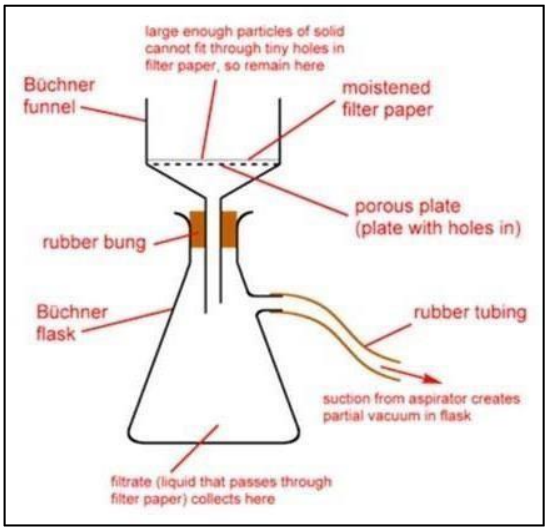


Figure 2: Buchner funnel.

Then put chloroform layer back into separating funnel.

Extract with 20 mL of 10% HCl solution.

The chloroform layer contains…….

The aqueous layer contains……..……..

Separate the layers.

Keep the upper aqueous layer and put the lower chloroform layer into the residue bottle.

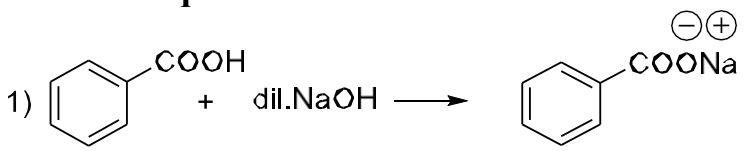
To the aqueous layer, add 10% NaOH until no further precipitation takes place.

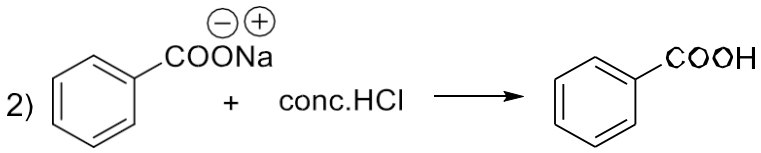
The precipitate is …….…….

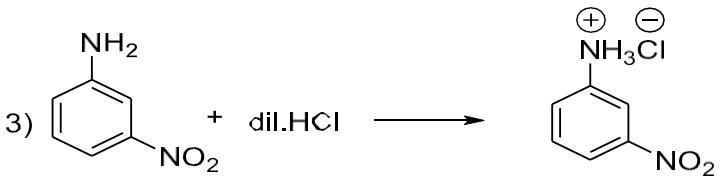
Suction filter the solid, wash with a little water and dry in the air at room temperature.

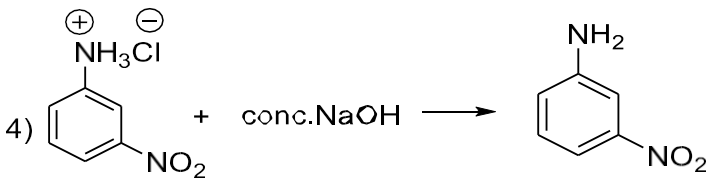
Submit your sample to your demonstrator before you leave.

Chemical equation:









Questions

Predict the outcome of the following extractions?

1) Benzoic acid dissolved in ether:
   A) Extract with aqueous HCl.
   B) Extract with H_2O.
   C) Extract with aqueous NaOH.

2) Aniline dissolved in ether:
   A) Extract with aqueous HCl.
   B) Extract with H_2O.
   C) Extract with aqueous NaOH

Methods for recognizing an organic compound

In order to recognize the unknown organic compound, we must follow the following methods:

1. Primary properties
2. Physical constants.
3. Analysis of elements
4. Solubility (solubility).
5. Functional groups.
6. preparation of derivatives

And we will come to each of them by explaining the method in detail.

First: the initial properties of the compound [detection of physical properties]

a. Physical state: solid or liquid.
b. Color.
c. Smell.

"For organic compounds, do not try to smell from the tube directly, but the smell is sawn from the tube [if it smells or write there is no smell]"

d. Combustion and nitrification detection.

Burn Test:

The aim is to differentiate between an aromatic compound and an aliphatic compound.

Note:

1. If the compound burns and has thick black smoke, this indicates that the compound is aromatic.
2. If the compound burns and has light yellow, blue or black smoke, this indicates that the compound is aliphatic.

Example of a Burn Test:

We take two (known) compounds for example and learn about the burning process:

Article I: Eliphatic organic matter such as ethanol

How it works:

In the gas cabinet, put about 1ml of the known substance in the burning lid [made of porcelain] and then expose it to direct flame inside the gas cabinet.

Viewing: Lightless pale yellow flame or blue with low-intensity smoke rising.
Conclusion: Aliphatic complex.

Article Two: Aromatic organic matter such as benzene

How it works:

Wash and dry the eyelid, then put [5-10 drops] of gasoline inside the lid and burn the gasoline with a direct flame inside the gas cabinet.

Viewing: Thick black smoke or dark yellow flame
Conclusion: aromatic compound.

Detection of the presence of metal in the aromatic compound or aliphatic:

How it works:

After the process of burning the compound, whether Alifati or Aromatic, put in the eyelid drops of distilled water on the burned compound, then bring a paper sold by the sun red color and moisten it with a little distilled water and then dip it inside the eyelid.

Viewing: Changed color to blue.

Conclusion: the presence of a mineral in the organic compound.

Note: If the color of the paper sold by the sun does not change to blue, this indicates that there is no metal in the compound.

Nitrification of aromatic compounds:

Nitration of aromatic compounds is done easily (confirmatory experiment) using the nitration mixture (Nitration test) **(electrophilic reaction),**

which is a way to indicate the presence of an aromatic compound and the reason for this is because the nitro group is colored and the compound that it is connected to is colored in yellow, and the color appears in aromatic compounds for the occurrence of tinnitus between the nitro group and the bye bonds (π) found in the aromatic compound, while this color does not appear in aliphatic compounds or the color is pale yellow because tinnitus does not occur.

How it works:

Take a clean and dry tube and put a little organic compound crystals and then put 1ml of nitrate mixture (HNO3/H2SO4) ((Be careful)) then heat the tube on

a direct flame in the gas cabinet and after boiling pour the contents of the tube into a cup with 15ml of distilled water.

Viewing:

1. Yellow, orange or red precipitate This is an indication of the presence of an aromatic compound.
2. Very pale yellow color or no color change is evidence of the presence of the aliphatic compound.

Physical Constant:

1. Melting point.Boilaing point

is the degree to which a substance transitions from a solid to a liquid state.

Action Steps:

We put the organic matter in a special lattice tube (less quantity) and measure the melting point from the beginning to the end of fusion and then take the average of the two degrees.

Example:

Take any organic compound (its melting point is known) measure its melting point and compare it with the melting point found in the references or with the professor of the subject.

* The melting point measured is always between positive or negative three degrees from the original melting point.

Important Notes:

1. If the melting point is less than three degrees lower than the original one, it indicates that the compound contains impurities.

2. If the range between the two readings is short within 3 degrees, this indicates that the material is pure.

Q: What is the effect of impurities on the melting point?

A: Impurities mostly reduces the melting point of the compound.

Note: There are several ways to find the melting point, including the old methods and modern methods, and we will deal in return with modern methods, which use the electric melting point device.

1. Boiling point 'B.P'

B.P is the degree at which the vapor pressure of a liquid is equal to the atmospheric pressure at which the substance begins to shift from a liquid to a gaseous state at this temperature.

Q: What is the effect of impurities on boiling point?

A: The presence of impurities in a liquid that caused the boiling point of this liquid to rise.

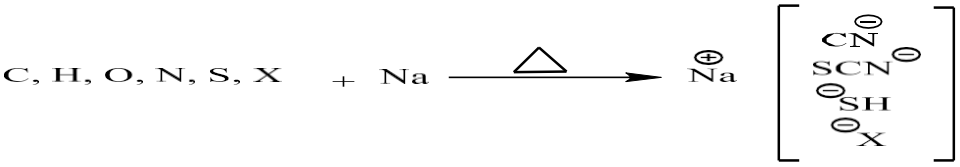
Detection of Elements

The elements present in organic compounds in a large proportion are carbon, hydrogen and oxygen (and therefore there is no need to detect them) and a smaller percentage of nitrogen, sulfur and halogens The presence of these elements in an organic compound can be determined as follows:

By melting the organic compound with sodium metal in a combustion tube at high temperature, the organic matter turns into an inorganic substance to form simple sodium salts that dissolve in water and ionize, which facilitates easy detection.

First: Molten Sodium Test [Lasagna's Test]

Reaction equation



How to work **(be careful and wear safety glasses)**

1. Prepare a glass with about 10-15 ml distilled water.
2. Take a small, clean, dry incinerator tube and put a small piece of shiny sodium in it Hold the tube with a mask.
3. Heat the tube to a benzene flame (lower the flame slightly) to melt the sodium metal.

Notice the formation of white fumes from the nozzle of the tube

4. Take a little (a few crystals) of the organic compound and mix it with a small amount of sucrose (to strengthen the carbon atoms in the compound) and add it to the tube.

5. Heat the tube slowly and then vigorously with the tube rotated during heating until the contents of the tube are charred (red hot mass).
6. Drop the tube quickly while it is hot and red inside the cup containing distilled water and break the tube with a glass leg in case it is not broken when dropping.

Note:

1. Be careful, this step should be done in the gas cabinet because a small piece of sodium may remain and may volatilize when it interacts with water.
2. This problem can be avoided by cooling the burning tube and then adding 1 ml of ethanol to break down the sodium by reacting with ethanol and then heating to the point of redness and then dropping the tube quickly into the water while it is hot as before.
3. Heat the contents of the cup until boiling (to concentrate the filtrate) so that the volume of the solution becomes 7-9 ml , then filter normal filtration by filter paper and use the filtrate to detect nitrogen and halogens.
4. **Discard** the filter paper and the remnants of the glass tube in the designated place, not in the sink.

Section one: Nitrogen detection:

Steps

Reaction equation:

$$NaCN + FeSO_4 \xrightarrow{\triangle} Na_4[Fe(CN)_6] \xrightarrow[Fe^{3+}]{H_2SO_4} Fe_4[Fe(CN)_6]_3$$

Action Steps:

1. Take a clean, dry tube and place 1ml of filtrate in it.
2. Add a teaspoon of ferrous sulfate (FeSO4) and shake well.
3. Heat the tube to a boil and then cool it under the water tap after which add on the wall of the tube drops of concentrated sulfuric acid (Dil. H2 SO_4). Then add drops of ferric chloride and leave for two minutes
4. If a greenish-blue or turquoise color (complex blue Prussia) is formed, this indicates the presence of nitrogen.

