Semester–V

17PHU514 CHEMISTRY PRACTICAL-I 4H–2C

Instruction Hours/week :L: 0 T:0 P:3 Marks: Internal:40 External: 60 Total:100

Course Objective

To make the student able to identify the elements and the functional groups present in an organic compound.

Course Outcome

On successful completion of the course the students should have

1. Learnt about the qualitative analysis of organic compounds.
2. Learnt the detection of elements and functional groups present in an organic compound by systematic analysis.

Systematic analysis of an organic compound

- Preliminary tests
- Detection of elements present
- Aromatic or aliphatic
- Saturated or unsaturated
- Nature of the functional group,
- Confirmatory tests– aldehydes, ketones, amines, amides, diamide, carbohydrates, phenols, acids, esters & nitro compounds.

Note: Each student should analyse minimum 6 compounds.

References:

1. Thomas, A.O. (2012). *Practical Chemistry for B.Sc. Main Students*. Cannanore: Kerala, Scientific Book Centre.
2. Ramasamy, R. (2011). *Allied Chemistry Practical Book*. Karur: Priya Publications.
3. Venkateswaran, V., Veeraswamy, R., & Kulandaivelu, A. R. (2015). *Basic Principles of Practical Chemistry* (2nd ed.). New Delhi: S. Chand Publications.

ESE Marks Allocation

Category	**Marks**
Experiment	40
Viva-Voce	10
Record	10
Total	**60**

KARPAGAM ACADEMY OF HIGHER EDUCATION

(Deemed to be University Established Under Section 3 of UGC Act 1956)

Coimbatore – 641 021.

LECTURE PLAN

DEPARTMENT OF BIOCHEMISTRY

STAFF NAME: Dr. M. Makeswari

SUBJECT NAME: CHEMISTRY PRACTICAL-I SUB.CODE:17PHU514

SEMESTER: V CLASS: III B.Sc Physics

S.No.	Lecture Duration Period	Topics to be Covered	Support Material/Page Nos
1	4	General discussion about practicals, Issuing apparatus and safety procedure to be followed in the laboratory	
2	4	Writing the experimental procedure	
3	4	Demonstration for systematic analysis of organic compound	R1:369-386 R2:48-54
4	4	Systematic analysis of organic compound–I	R1:369-386 R2:48-54
5	4	Systematic analysis of organic compound-II	R1:369-386 R2:48-54
6	4	Systematic analysis of organic compound-III	R1:369-386 R2:48-54
7	4	Systematic analysis of organic compound-IV	R1:369-386 R2:48-54
8	4	Systematic analysis of organic compound-V	R1:369-386 R2:48-54
9	4	Systematic analysis of organic compound-VI	R1:369-386 R2:48-54
10	4	Viva-voce questions discussion	R1:527-531
11	4	Revision	
12	4	Model Practical Examination	
	Total No. of Hours Planned For Practical's = 48		

References:

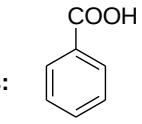
R1.Thomas, A.O. (2012). *Practical Chemistry for B.Sc. Main Students.* Cannanore: Kerala, Scientific Book Centre.

R2. Ramasamy, R. (2011). *Allied Chemistry Practical Book*. Karur: Priya Publications.

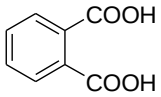
QUALITATIVE ANALYSIS OF ORGANIC COMPOUNDS

Compounds given for organic analysis

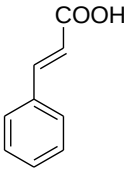
Solids:



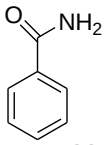
Benzoic acid (aromatic mono carboxylic acid)



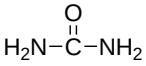
Phthalic acid (aromatic di carboxylic acid)



Cinnamic acid (aromatic unsaturated monocarboxylic acid)



Benzamide (amide)

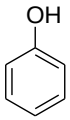


Urea (diamide)