Section Two: Sulfur Detection:

Reaction equation:

$$Na_2S + Pb(CH_3COO)_2 \xrightarrow{CH_3COOH} PbS\downarrow + CH_3C\overset{\ominus\oplus}{O}ONa$$

Action Steps:

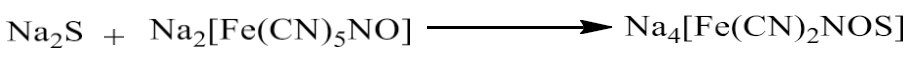
1. Take 1ml of filtrate in a clean, dry tube.
2. Add to it 1ml of diluted acetic acid (CH3COOH) solution.
3. Add 1ml of lead acetate (lead acetate) [5% $Pb(CH3COO)_2$]
4. Shake the tube well

Viewing:

If a black precipitate tends to brown, this indicates the presence of sulfur.

Note: Take 1ml of filtrate and then add 2 drops of newly prepared sodium nitroprusside solution (Na2[Fe(CN)5NO) if a purple red color appears indicating the presence of sulfur.

Reaction equation:



$$Na_2S + Na_2[Fe(CN)_5NO] \longrightarrow Na_4[Fe(CN)_2NOS]$$

Section III: Detection of halogens (chlorine, bromine and iodine)

Halogen detection is carried out in two ways:

1. **Detection of halogens in the presence of nitrogen and sulfur** Accordingly, nitrogen and sulfur must be eliminated if they are present in the organic compound before halogen detection can begin.

   The aim is so that there is no interference in the sedimentation and the gases are eliminated as shown in the following reaction equations:

$$NaCN + HNO_3 \xrightarrow{\triangle} HCN\uparrow + NaNO_3$$

$$Na_2S + H_2SO_4 \xrightarrow{\triangle} H_2S\uparrow + Na_2SO_4$$

Action Steps:

1. Take 1 ml filtrate in a clean, dry tube.
2. Add 1 ml of concentrated nitric acid (Conc. HNO3) if nitrogen is present or add 1 ml of concentrated sulfuric acid (Conc. H2SO4) if sulfur is present.
3. Preheat the tube to a direct flame in the gas cabinet until all gases are gone, then detect halogens

1. Be careful the rising gases are toxic

2. **Detection of halogens after the elimination of nitrogen and sulfur:**

Reaction equation:

$$NaX + AgNO_3 \xrightarrow{HNO_3} AgX\downarrow + NaNO_3$$

1. Take 1 ml of filtrate in a clean, dry tube.
2. Add about 1 ml of dilute nitric acid.
3. Add about 1ml of silver nitrate solution (AgNO3 5%)

Viewing:

1. If a bleach precipitate forms that turns into a light gray in sunlight, it indicates the presence of chlorine.
2. If a pale-yellow precipitate is formed it indicates the presence of iodine.
3. If a yellowish-white precipitate is formed, it indicates the presence of bromine.

differentiating between bromine and iodine

Pay attention to the process of differentiating between yellow and orange, as you may not be able to distinguish between them, so perform the following differentiation process:

1- Add 1ml of carbon tetrachloride (CCl4) to 1ml of the remaining filtration.

2- Add drops of hydrogen peroxide (H_2O_2) or chlorine water Cl_2, then block the tube with a plug and shake vigorously.

Viewing:

1. The formation of the color of the organic layer to orange indicates the presence of bromine Br_2.
2. The color of the organic layer to purple indicates the presence of iodine I_2.

(b) Detection of halogens for lack of nitrogen and sulfur:

Reaction equation:

How it works:

1. Take 1ml of filtrate in a clean, dry test tube.
2. Add about 1ml of dilute nitric acid.
3. Add about 1ml of silver nitrate (AgNO3 5%).

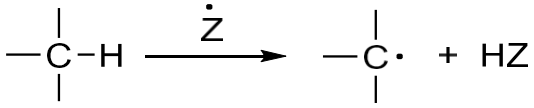
Viewing:

1. If a white precipitate is formed that turns into light gray in sunlight, it indicates the presence of chlorine.
2. If a pale yellow precipitate is formed, it indicates the presence of iodine.
3. If a yellowish-white precipitate is formed, it indicates the presence of bromine.

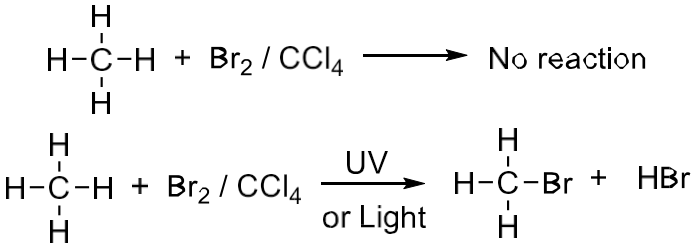
Aliphatic Hydrocarbon (Bonding) (Alkanes and Alkenes)

Alkanes

In general C – H and C – C bonds in alkanes are unreactive towards polar reagents. Reaction generally occurs by the formation of radicals in the presence of a suitable initiator ($Z^{\cdot}$). This type of reaction is called **Free Radical Substitution**.



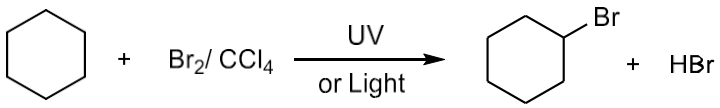
Bromine to an Alkane:



Test-tube 1

- Take 1 mL of cyclohexane.
- Add 3 drops of Br_2/CCl_4 solution.
- In the presence of light from the sun or a UV lamp, the bromine undergoes hemolytic fission and readily reacts with the cyclohexane.

Chemical equation:

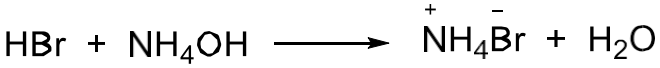


- Dip a clean glass rod into conc. NH_4OH and hold the glass rod over the mouth of the test tube. **What happened?**

……...……
……...

The observing is the formation of NH_4Br which is a test for the presence of HBr.

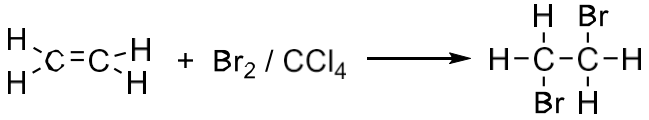
Chemical equation:



Alkenes

Alkenes undergo **polar addition reactions** initiated by electron rich system of the double bond.

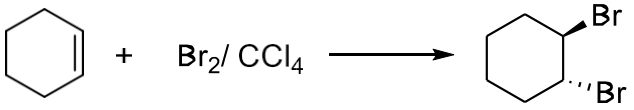
Addition of Bromine to an Alkene



Test-tube 2

- Take 3 drops of cyclohexene.
- Add 3 drops of Br_2/CCl_4 solution.

Chemical equation:



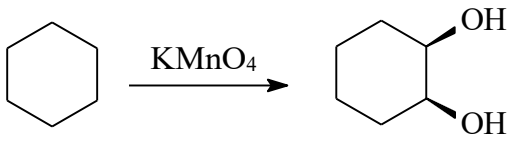
Alkene with Potassium Permanganate ($KMnO_4$)

Reaction with dil. $KMnO_4$ solution is also a test for the presence of carbon- carbon double bonds. The double bond of an alkene is easily oxidized to a di-OL.

Test-tube 3

- Take 3 mL of dil. $KMnO_4$ solution.
- Add 3 drops of cyclohexene.
- Shake.

Chemical equation:



Schedule Number 2

Test	Observation	Result	Chemical equation
 + Br_2 / CCl_4 (light or UV.)			
 + Br_2 / CCl_4 (Direct)			
 + $KMnO_4$			

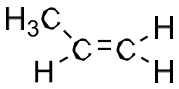
Questions:

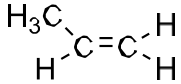
Complete the following reactions:

1)  + Br_2 / CCl_4 $\xrightarrow{UV.}$

2)  + Br_2 / CCl_4 $\longrightarrow$

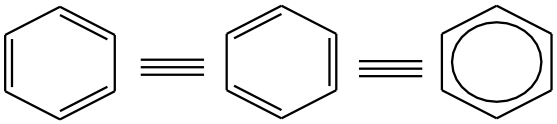
3) CH_3CH_3 + Br_2 / CCl_4 $\xrightarrow{Light}$

4)  + Br_2 / CCl_4 $\longrightarrow$

5)  + $KMnO_4$ $\longrightarrow$

6)  + $KMnO_4$ $\longrightarrow$

Aromatic Hydrocarbons



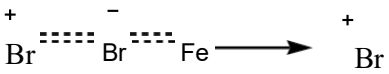
Benzene

Aromatic compounds have multiple double bonds; these compounds do not undergo addition reactions. Their lack of reactivity toward addition reactions is due to the great stability of the ring systems **that result from resonance.**

Bromine with Benzene

Test-tube 1

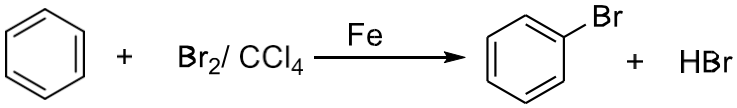
- Take 1 mL of 90% acetic acid (solvent).
- Add 5 drops of benzene.
- Add 5 drops of Br_2/CCl_4.
- Pour the contents of the tube into the vial containing the iron powder, shake. Polarization of the bromine occurs



The positive bromine species is a better electrophile than molecular bromine.

The type of reaction in benzene is **electrophilic aromatic substitution.**

Chemical equation:

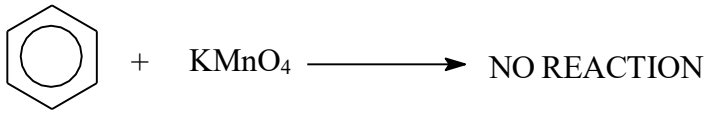


Benzene with Potassium Permanganate ($KMnO_4$)

Test-tube 2

- Take 1 mL of dilute aqueous $KMnO_4$ solution.
- Add 2 drops of benzene. - Shake.

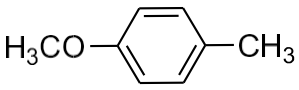
Chemical equation:



Oxidation of Alkyl Side-Chains

alkylbenzenes are oxidized to benzoic acids (-COOH), as long as the alkyl group contains at least one hydrogen at the benzylic position.

p-Methoxytoulene with $KMnO_4$

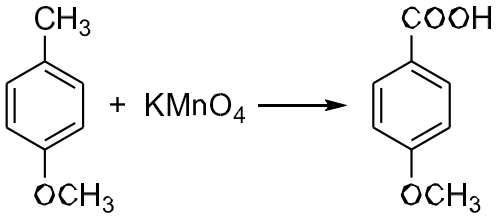


p-Methoxytoulene

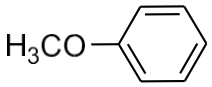
Test-tube 3

- Take 1 mL of dilute aqueous $KMnO_4$ solution.
- Add one drop of *p*-methoxytoulene.
- Shake.

Chemical equation



Anisole (Methoxybenzene) with $KMnO_4$



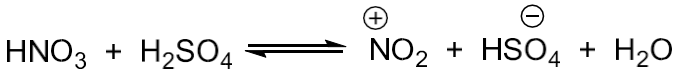
Methoxybenzene

Test-tube 4

- Take 1 mL of dilute aqueous $KMnO_4$ solution.
- Add 2 drops of anisole (methoxybenzene).
- Shake.

Nitration of Benzene

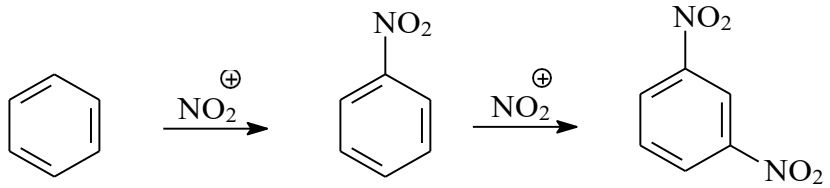
Nitration occurs when one (or more) of the hydrogen atoms on the benzene ring is replaced by a nitro group, NO_2. Nitrating mixture is concentrated nitric acid (HNO_3) with sulfuric acid (H_2SO_4).



Test-tube 5

- Take 1 mL of nitrating mixture (conc. H_2SO_4 + conc. HNO_3).
- Add 5 drops of benzene.
- Shake well.
- Take about 20 mL of distilled water in a small beaker.
- Pour reaction mixture into this water.

Observation



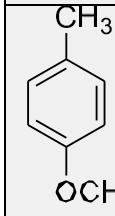
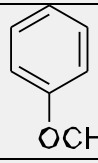
Benzene
a liquid less dense than water

Nitrobenzene
a liquid more dense than water

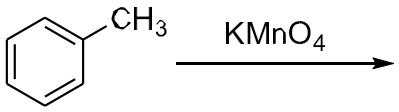
1,3- Dinitrobenzene
solid

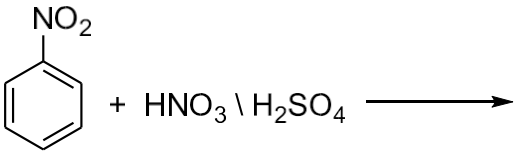
The main product of my reaction is ……..

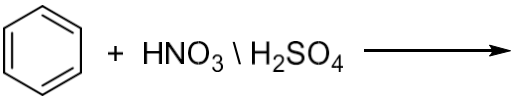
Schedule number 3

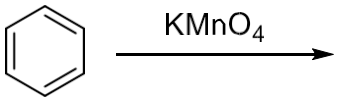
Test	Observation	Result	Chemical equation
 + Br_2 / CCl_4 (Direct)			
 + Br_2 / CCl_4 (Fe)			
 + $KMnO_4$			
 + $KMnO_4$			
 + $KMnO_4$			
 + $HNO_3 \setminus H_2SO_4$			

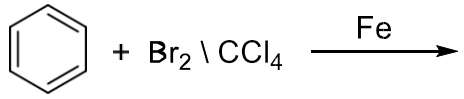
Questions

1) 

2) 

3) 

4) 

5) 

Hydroxy Compounds (Alcohols and Phenols)

Preparation of Alkyl Halide from Alcohol

In practice:

Reaction 1

$$ROH + SOCl_2 \longrightarrow RCl + SO_2 + HCl$$

Thionyl choride

Reaction 2

$$ROH + PCl_5 \longrightarrow RCl + POCl_2 + HCl$$

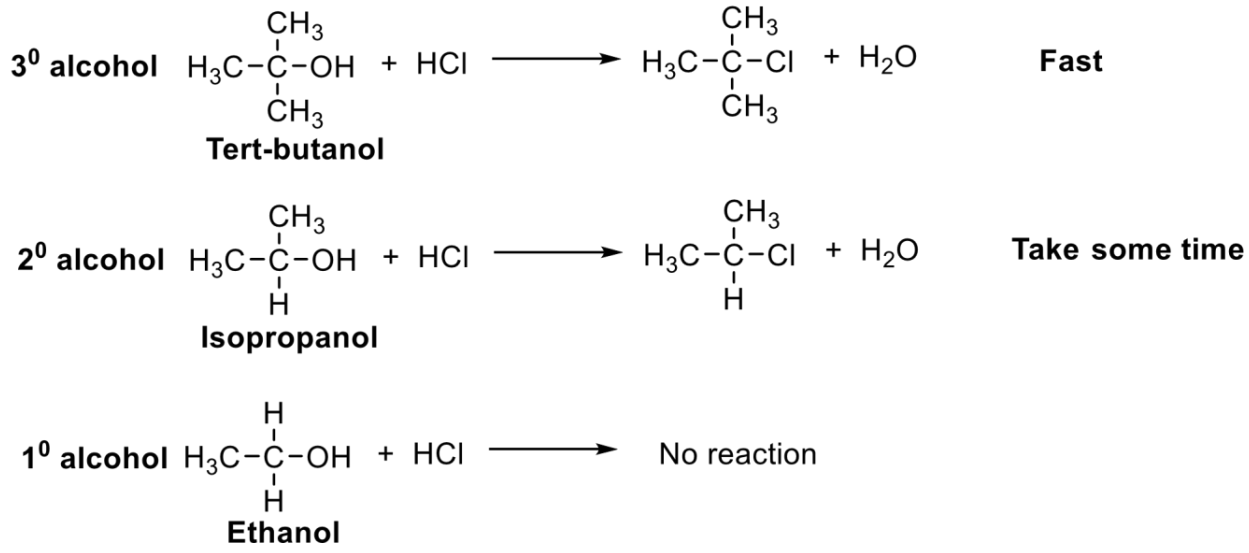
pentachlorphosphors

Lucas' reagent

Test-tube 1

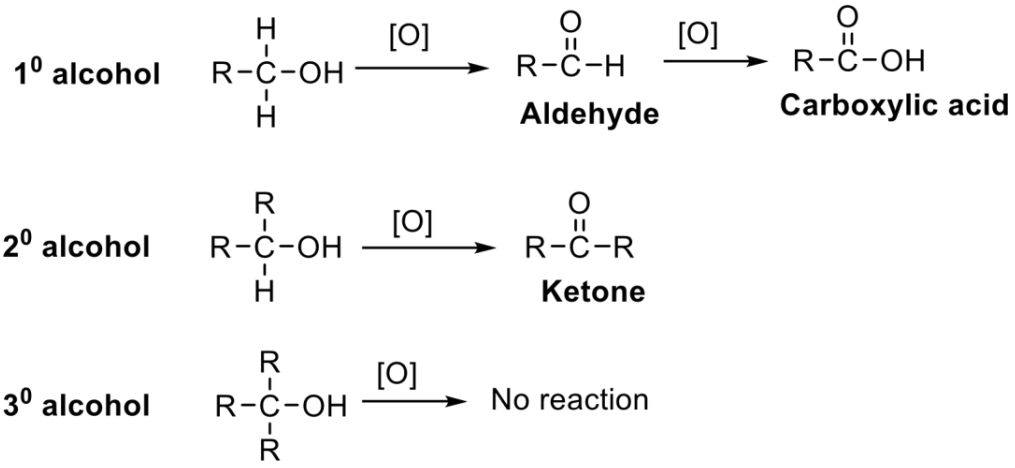
- Take 1 mL of conc. HCl in three test tubes.
- Add 10 drops of *t*-butanol in test tube 1.
- Add 10 drops of isopropanol in test tube 2.
- Add 10 drops of ethanol in test tube 3.
- Shake.

Chemical equation:



Oxidation of Alcohols

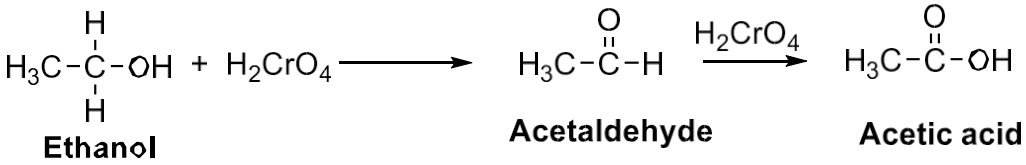
Reaction with an oxidizing agent e.g. $KMnO_4$, H_2CrO_4, is an important synthesis of aldehydes, ketones and carboxylic acids.



Test-tube 2

- Take 1 mL of chromic acid (H_2CrO_4).
- Add 5 drops of ethanol (primary alcohol). - Place the tube in hot water bath.

Chemical equation:

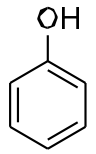


Test-tube 3

- Take 1 mL of chromic acid (H_2CrO_4).
- Add 5 drops of *t*-butanol (tertiary alcohol).
- Place the tube in hot water bath.

Phenols

Phenols are compounds that possess a hydroxyl group directly attached to an aromatic ring.



Phenol

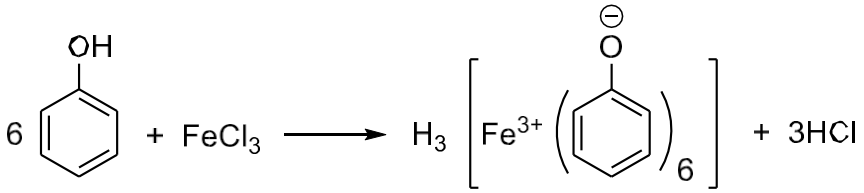
Ferric chloride ($FeCl_3$)

phenol group will form a blue, violet, purple, green, or red -brown color upon addition of aqueous ferric chloride ($FeCl_3$). This reaction **can be used as a test for phenol group.**

Test-tube 4

- Take 3 drops of the aqueous phenol solution. -
Add 2 drops of $FeCl_3$ solution.