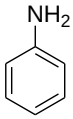
$C_6H_{12}O_6$

Glucose (carbohydrate)

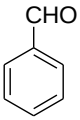
Liquids:



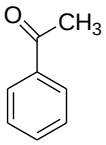
Phenol



Aniline (amine)



Benzaldehyde (aldehyde)



Acetophenone (ketone)

S. No.	Compound	Nature	Nitrogen	Aromatic or Aliphatic	Saturated or Unsaturated	Functional Group
1.	Benzoic acid	Colourless solid	Absent	Aromatic	Saturated	Monocarboxylic acid
2.	Phthalic acid	Colourless solid	Absent	Aromatic	Saturated	Dicarboxylic acid
3.	Cinnamic acid	Colourless solid	Absent	Aromatic	Unsaturated	Monocarboxylic acid
4.	Benzamide	Colourless solid	Present	Aromatic	Saturated	Amide
5.	Urea	Colourless solid	Present	Aliphatic	Saturated	Diamide
6.	Glucose	Colourless solid	Absent	Aliphatic	Saturated	Carbohydrate
7.	Phenol	Colourless liquid	Absent	Aromatic	Saturated	Phenol
8.	Aniline	Pale brown liquid	Present	Aromatic	Saturated	Amine
9.	Benzaldehyde	Colourless liquid	Absent	Aromatic	Saturated	Aldehyde
10.	Acetophenone	Colourless liquid	Absent	Aromatic	Saturated	Ketone

QUALITATIVE ANALYSIS OF ORGANIC COMPOUND

GENERAL PROCEDURE

S. No.	Experiment	Observation	Inference
	I. Preliminary test		
1.	**Colour and appearance** Colour and appearance of the substance is noted.	a) Brown or dark coloured solid or liquid b) Colourless liquid c) Colourless solid	a) May be aromatic amines or phenols b) May be aldehyde or ketone c) May be acids or amides or carbohydrates
2.	**Odour of the substance** Odour of the given substance is noted.	a) Phenolic smell b) Aniline like smell c) Odour of almond d) Pleasant odour e) No characteristic odour	a) May be phenols b) May be aromatic amine (aniline) c) May be aldehyde d) May be ketone e) Absence of amine, phenols, aldehyde and ketone.
3.	**Solubility test** Solubility of the given organic substance is tested in the following solvents. a) In water b) In dilute hydrochloric acid	a) Soluble in the cold condition b) Soluble in the hot condition a) Soluble b) Insoluble	a) May be carbohydrates or diamide like urea b) May be aromatic acids or amides a) May be aromatic amine (aniline) b) Absence of aromatic amine (aniline)
4.	**Preparation of the sodium fusion extract:** A piece of dry sodium metal is fused well in an ignition tube. To this, a little of the substance is added and the tube is heated gently until the reaction subsides and then heated to redness. The red hot end of the tube is plunged in 10 ml of distilled water in a mortar. The contents are ground well, boiled in a china dish and filtered. The filtrate is called sodium fusion extract. This is used for the following tests.		

S. No.	Experiment	Observation	Inference
	a) Test for nitrogen To about 2 ml of the extract a strong solution of freshly prepared ferrous sulphate is added. The solution is boiled, cooled and then dilute hydrochloric acid is added. **b) Test for sulphur** To about 1 ml of the extract 1 or 2 drops of freshly prepared sodium nitroprusside solution is added. **c) Test for halogens** To about 1 ml of the extract added 1 or 2 drops of dilute nitric acid and 1 or 2 drops of silver nitrate solution is added.	a) Blue or green precipitate or solution is obtained b) No blue or green precipitate or solution is obtained a) Violet colouration b) No violet colouration a) Curdy white precipitate soluble in ammonium hydroxide b) Pale yellow precipitate sparingly soluble in ammonium hydroxide c)Yellow precipitate insoluble in ammonium hydroxide d) No precipitate	a) Presence of nitrogen b) Absence of nitrogen a) Presence of sulphur b) Absence of sulphur a) Presence of chlorine b) Presence of bromine c) Presence of Iodine d) Absence of halogens
5.	**Test for aliphatic or aromatic character**		
	a) Ignition test A little of the substance is burnt in a nickel spatula.	a) Burns with a luminous smoky flame b) Burns with a non-luminous flame	a) Presence of aromatic compound b) Presence of aliphatic compound