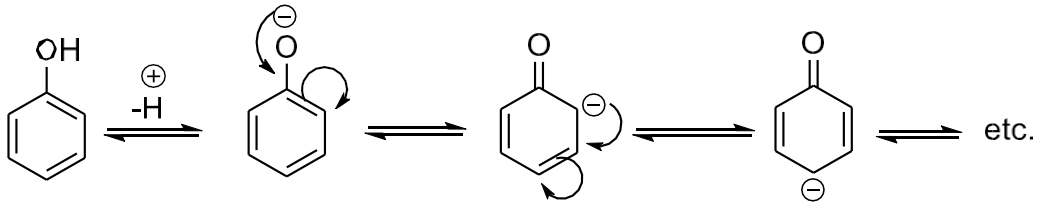
Chemical equation:



violet complex

Acidity of Phenols

Resonance stabilization of the charge in the anion is responsible for phenols being weak acids.



Test-tube 5

- Take 1 mL of aqueous phenol solution.
- Add 1 drop of bromothymol blue.
  (**pH color** change of bromothymol blue; (yellow at pH 6.2) to (blue at pH 7.6).

Observation

The color of the solution ……..…….

The solution has a pH of ……..…….

Test-tube 6

- Take 1 mL of aqueous phenol solution.
- Add 1 drop of bromophenol blue.
  (**pH color** change of bromophenol blue; (yellow; pH 3.0 to blue; pH 4.6).

Observation

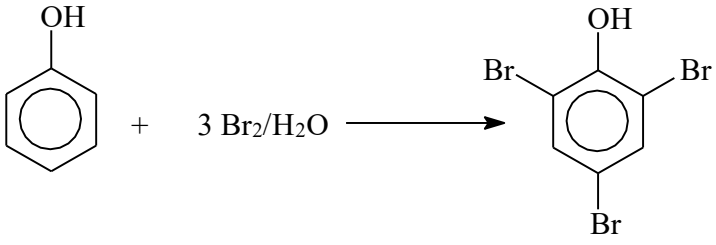
The color of the solution …….……..…….

The solution has a pH of ……...……...

Conclusion

The phenol solution therefore has a pH somewhere between ……. and ……

Electrophilic Substitution in Phenol

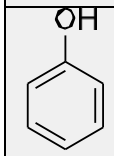
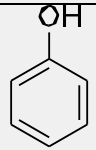


2,4,6-tribromophenol (white ppt)

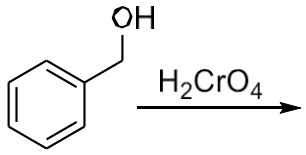
Test-tube 7

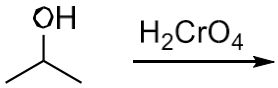
- Take 3 drops of the aqueous phenol solution.
- Add 2 mL of bromine water.

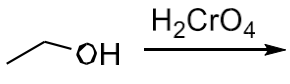
Schedule number 4

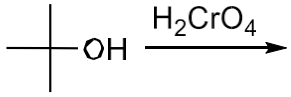
Test	Observation	Result	Chemical equation
1^o alcohol + Conc.HCl			
2^o alcohol + Conc.HCl			
3^o alcohol + Conc.HC			
1^o alcohol + H_2CrO_4			
3^o alcohol + H_2CrO_4			
 + $FeCl_3$			
 + Br_2 / H_2O			

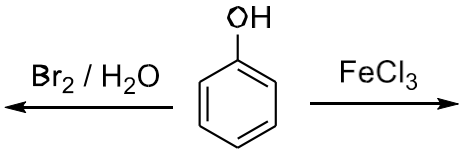
Questions

1) 

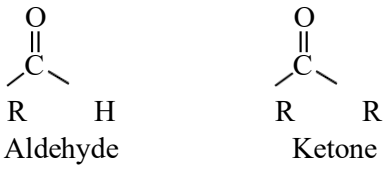
2) 

3) 

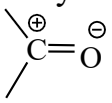
4) 



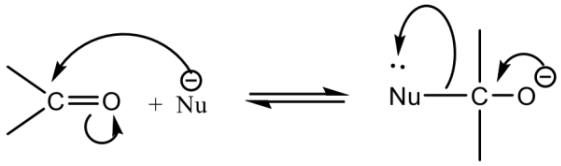
Aldehydes and Ketones

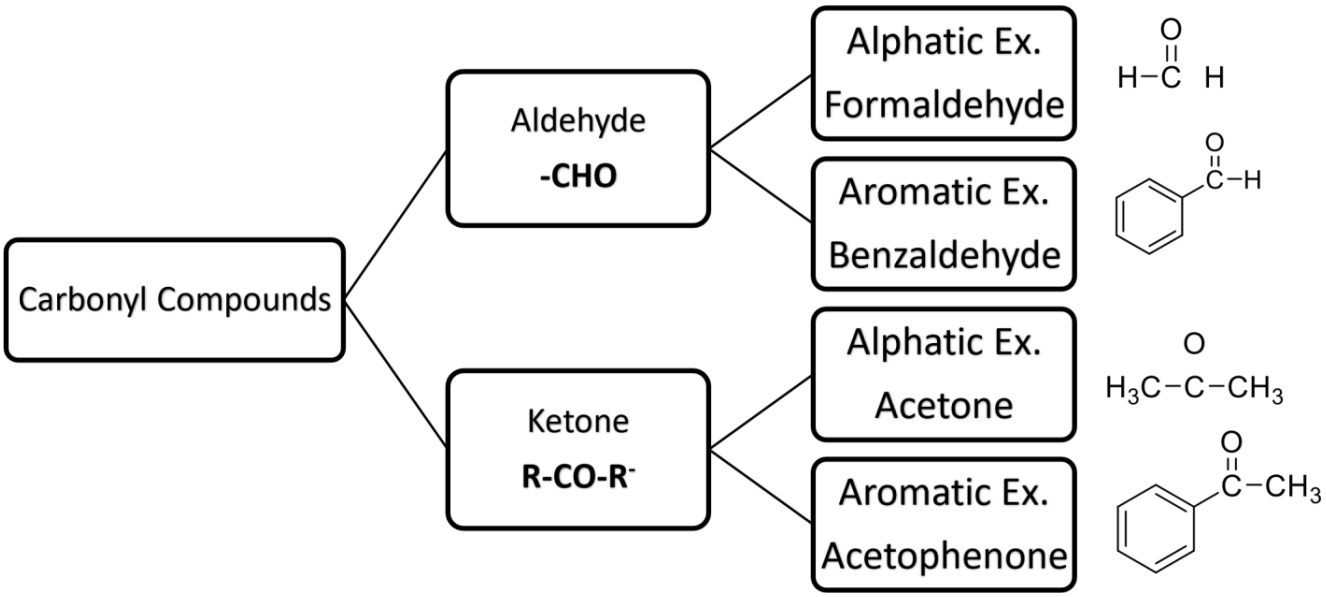


Aldehydes and ketones are characterized by carbonyl group-polarized double bond.



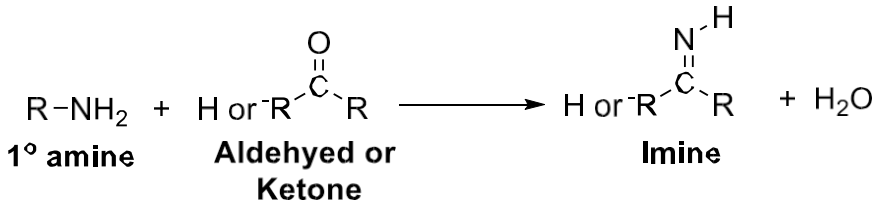
Attack by nucleophiles therefore occurs at the C^+ end.





Carbonyl Compounds with Amines

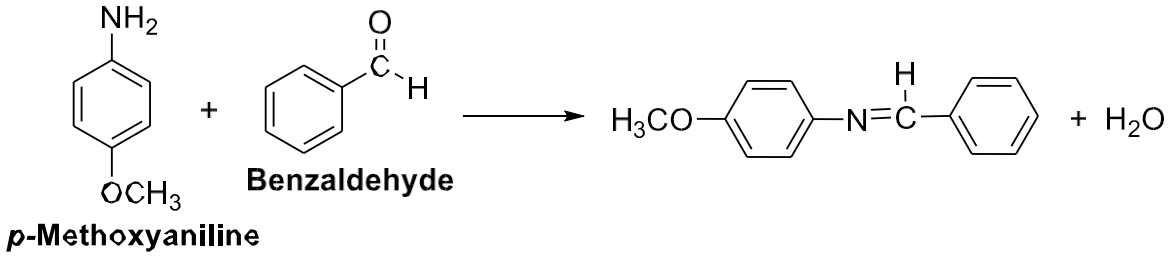
Aldehydes and ketones could react with ammonia or 1°-amines to form imine derivatives, also known as Schiff bases (compounds having a C=N function).



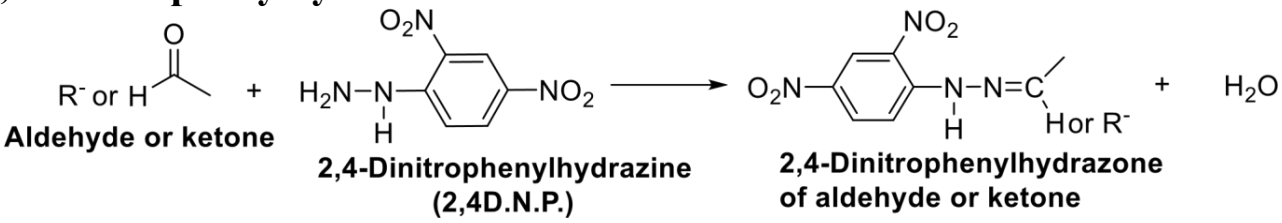
Test-tube 1

- Take 0.5 mL of ethanol.
- Add 5 drops of benzaldehyde.
- Add 1 mL of *p*-methoxyaniline (*p*-Anisidine) in ethanol-water.
- Shake.
- Place in a hot water bath.
- Cool the tube and add 1 drop of water.

Chemical equation:



2,4-Dinitrophenylhydrazone Formation

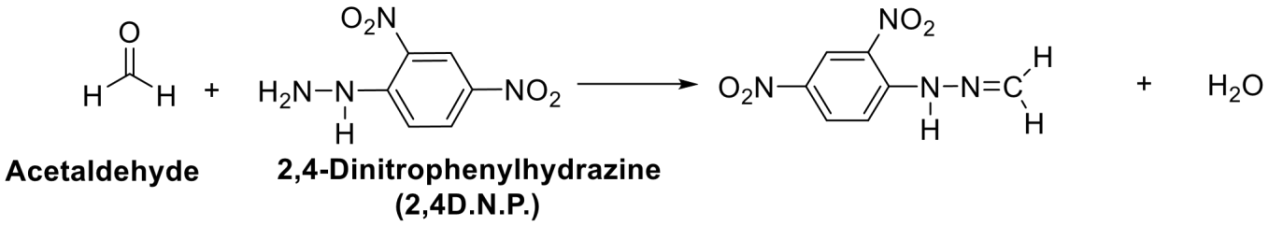


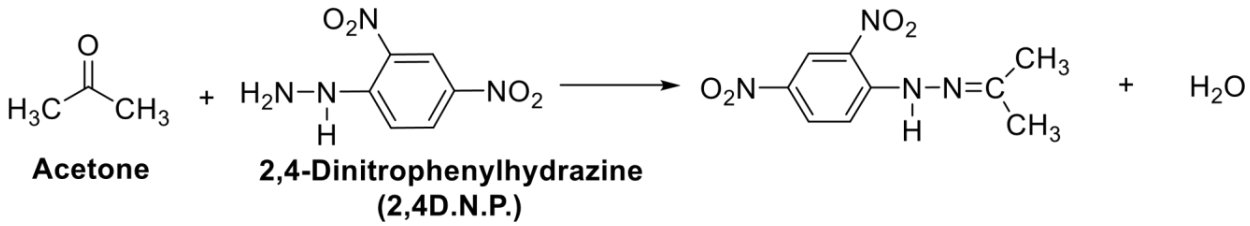
The reaction is used to identify aldehydes and ketones.

Test-tube 2

- Take 1 mL of 2,4-dinitrophenylhydrazone (2,4D.N.P.) reagent.
- Add 1 drop of acetaldehyde or acetone.

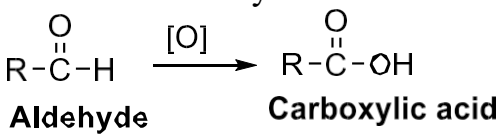
Chemical equation:

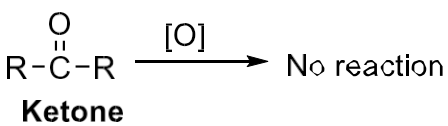




Oxidation of Carbonyl group

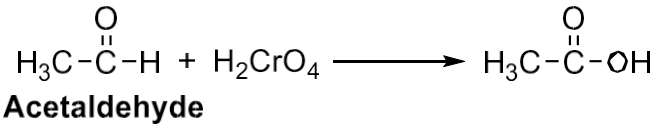
Aldehydes could oxidize to form carboxylic acid while ketone does not oxidize.

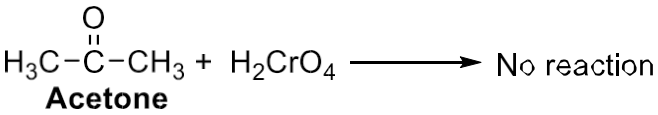




Test-tube 4

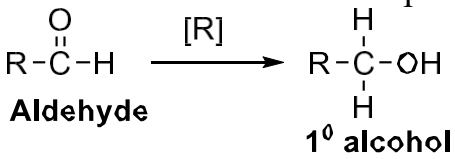
- **Take two test tubes** add 5 drops of acetaldehyde and the other add 5 drops acetone.
- Add 10 drops of chromic acid for the two test tubes (take care). - Place the tubes in the hot water bath. **Chemical equation:**



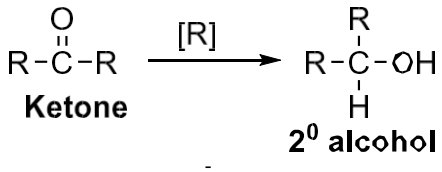


Reduction of Carbonyl group

Addition of a hydride anion ($H:^-$) to an aldehyde or ketone gives an alkoxide anion, which on protonation yields the corresponding alcohol. Aldehydes produce 1°-alcohols and ketones produce 2°-alcohols.



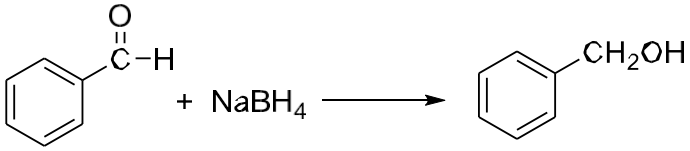
Reducing reagent: $NaBH_4$



Test-tube 3

- Take 1 mL of ethanol.
- Add 5 drops of benzaldehyde.
- Add 2 mL of $NaBH_4$ solution.
- Allow to stand.
- Add a few pieces of ice to a small beaker. - Pour into the reaction mixture.

Chemical equation:



Distinguishing Test between Aldehyde and Ketone

Tollen's reagent (a weak oxidizing agent) – ammonical silver nitrate with NH_4^+ as the oxidant.

Test-tube 5

-Take 2 mL of $AgNO_3$ solution.

-Add 8 drops of 5% NaOH solution.

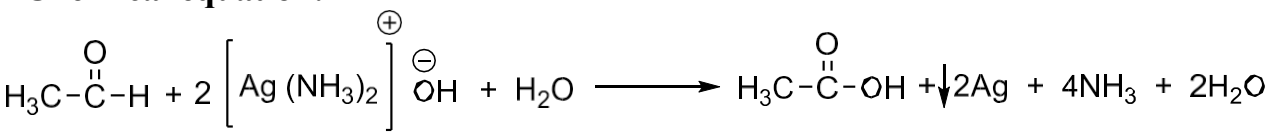
-Add ammonium hydroxide dropwise and with mixing until the black precipitate just dissolves. (This is Tollen's reagent) - Divide the solution into 2-test-tubes.

Reaction E (i)

-Add 1 drop acetaldehyde of to the sample of Tollen's reagent in the test-tube.

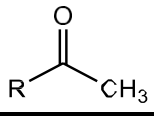
-Place the tube in the hot water bath.

Chemical equation:



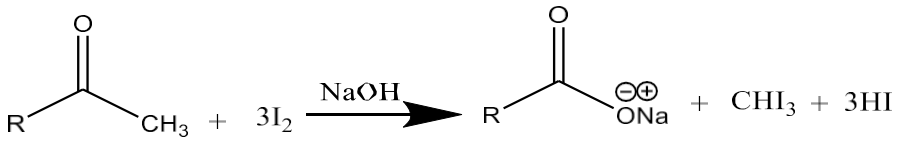
Reaction E (ii)

- Add 1 drop of acetone to the sample of Tollen's reagent in the test-tube.
- Place the tube in the hot water bath.

Detection of the acetylcholine group: 

Iodoform test:

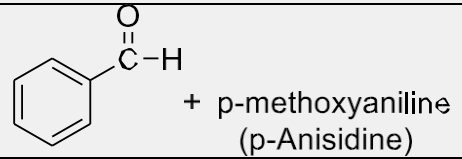
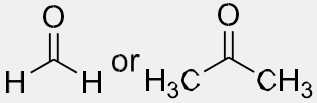
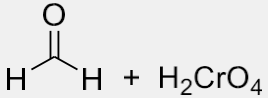
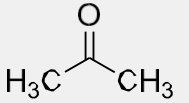
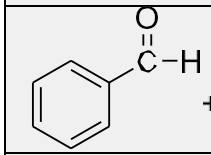
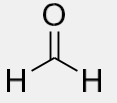
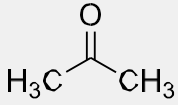
Reaction equation:



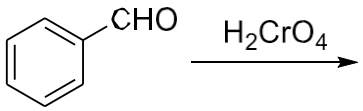
Test-tube 6

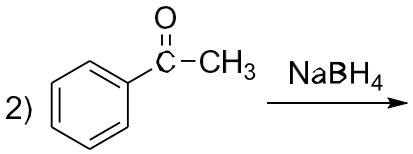
1. Place in a 3ml test tube of iodine solution (new preparation) in the gas cabinet
2. Take a few crystals of the unknown substance or 1ml if it is liquid.
3. Add 1ml of sodium hydroxide solution (NaOH 10%), shake the tube and heat in a water bath for three minutes.

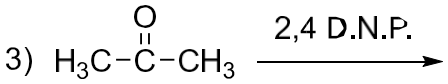
Schedule number 5

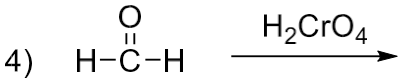
Test	Observation	Result	Chemical equation
 + p-methoxyaniline (p-Anisidine)			
 or + 2,4 D.N.P.			
 + H_2CrO_4			
 + H_2CrO_4			
 + $NaBH_4$			
 + Tollen's reagent			
 + Tollen's reagent			
Iodoform Test			

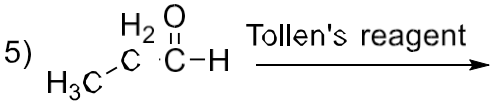
Questions:

1) 

2) 

3) 

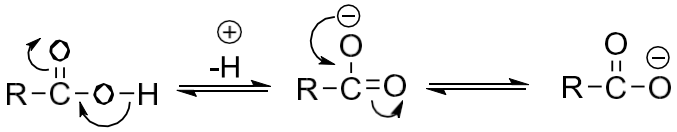
4) 

5) 

Carboxylic acids and Their Derivatives

Reaction of Carboxylic acid with Sodium bicarbonate

Carboxylic acids are stronger acids than phenols.

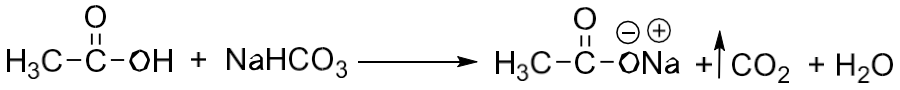


Test-tube 1

- Take 1 mL of 4% sodium bicarbonate solution ($NaHCO_3$). -
Add one drop of 90% acetic acid solution.

Note the CO_2 evolved (effervescence).

Chemical equation:



Relative Acidities of Some Substituted Benzoic Acid

a) Electron withdrawing substituents in Ar will reduce the charge on the carboxylate anions.
b) The anion will therefore be stabilized.
c) The acid will therefore show a greater tendency to dissociate.
d) The acid will therefore be stronger if Ar is electron withdrawing than if Ar is electron donating.

Test-tube 2, 3, 4

- Place 1 mL of *p*-nitrobenzoic acid in test-tube 2.
- Place 1 mL of benzoic acid in test-tube 3.
- Place 1 mL of *p*-methoxybenzoic acid in test-tube 4.
- Add 1 drop of bromophenol blue solution to each tube.
  (**pH color change** of bromophenol blue; yellow (pH 3.0), blue (pH 4.6).
- Add 1 drop of 0.1M NaOH to each tube.