S. No.	Experiment	Observation	Inference
	b) Nitration test A little of the substance is heated with 1 ml of conc. nitric acid and 1 ml of conc. sulphuric in a test tube and poured into cold water in a beaker.	a) Yellow precipitate or solution is obtained b) No yellow precipitate or solution is obtained	a) Presence of aromatic compound b) Presence of aliphatic compound
6.	**Test for saturation or unsaturation**		
	a) Bromine–water test A little of the substance is shaken up with 1 ml of water and bromine water is added drop by drop.	a) Decolourisation takes place readily b) Decolourisation takes place with the formation of a white precipitate c) No decolourisation takes place readily	a) Presence of unsaturated compound b) Presence of saturated compounds like amines or phenols c) Presence of saturated compound
	b)Potassium permanganate test A little of the substance is treated with a dilute solution of potassium permanganate.	a) Decolourisation takes place readily b) No decolourisation takes place readily	a) Presence of unsaturated compound or easily oxidisable compounds like phenols or amines or aldehydes b) Presence of saturated compound
7.	**Sodium carbonate test** A little of the substance is added to 1 ml of a strong solution of sodium carbonate.	a) Vigorous effervescence takes place evolving carbon dioxide gas b) No vigorous effervescence takes place	a) Presence of acids b) Absence of acids
8.	**Sodium hydroxide test:** To a little of the substance about 2 ml of 10% sodium hydroxide solution is added and boiled gently.	a) Dissolves readily in the cold condition and the substance is regenerated on adding dilute hydrochloric acid b) Solution turns yellow or brown on boiling	a) Presence of acids b) May be carbohydrates

S. No.	Experiment	Observation	Inference
		c) On heating ammonia gas is evolved. It gives dense white fumes with a glass rod dipped in conc. hydrochloric acid	c) May be amides
9.	**Soda-Lime test** A little of the substance is heated with powdered soda lime and heated strongly.	a) Ammonia gas is evolved b) No ammonia gas is evolved	a) May be amides b) Absence of amides
10.	**Conc. sulphuric acid test** A little of the substance is treated with 2 ml of conc. sulphuric acid and warmed.	a) The substance chars with smell of burnt sugar b) No characteristic change	a) May be carbohydrates b) Absence of carbohydrates
11.	**Neutral $FeCl_3$ test** To a little of the substance dissolved in water or alcohol, about 2 ml of neutral ferric chloride is added.	a) Violet or blue or green colour is obtained b) No violet or blue or green colour is obtained	a) Presence of phenol b) Absence of phenol
	If the substance does not contain nitrogen, the following tests are conducted.		
	II. Test for functional groups		
1.	**Test for acids** **a) Ester test** A little of the substance is mixed with a few drops of alcohol and 2 drops of conc. sulphuric acid. The mixture is gently warmed and poured into a beaker containing dilute sodium carbonate solution. **b) Phenolphthalein test** To about 2 ml of sodium hydroxide solution, 1 drop of dilute phenolphthalein indicator is added pink colour appears. To this, the substance dissolved in water or alcohol is added drop by drop in excess.	a) A pleasant fruity odour is noted b) No fruity odour is noted a) Pink colour disappears b) Pink colour does not disappear	a) Presence of carboxylic acid b) Absence of carboxylic acid a) Presence of carboxylic acid b) Absence of carboxylic acid