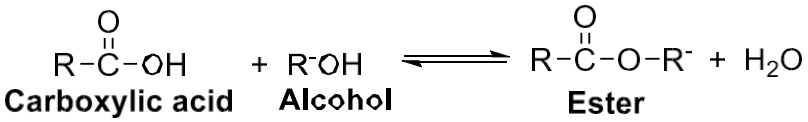
Observation

1) Color of p-nitrobenzoic acid ……
2) Color of benzoic acid ……
3) Color of p-methoxybenzoic acid ……

Order of acidity:

……

Esterification

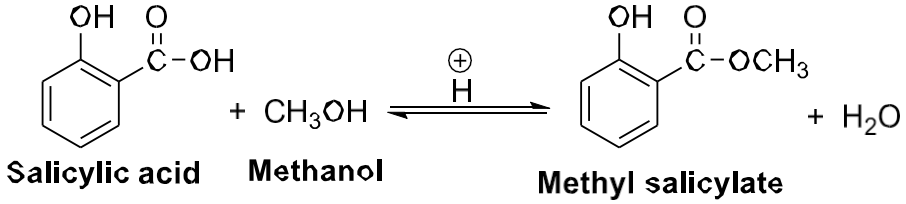


Test-tube 5

- Take 2 mL of the solution of sulfuric acid in methanol.
- Add 5 drops of the solution of salicylic acid in methanol.
- Place the tube in hot water bath.Take about 15 mL of cold water in a small beaker.
- Add the contents of the tube to the beaker.

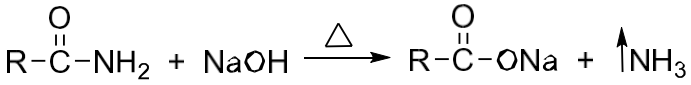
The ester, methyl salicylate (oil of wintergreen) has a distinctive smell.

Chemical equation:



Amide Hydrolysis

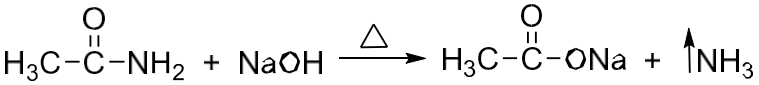
Susceptible to basic (and acidic) hydrolysis but are less reactive than esters.



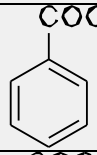
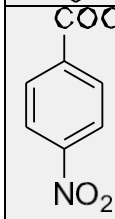
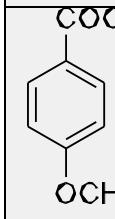
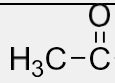
Test-tube 6

- Take 1 mL of the ethanol solution of acetamide.
- Add 1 mL of 10% NaOH solution.
- Then take red litmus and keep it on the top of the tube. - Place the tube in the hot water bath.

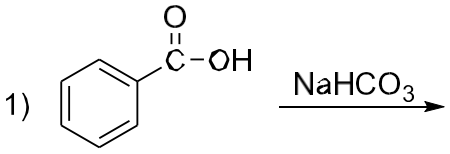
Chemical equation:

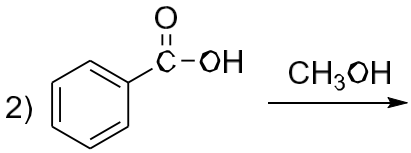


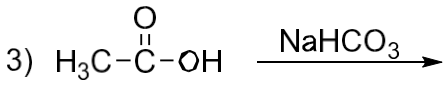
Schedule number 6

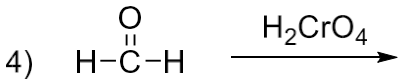
Test	Observation	Result	Chemical equation
Acetic acid + $NaHCO_3$			
 + Bromophenol blue			
 + Bromophenol blue			
 + Bromophenol blue			
Esterification			
 + 10% NaOH with red litmus paper			

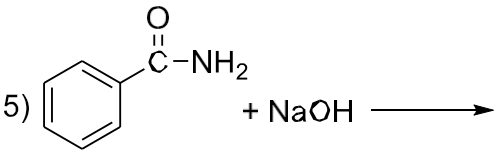
Questions:

1) 

2) 

3) 

4) 

5) 

Carbohydrates

Carbohydrates are compounds containing C, H, O and the H and O are present in the same proportion as in water. The word carbohydrate can be expressed as hydrates of carbon because molecular formulas of these compounds.

Example; Glucose has the molecular formula $C_6H_{12}O_6$, which might be written as $C_6(H_2O)_6$.

The chemistry of carbohydrates is mainly the combined chemistry of two functional groups: the hydroxyl group and the carbonyl group.

Carbohydrates are usually classified according to their structure as;

1) Monosaccharides: (glucose, galactose and fructose).
2) Disaccharides: (sucrose, maltose and lactose). 3) Polysaccharides: (starch and inulin).

The three classes of carbohydrates are related to each other through hydrolysis.

$$\text{polysaccharide} \xrightarrow[H^+]{H_2O} \text{oligosaccharides} \xrightarrow[H^+]{H_2O} \text{monosaccharides}$$

$$[C_{12}H_{20}O_{10}]_n \xrightarrow[H^+]{n\,H_2O} n\,C_{12}H_{22}O_{11} \xrightarrow[H^+]{n\,H_2O} 2n\,C_6H_{12}O_6$$

starch (a polysaccharide) — maltose (a disaccharide) — glucose (a monosaccharide)

Monosaccharides (or simple sugars, as they are sometimes called) are carbohydrates that cannot be hydrolyzed to simpler compounds.

Polysaccharides contain many monosaccharide units—sometimes hundreds or even thousands. Usually, but not always, the units are identical. Example; starch and cellulose, contain linked units of the same monosaccharide, glucose.

Oligosaccharides (from the Greek oligos, few) contain at least two and generally no more than a few linked monosaccharide units. They may be called disaccharides, trisaccharides, and so on, depending on the number of units, which may be the same or different. Example; Maltose is a disaccharide made of two glucose units. Sucrose is made of two different monosaccharide units: glucose and fructose.

Physical properties

Colorless solids, which decomposes on heating and therefore have no definite melting points. All are soluble in cold water except starch.

General Reactions:

❖ Molisch's Test

Test-tube 1

- Take concentrated solution of the carbohydrate in water.
- Add equal amount of α-naphthol solution.
- Carefully add excess amount of concentrated H_2SO_4 inside the wall of the tube to form a heavy layer at the bottom.

Observation

A deep violet ring is produced at the interface.

Shake the solution.

Observation

The violet color spreads through the whole solution.

❖ Reduction of Fehling's Solution (A+B)

Test-tube 2

- Take 1 mL of sugar solution.
- Add 1 mL of Fehling's solution (A+B). - Boil the soln. for one minute.

Observation

- Glucose, Fructose, Maltose (Malt sugar), and Lactose (Milk sugar); Reduction takes place and a red ppt. of cuprous oxide is formed.
- Starch and Sucrose give –ve result.

❖ Barfoed′s Test: (Copper Acetate in Acetic Acid Solution)

Test-tube 3

- Take 1 mL of sugar solution.
- Add 1 mL of Barfoed's reagent. - Boil the soln. for one minute.

Observation

- Glucose and Fructose give red ppt. of cuprous oxide appears.
- Maltose gives red ppt. only after prolonged heating (more than 15 min) as it is hydrolyzed to glucose.
- Lactose (Milk sugar) gives red ppt. only after prolonged heating (more than 15 min) as it is hydrolyzed to glucose and galactose.
- Starch and Sucrose give –ve result.

❖ Rapid Furfural Test

Test-tube 4

- Take 1 mL of dil. sugar solution.
- Add 1 mL of α-naphthol solution.
- Add 3 mL of conc. HCl. - Boil in a water bath.

Observation

- Glucose, Maltose, and Lactose (Milk sugar); a violet color appears after some time.
- Fructose and Sucrose (Can sugar); an immediate violet coloration on boiling.

❖ Iodine Test (I_2 Solution)

Test-tube 5

- In two test tubes take 1 mL of dil. Sugar (Sucrose and Starch) solution.
- Add 1 mL of I_2 solution.

Observation

- Starch gives blue-black color
- Sucrose –ve

❖ Tollen's reagent (Ammoniacal Silver Nitrate)

Test-tube 6

- Take 1 mL of sugar solution.
- Add 1 mL of dil. ammoniacal silver nitrate (Tollen's reagent).
- Boil the soln. for one minute.
- Place the test tube on a water bath.

Observation

- Glucose, Fructose, Maltose (Malt sugar) and Lactose (Milk sugar); a silver mirror is produced in 1-2 minutes.

Starch and Sucrose (Can sugar) give –ve result.

❖ Osazone formation

Test-tube 7

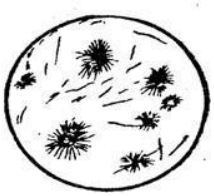
- Take solid sugar, phenyhydrazine hydrochloride, and sodium acetate in the ratio of 1:2:3.
- Add 5 drops of water.
- Place in a hot water bath for 10-15 minutes.

Observation

- Glucose and Fructose; yellow ppt. of the osazone appears after 10-15 minutes. Examine under the microscope, yellow needles aggregated in the form of sheaves.
- Maltose (Malt sugar); Forms yellow ppt. of osazone soluble in hot water, the yellow crystals of the osazone will appears only after cooling the soln. Examine the crystals under the microscope.
- Lactose (Milk sugar); Forms yellow ppt. of osazone soluble in hot water, the yellow crystals of the osazone will appears only after cooling the soln. Examine the crystals under the microscope.
- Starch and Sucrose (Can sugar); –ve result.