S. No.	Experiment	Observation	Inference
	c) Fluorescein test A small amount of the substance is mixed with few drops of resorcinol in a dry test tube. 3 drops of conc. sulphuric acid is added. Shake well, boil gently and then pour into 100 ml of cold water taken in a beaker. Stir well and then sodium hydroxide solution is added in drops.	a) An intense greenish yellow fluorescence is produced b) No intense greenish yellow fluorescence is produced	a) Presence of dicarboxylic acid b) Presence of monocarboxylic acid
2.	**Test for phenols** **a) Liebermann's reaction** A little of the substance is mixed with a few crystals of sodium nitrate and 3 or 4 drops of conc. sulphuric acid. This is gently warmed and poured into water. To this sodium hydroxide is added and stirred well.	a) Red solution is obtained. This turns blue or green on adding sodium hydroxide solution b) No red solution is obtained	a) Presence of phenol b) Absence of phenol
	b) Phthalein fusion test A little of the substance is mixed with phthalic anhydride and 1 ml of conc. sulphuric acid and the mixture is gently heated and poured into a beaker containing water. To this sodium hydroxide solution is added with stirring.	a) Pink or red colour is obtained b) No pink or red colour is obtained	a) Presence of phenol b) Absence of Phenol
	c) Azo-dye test A few drops of aniline is dissolved in about 5 ml of dilute hydrochloric acid. To this 5 ml of a strong solution of sodium nitrate is added in drops with constant shaking and cooling in cold water. To the above solution, a solution of the substance dissolved in 10% sodium hydroxide is added.	a) Scarlet red dye is obtained b) No scarlet red dye is obtained	a) Presence of phenol b) Absence of phenol

S. No.	Experiment	Observation	Inference
3.	**Test for carbohydrates** **a) Molisch's test** To a little of the substance in water a few drops of an alcoholic solution of 1-naphthol are added. To this mixture, conc. sulphuric acid is added along the sides of the test tube without shaking. **b) Tollen's reagent test** To a little of the substance add about 2 ml of Tollen's reagent. This is shaken well and heated in a boiling water bath. **c) Fehling's test** 1 ml of Fehling solution (A) is mixed with 1 ml of Fehling solution (B). The mixture is added to a little of the substance dissolved in water, shaken well and heated in a boiling water bath.	a) Violet ring is obtained at the junction of the two layers and this spreads slowly b) No violet ring is obtained a) Black precipitate or bright silver mirror is formed b) No black precipitate or bright silver mirror is formed a) Red precipitate is obtained b) No red precipitate is obtained	a) Presence of carbohydrate b) Absence of carbohydrate a) Presence of carbohydrate b) Absence of carbohydrate a) Presence of reducing sugars b) Absence of reducing sugars
4.	**Test for Aldehyde and Ketone** **a) Schiff's reagent test** To a little of the substance Schiff's reagent is added and shaken well. **b) Tollen's reagent test** To a little of the substance a few drops of Tollen's reagent is added and kept it in a hot water bath. **c) Legal's test** To a little of the substance a few drops of freshly prepared sodium nitroprusside and a few drops of 10% sodium hydroxide is added.	a) Violet colour is formed b) No violet colour is formed a) Silver mirror is obtained b) No silver mirror is obtained a) Wine red or blue colour is formed b) No wine red or blue colour is formed	a) Presence of aromatic aldehyde b) Absence of aromatic aldehyde a) Presence of aldehyde b) Presence of ketone a) Presence of ketone like acetophenone b) Absence of ketone

S. No.	Experiment	Observation	Inference
	d) *m*-Dinitrobenzene test To a little of the substance a small amount of *m*-dinitrobenzene and a few drops of dilute sodium hydroxide is added.	a) Violet or red colour is formed b) No violet or red colour is formed	a) Presence of ketone like acetophenone b) Absence of ketone
	If the substance contains nitrogen, the following tests are conducted.		
5.	**Test for amides** **a) Sodium hydroxide test** A little of the substance is heated with 5 ml of 10% sodium hydroxide solution till no more ammonia is evolved. It is then cooled and acidified with conc. hydrochloric acid. **b) Biuret test** A little of the substance is heated in a dry test tube for a few minutes. It is cooled and the residue is dissolved in 2 ml of water. To this 2 drops of dilute copper sulphate solution are added and then 10% sodium hydroxide solution is added dropwise. **c) Oxalic acid test** To a strong aqueous solution of the substance added oxalic acid solution, shaken well.	a) White precipitate is obtained b) No white precipitate is obtained a) Violet colour is obtained b) No violet colour is obtained a) White precipitate is obtained b) No white precipitate is obtained	a) Presence of an aromatic amide b) Presence of an aliphatic amide (urea) a) Presence of a diamide like urea b) Absence of a diamide like urea a) Presence of a diamide like urea b) Absence of a diamide like urea
6.	**Test for amines** **a) Action on nitrous acid** A little of the substance is dissolved in about 3 ml of dilute hydrochloric acid. To this a strong solution of sodium nitrate is added drop wise cooling the mixture in ice cold water.	a) A clear solution is produced b) No clear solution is produced	a) Presence of aromatic primary amine (aniline) b) Absence of aromatic primary amine (aniline)

	To the clear solution, a solution of 2-naphthol in sodium hydroxide is added.	a) Scarlet red dye is obtained b) No scarlet red dye is obtained	a) Presence of aromatic primary amine (aniline) b) Absence of aromatic primary amine (aniline)

Report:

1. Element present -

2. Aromatic / Aliphatic -

3. Saturated / Unsaturated -

4. Functional group present -

The given organic compound is

MODEL ANALYSIS-1
Urea (Diamide)

S. No.	Experiment	Observation	Inference
	I. Preliminary test		
1.	**Colour and appearance** Colour and appearance of the substance is noted.	Colourless solid	May be acids or amides or carbohydrates
2.	**Odour of the substance** Odour of the given substance is noted.	No characteristic odour	Absence of amine, phenols, aldehyde and ketone.
3.	**Solubility test** Solubility of the given organic substance is tested in the following solvents. In water	 Soluble in the cold condition	 May be carbohydrates or diamide like urea
4.	**Preparation of the sodium fusion extract:** A piece of dry sodium metal is fused well in an ignition tube. To this, a little of the substance is added and the tube is heated gently until the reaction subsides and then heated to redness. The red hot end of the tube is plunged in 10 ml of distilled water in a mortar. The contents are ground well, boiled in a china dish and filtered. The filtrate is called sodium fusion extract. This is used for the following tests.		
	a) Test for nitrogen To about 2 ml of the extract a strong solution of freshly prepared ferrous sulphate is added. The solution is boiled, cooled and then dilute hydrochloric acid is added. **b) Test for sulphur** To about 1 ml of the extract 1 or 2 drops of freshly prepared sodium nitroprusside solution is added. **c) Test for halogens** To about 1 ml of the extract added 1 or 2 drops of dilute nitric acid and 1 or 2 drops of silver nitrate solution is added.	 Green solution is obtained No violet colouration No precipitate	 Presence of nitrogen Absence of sulphur Absence of halogens

5.	**Test for aliphatic or aromatic character**		
	a) Ignition test A little of the substance is burnt in a nickel spatula. **b) Nitration test** A little of the substance is heated with 1 ml of conc. nitric acid and 1 ml of conc. sulphuric in a test tube and poured into cold water in a beaker.	Burns with a non-luminous flame No yellow precipitate or solution is obtained	Presence of aliphatic compound Presence of aliphatic compound
6.	**Test for saturation or unsaturation**		
	a) Bromine–water test A little of the substance is shaken up with 1 ml of water and bromine water is added drop by drop. **b)Potassium permanganate test** A little of the substance is treated with a dilute solution of potassium permanganate.	No decolourisation takes place readily No decolourisation takes place readily	Presence of saturated compound Presence of saturated compound
7.	**Sodium carbonate test** A little of the substance is added to 1 ml of a strong solution of sodium carbonate.	No vigorous effervescence takes place	Absence of acids
8.	**Sodium hydroxide test:** To a little of the substance about 2 ml of 10% sodium hydroxide solution is added and boiled gently.	On heating ammonia gas is evolved. It gives dense white fumes with a glass rod dipped in conc. hydrochloric acid	May be amides
9.	**Soda-Lime test** A little of the substance is heated with powdered soda lime and heated strongly.	Ammonia gas is evolved	May be amides
10.	**Conc. sulphuric acid test** A little of the substance is treated with 2 ml of conc. sulphuric acid and warmed.	No characteristic change	Absence of carbohydrates
11.	**Neutral $FeCl_3$ test** To a little of the substance dissolved in water or alcohol, about 2 ml of neutral ferric chloride is added.	No violet or blue or green colour is obtained	Absence of phenol