Glucosazone

Maltosazone



Lactosazone or Fructosazon

❖ Water Solubility Test

Test-tube 8

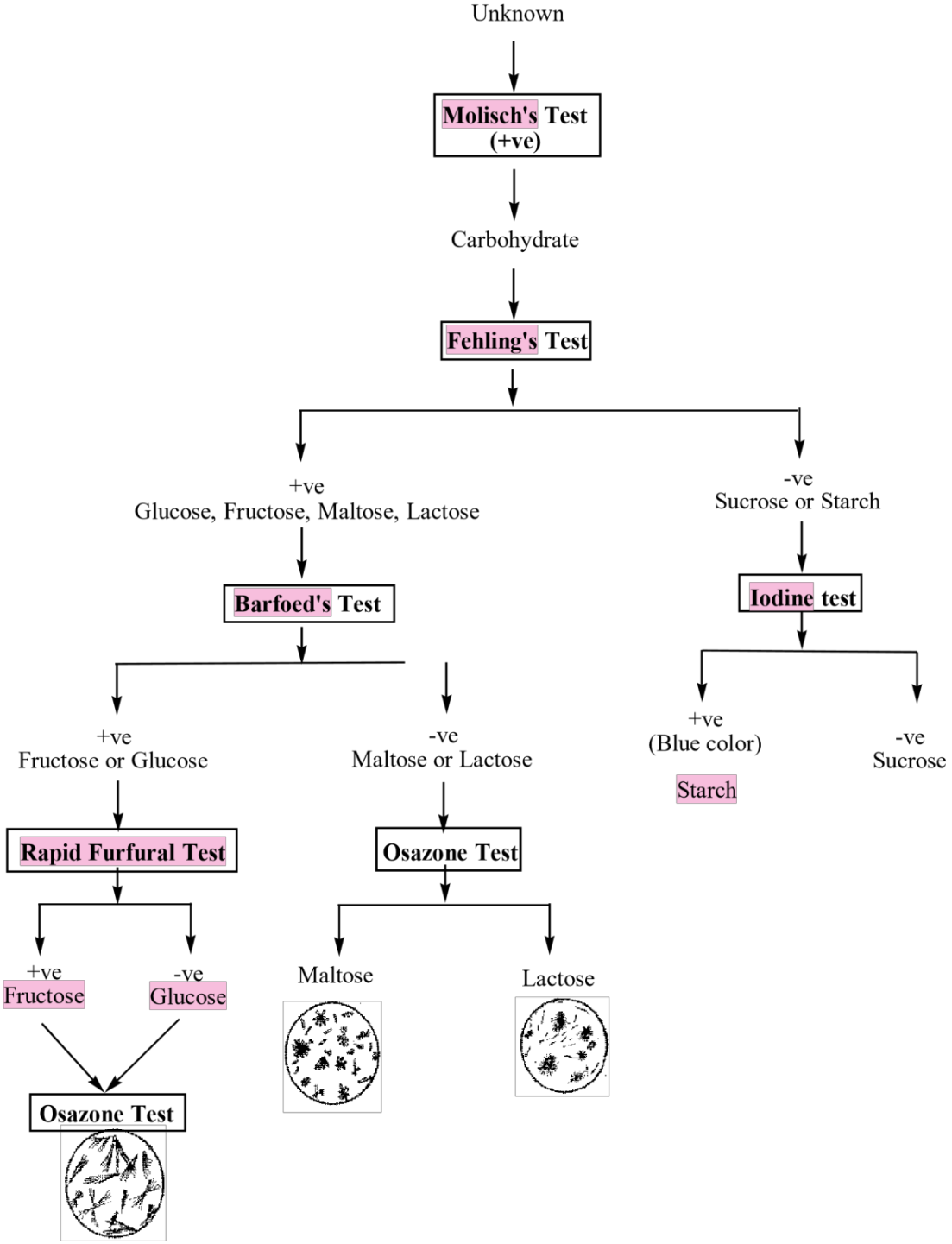
- Take solid sugar.
- Add water. - Shake.

Observation

- Mono-and disaccharides are soluble in water.
- Starch insoluble in water.

General Scheme for Identification of Carbohydrates

Starch, Sucrose, Glucose, Fructose, Maltose, Lactose



Schedule number 7 **Sugar name:**

Test	Observation	Result	Chemical equation
Molisch's Test			
Fehling's Solution (A+B)			
Barfoed's Test			
Rapid Furfural Test			
Iodine test			
Tollen’s reagent			
H_2O			

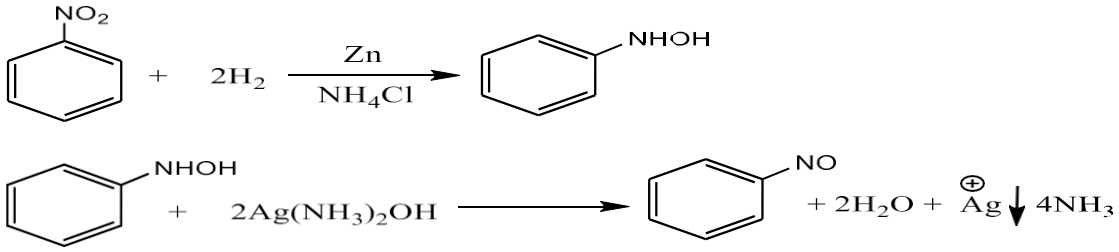
Amino Compounds

Test- tube 1

Nitro group detection:

The nitro group is detected by group reduction by ammonium chloride (NH4Cl).

Reaction equation:



Action Steps:

1. Take a few crystals of the unknown substance or 1ml if it is liquid.
2. Add 5ml of ethanol (50%) and shake the tube well
3. Add 0.5g of ammonium chloride (NH4Cl) to the tube and shake the tube well.
4. Add 0.5g of zinc powder (Zn) to the tube and shake the tube well
5. Preheat the tube directly into the gas cabinet until boiling (be careful during the heating process).
6. Filter the tube into a clean, dry test tube.
7. Take 1ml of filtrate, add Tolens solution to it and heat in a water bath.

Observation

A black, brown or silver mirror precipitate is formed.

Basicity of Amines

Test-tube 1

- Take 1 mL of aqueous aniline.
- Add 2 drops of phenolphthalein.
  (pH color change of phenolphthalein; colorless pH 8.0 to pink pH 10.0).

Observation

Aniline: Color ……. ∴ pH is ……..…

- Add 2 drops of *p*-nitrophenol solution to the aniline tube.
  (**pH color change** of *p*-nitrophenol; colorless pH 5.0 to yellow pH 7.0.)

Observation

Aniline: Color ……. ∴ pH is ……

Test-tube 2

- Take 1 mL of aqueous methylamine.
- Add 2 drops of phenolphthalein.
  (pH color change of phenolphthalein; colorless pH 8.0 to pink pH 10.0).

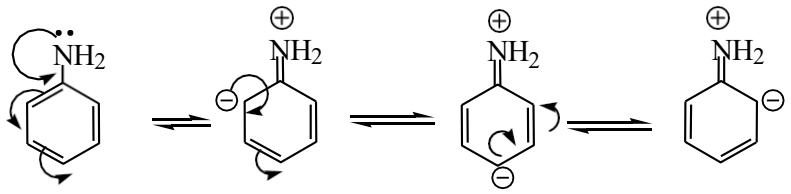
Observation

Methylamine: Color ……. ∴ pH is ……

The pH of the aniline solution is between …… and ……..…

Aniline is **(less - more)** basic than methylamine.

The lone pair of electrons on the nitrogen of aniline is delocalized over the ring.



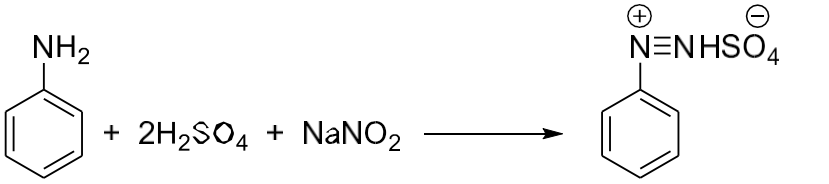
Protonation of this nitrogen is therefore less favorable than in the case of methylamine (no resonance possible).

Diazotization (Reaction with Nitrous Acid)

Test-tube 3

- Take 1 mL of the solution of aniline in 10% H_2SO_4.
- Slowly add 5 drops of $NaNO_2$ solution.
- Shake the tube after adding each drop.
- Set the tube aside.

Chemical equation:



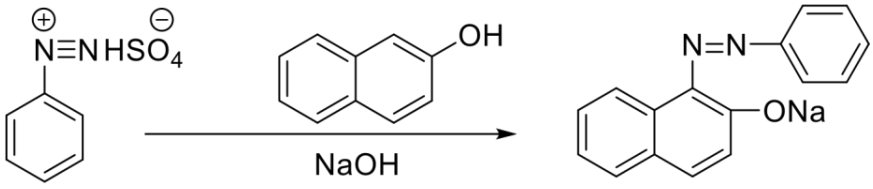
Aniline

Benzene diazonium hydrogen sulfate

Test-tube 4

- Take 1 mL of 2-naphthol solution in sodium hydroxide.
- Pour a little (less than half) of the diazonium salt solution in Test-tube 4 into the 2-naphthol solution.

Chemical equation:



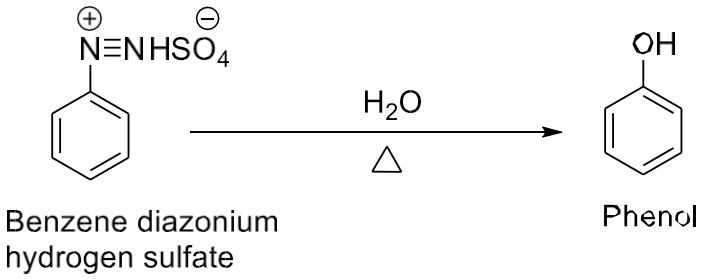
Benzene diazonium hydrogen sulfate

Azo Dye
(orange-red ppt.)

Test-tube 5

- Take 10 mL of hot water.
- Add rest of the diazonium salt solution from Test-tube 4.
- Heat and swirl.