	II. Test for functional groups		
1.	**Test for acids** **Ester test** A little of the substance is mixed with a few drops of alcohol and 2 drops of conc. sulphuric acid. The mixture is gently warmed and poured into a beaker containing dilute sodium carbonate solution.	No fruity odour is noted	Absence of carboxylic acid
2.	**Test for phenols** **Liebermann's reaction** A little of the substance is mixed with a few crystals of sodium nitrate and 3 or 4 drops of conc. sulphuric acid. This is gently warmed and poured into water. To this sodium hydroxide is added and stirred well.	No red solution is obtained	Absence of phenol
3.	**Test for carbohydrates** **Molisch's test** To a little of the substance in water a few drops of an alcoholic solution of 1-naphthol are added. To this mixture, conc. sulphuric acid is added along the sides of the test tube without shaking.	No violet ring is obtained	Absence of carbohydrate
4.	**Test for Aldehyde and Ketone** **a) Schiff's reagent test** To a little of the substance Schiff's reagent is added and shaken well. **b) Legal's test** To a little of the substance a few drops of freshly prepared sodium nitroprusside and a few drops of 10% sodium hydroxide is added.	No violet colour is formed No wine red or blue colour is formed	Absence of aromatic aldehyde Absence of ketone

5.	**Test for amides** **a) Sodium hydroxide test** A little of the substance is heated with 5 ml of 10% sodium hydroxide solution till no more ammonia is evolved. It is then cooled and acidified with conc. hydrochloric acid. **b) Biuret test** A little of the substance is heated in a dry test tube for a few minutes. It is cooled and the residue is dissolved in 2 ml of water. To this 2 drops of dilute copper sulphate solution are added and then 10% sodium hydroxide solution is added dropwise. **c) Oxalic acid test** To a strong aqueous solution of the substance added oxalic acid solution, shaken well.	No white precipitate is obtained Violet colour is obtained White precipitate is obtained	Presence of an aliphatic amide (urea) Presence of a diamide like urea Presence of a diamide like urea
6.	**Test for amines** **Action on nitrous acid** A little of the substance is dissolved in about 3 ml of dilute hydrochloric acid. To this a strong solution of sodium nitrate is added drop wise cooling the mixture in ice cold water.	No characteristic change	Absence of aromatic primary amine (aniline)

Report:

1. Element present - Presence of nitrogen and absence of special elements like sulphur and other halogens.
2. Aromatic / Aliphatic - Aliphatic
3. Saturated / Unsaturated - Saturated
4. Functional group present - Diamide like urea

The given organic compound is aliphatic saturated diamide like urea.

MODEL ANALYSIS-2
Aniline (Amine)

S. No.	Experiment	Observation	Inference
	I. Preliminary test		
1.	**Colour and appearance** Colour and appearance of the substance is noted.	Brown coloured liquid	May be aromatic amines
2.	**Odour of the substance** Odour of the given substance is noted.	Aniline like smell	May be aromatic amine (aniline)
3.	**Solubility test** Solubility of the given organic substance is tested in the following solvents. In dilute hydrochloric acid	 Soluble	 May be aromatic amine (aniline)
4.	**Preparation of the sodium fusion extract:** A piece of dry sodium metal is fused well in an ignition tube. To this, a little of the substance is added and the tube is heated gently until the reaction subsides and then heated to redness. The red hot end of the tube is plunged in 10 ml of distilled water in a mortar. The contents are ground well, boiled in a china dish and filtered. The filtrate is called sodium fusion extract. This is used for the following tests.		
	a) Test for nitrogen To about 2 ml of the extract a strong solution of freshly prepared ferrous sulphate is added. The solution is boiled, cooled and then dilute hydrochloric acid is added.	Green solution is obtained	Presence of nitrogen
	b) Test for sulphur To about 1 ml of the extract 1 or 2 drops of freshly prepared sodium nitroprusside solution is added.	No violet colouration	Absence of sulphur
	c) Test for halogens To about 1 ml of the extract added 1 or 2 drops of dilute nitric acid and 1 or 2 drops of silver nitrate solution is added.	No precipitate	Absence of halogens

5.	**Test for aliphatic or aromatic character**		
	a) Ignition test A little of the substance is burnt in a nickel spatula.	Burns with a luminous smoky flame	Presence of aromatic compound
	b) Nitration test A little of the substance is heated with 1 ml of conc. nitric acid and 1 ml of conc. sulphuric in a test tube and poured into cold water in a beaker.	Yellow solution is obtained	Presence of aromatic compound
6.	**Test for saturation or unsaturation**		
	a) Bromine–water test A little of the substance is shaken up with 1 ml of water and bromine water is added drop by drop.	Decolourisation takes place with the formation of a white precipitate	Presence of saturated compounds like amines or phenols
	b)Potassium permanganate test A little of the substance is treated with a dilute solution of potassium permanganate.	Decolourisation takes place readily	Presence of unsaturated compound or easily oxidisable compounds like phenols or amines or aldehydes
7.	**Sodium carbonate test** A little of the substance is added to 1 ml of a strong solution of sodium carbonate.	No vigorous effervescence takes place	Absence of acids
8.	**Sodium hydroxide test:** To a little of the substance about 2 ml of 10% sodium hydroxide solution is added and boiled gently.	No characteristic change	Absence of acids, carbohydrates and amides
9.	**Soda-Lime test** A little of the substance is heated with powdered soda lime and heated strongly.	No ammonia gas is evolved	Absence of amides
10.	**Conc. sulphuric acid test** A little of the substance is treated with 2 ml of conc. sulphuric acid and warmed.	No characteristic change	Absence of carbohydrates
11.	**Neutral $FeCl_3$ test** To a little of the substance dissolved in water or alcohol, about 2 ml of neutral ferric chloride is added.	No violet or blue or green colour is obtained	Absence of phenol

	II. Test for functional groups		
1.	**Test for acids** **Ester test** A little of the substance is mixed with a few drops of alcohol and 2 drops of conc. sulphuric acid. The mixture is gently warmed and poured into a beaker containing dilute sodium carbonate solution.	No fruity odour is noted	Absence of carboxylic acids
2.	**Test for phenols** **Liebermann's reaction** A little of the substance is mixed with a few crystals of sodium nitrate and 3 or 4 drops of conc. sulphuric acid. This is gently warmed and poured into water. To this sodium hydroxide is added and stirred well.	No red solution is obtained	Absence of phenol
3.	**Test for carbohydrates** **Molisch's test** To a little of the substance in water a few drops of an alcoholic solution of 1-naphthol are added. To this mixture, conc. sulphuric acid is added along the sides of the test tube without shaking.	No violet ring is obtained	Absence of carbohydrate
4.	**Test for Aldehyde and Ketone** **a) Schiff's reagent test** To a little of the substance Schiff's reagent is added and shaken well. **b) Legal's test** To a little of the substance a few drops of freshly prepared sodium nitroprusside and a few drops of 10% sodium hydroxide is added.	No violet colour is formed No wine red or blue colour is formed	Absence of aromatic aldehyde Absence of ketone