Chemical equation:



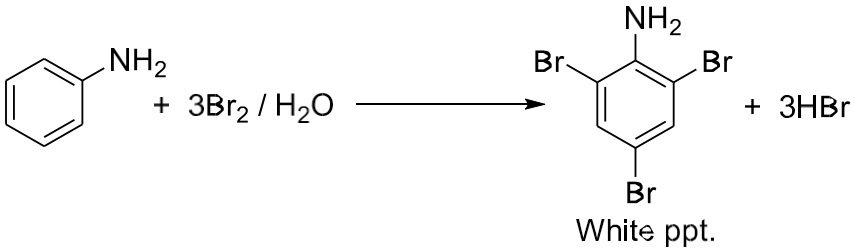
Bromination of Aniline

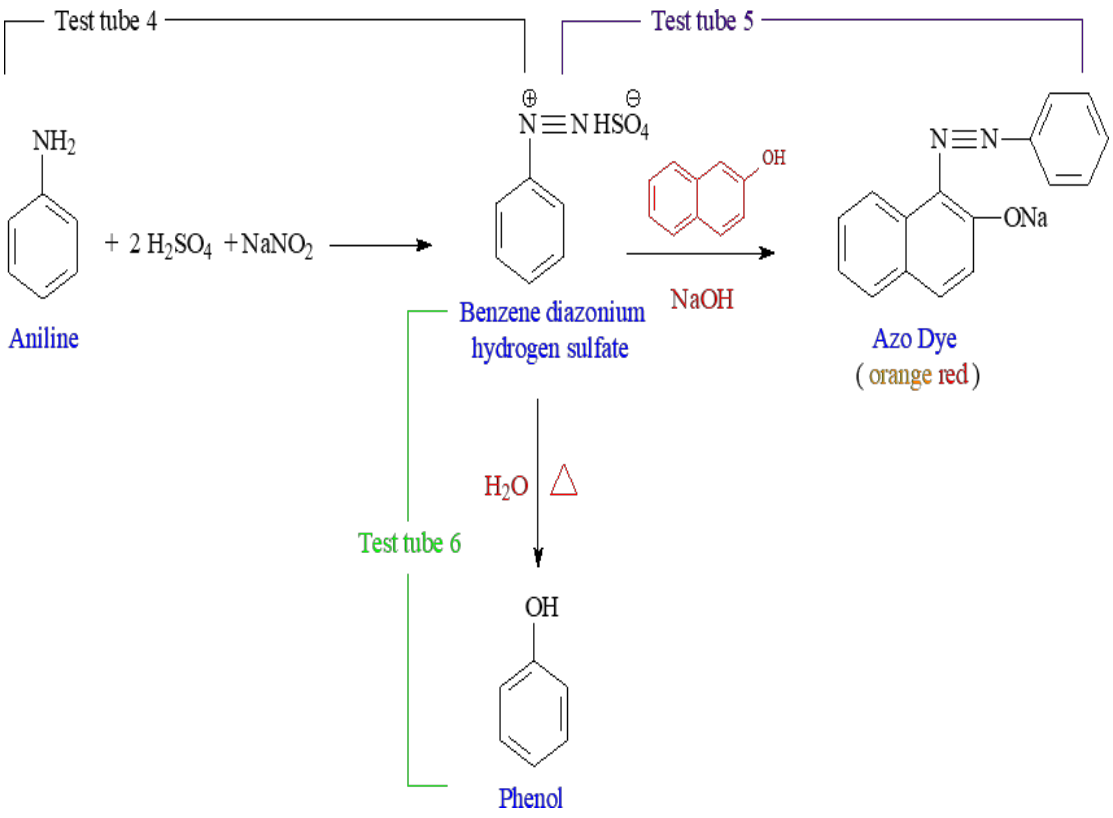
Aniline is highly reactive to electrophilic substitution reactions (-NH_2 is a strong electron-donor).

Test-tube 6

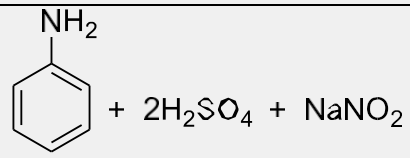
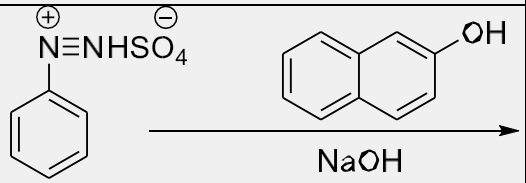
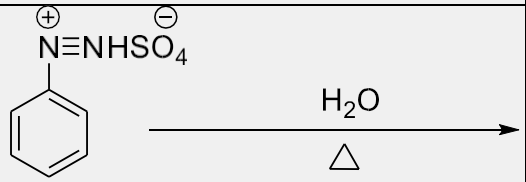
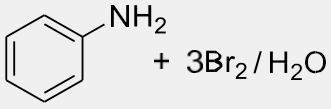
- Take 3 drops of aqueous aniline solution.
- Add 1 mL of bromine water.

Chemical equation:

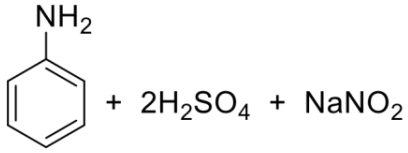


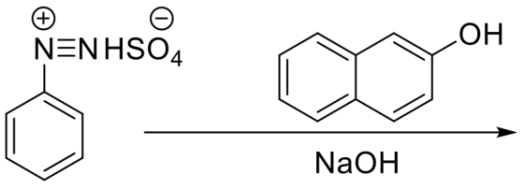

Test tube 4
Test tube 5
NH2
+ 2 H2SO4 +NaNO2
⊕ ⊖
N≡N HSO4
OH
NaOH
N≡N
ONa
Aniline
Benzene diazonium
hydrogen sulfate
Azo Dye
(orange red)
H2O
Test tube 6
OH
Phenol

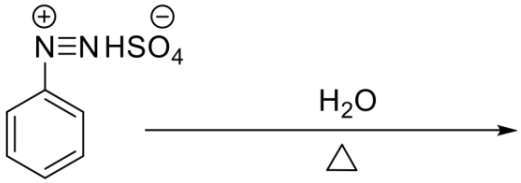
Schedule number 8

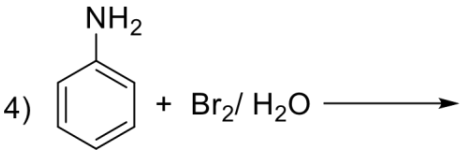
Test	Observation	Result	Chemical equation
			
			
			
			

Questions:

1) 

2) 

3) 

4) 

College of Science

Chemistry Department

Unknown No…….

Student's Name: …… **Student Number:** ……..

1- Physical Examination

		Physical State
		Color
		Odor
Results:	Observation:	**Ignition Test**
		Detection of metal
Results:	Observation:	**)Nitration)**
m.p= C^0		**m.p Observed**

2- Elements Test:

N	S	Cl	Br	I
ve	ve	ve	ve	ve

The Unknown Compound contains:

……..

3- Solubility Test:

H_2O	NaOH 10%	$NaHCO_3$ 10%	HCl %10	Conc. H_2SO_4	Litmus Paper
ve	ve	ve	ve	ve	

RESLTS:

……

4- Preliminary Classification Tests

Inferences	Observation	Reagent

Result: The unknown compound contains the following functional group(s):

1- …… 2- ……

5- Preliminary Examination of the Literature

Possible Compounds	m.p c^0	Chemical structure of Possible compounds	Note

6- Special Tests:

Inferences	Results	Reagent

7- Probability Compounds:

Probability Compound	Name of derivatives and their m.p C^0		
1-	اسم المشتق	اسم المشتق	اسم المشتق
	m.p ° =	m.p ° =	m.p ° =
2-			

8- Special Comments:

.....
.....
.....
.....
.....

9- The Name of Compound and Chemical Formula:

Chemical structur	Name of compound

College of Science

Chemistry Department

Unknown No (1)

Student's Name: …… **Student Number:** ……..

1- Physical Examination

		Physical State
		Color
		Odor
Results:	Observation:	**Ignition Test**
		Detection of metal
Results:	Observation:	**)Nitration)**
m.p= C^0		**m.p Observed**

2- Elements Test:

N	S	Cl	Br	I
ve	ve	ve	ve	ve

The Unknown Compound contains:

……..

3- Solubility Test:

H_2O	NaOH 10%	$NaHCO_3$ 10%	HCl %10	Conc. H_2SO_4	Litmus Paper
ve	ve	ve	ve	ve	

RESLTS:

……

4- Preliminary Classification Tests

Inferences	Observation	Reagent

Result: The unknown compound contains the following functional group(s):

1-…… 2- ……

5- Preliminary Examination of the Literature

Compounds Possible	m.p c^0	Chemical structure of Possible compounds	Note

6- Special Tests:

Inferences	Results	Reagent

7- Probability Compounds:

Probability Compound	Name of derivatives and their m.p C^0		
1-	اسم المشتق	اسم المشتق	اسم المشتق
	m.p ° =	m.p ° =	m.p ° =
2-			

8- Special Comments:

.....
.....
.....
.....
.....

9- The Name of Compound and Chemical Formula:

Chemical structure	Name of compound

College of Science

Chemistry Department

Unknown No (2)

Student's Name: …… **Student Number:** ……..

1- Physical Examination

		Physical State
		Color
		Odor
Results:	Observation:	**Ignition Test**
		Detection of metal
Results:	Observation:	**)Nitration)**
m.p= C^0		**m.p Observed**

2- Elements Test:

N	S	Cl	Br	I
ve	ve	ve	ve	ve

The Unknown Compound contains:

……..

3- Solubility Test:

H_2O	NaOH 10%	$NaHCO_3$ 10%	HCl %10	Conc. H_2SO_4	Litmus Paper
ve	ve	ve	ve	ve	

RESLTS:

……

4- Preliminary Classification Tests

Inferences	Observation	Reagent

Result: The unknown compound contains the following functional group(s):

2- …… 2- ……

5- Preliminary Examination of the Literature

Possible Compounds	m.p c^0	Chemical structure of Possible compounds	Note

6- Special Tests:

Inferences	Results	Reagent

7- Probability Compounds:

Probability Compound	Name of derivatives and their m.p C^0		
1-	اسم المشتق	اسم المشتق	اسم المشتق
	m.p ° =	m.p ° =	m.p ° =
2-			

8- Special Comments:

.....
.....
.....
.....
.....

9- The Name of Compound and Chemical Formula:

Chemical structur	Name of compound

College of Science

Chemistry Department

Unknown No (3)

Student's Name: …… **Student Number:** ……..

1- Physical Examination

		Physical State
		Color
		Odor
Results:	Observation:	**Ignition Test**
		Detection of metal
Results:	Observation:	**)Nitration)**
m.p= C^0		**m.p Observed**

2- Elements Test:

N	S	Cl	Br	I
ve	ve	ve	ve	ve

The Unknown Compound contains:

……..

3- Solubility Test:

H_2O	NaOH 10%	$NaHCO_3$ 10%	HCl %10	Conc. H_2SO_4	Litmus Paper
ve	ve	ve	ve	ve	

RESLTS:

……

4- Preliminary Classification Tests

Inferences	Observation	Reagent

Result: The unknown compound contains the following functional group(s):

3- …… 2- ……

5- Preliminary Examination of the Literature

Possible Compounds	m.p c^0	Chemical structure of Possible compounds	Note

6- Special Tests:

Inferences	Results	Reagent

7- Probability Compounds:

Probability Compound	Name of derivatives and their m.p C^0		
1-	اسم المشتق	اسم المشتق	اسم المشتق
	m.p ° =	m.p ° =	m.p ° =
2-			

8- Special Comments:

.....
.....
.....
.....
.....

9- The Name of Compound and Chemical Formula:

Chemical structur	Name of compound