5.	**Test for amides** **Sodium hydroxide test** A little of the substance is heated with 5 ml of 10% sodium hydroxide solution till no more ammonia is evolved. It is then cooled and acidified with conc. hydrochloric acid.	No characteristic change	Absence of amides
6.	**Test for amines** **Action on nitrous acid** A little of the substance is dissolved in about 3 ml of dilute hydrochloric acid. To this a strong solution of sodium nitrate is added drop wise cooling the mixture in ice cold water. To the clear solution, a solution of 2-naphthol in sodium hydroxide is added.	A clear solution is produced Scarlet red dye is obtained	Presence of aromatic primary amine (aniline) Presence of aromatic primary amine (aniline)

Report:

1. Element present - Presence of nitrogen and absence of special elements like sulphur and other halogens.
2. Aromatic / Aliphatic - Aromatic
3. Saturated / Unsaturated - Saturated
4. Functional group present - Amine

The given organic compound is aromatic saturated amine.

MODEL ANALYSIS-3

Carbohydrate (Glucose)

S. No.	Experiment	Observation	Inference
	I. Preliminary test		
1.	**Colour and appearance** Colour and appearance of the substance is noted.	Colourless solid	May be acids or amides or carbohydrates
2.	**Odour of the substance** Odour of the given substance is noted.	No characteristic odour	Absence of amine, phenols, aldehyde and ketone.
3.	**Solubility test** Solubility of the given organic substance is tested in the following solvents. In water	 Soluble in the cold condition	 May be carbohydrates or diamide like urea
4.	**Preparation of the sodium fusion extract:** A piece of dry sodium metal is fused well in an ignition tube. To this, a little of the substance is added and the tube is heated gently until the reaction subsides and then heated to redness. The red hot end of the tube is plunged in 10 ml of distilled water in a mortar. The contents are ground well, boiled in a china dish and filtered. The filtrate is called sodium fusion extract. This is used for the following tests.		
	a) Test for nitrogen To about 2 ml of the extract a strong solution of freshly prepared ferrous sulphate is added. The solution is boiled, cooled and then dilute hydrochloric acid is added. **b) Test for sulphur** To about 1 ml of the extract 1 or 2 drops of freshly prepared sodium nitroprusside solution is added. **c) Test for halogens** To about 1 ml of the extract added 1 or 2 drops of dilute nitric acid and 1 or 2 drops of silver nitrate solution is added.	No blue or green precipitate or solution is obtained No violet colouration No precipitate	Absence of nitrogen Absence of sulphur Absence of halogens

5.	**Test for aliphatic or aromatic character**		
	a) Ignition test A little of the substance is burnt in a nickel spatula.	Burns with a non-luminous flame	Presence of aliphatic compound
	b) Nitration test A little of the substance is heated with 1 ml of conc. nitric acid and 1 ml of conc. sulphuric in a test tube and poured into cold water in a beaker.	No yellow precipitate or solution is obtained	Presence of aliphatic compound
6.	**Test for saturation or unsaturation**		
	a) Bromine–water test A little of the substance is shaken up with 1 ml of water and bromine water is added drop by drop.	No decolourisation takes place readily	Presence of saturated compound
	b)Potassium permanganate test A little of the substance is treated with a dilute solution of potassium permanganate.	No decolourisation takes place readily	Presence of saturated compound
7.	**Sodium carbonate test** A little of the substance is added to 1 ml of a strong solution of sodium carbonate.	No vigorous effervescence takes place	Absence of acids
8.	**Sodium hydroxide test:** To a little of the substance about 2 ml of 10% sodium hydroxide solution is added and boiled gently.	Solution turns yellow or brown on boiling	May be carbohydrates
9.	**Soda-Lime test** A little of the substance is heated with powdered soda lime and heated strongly.	No ammonia gas is evolved	Absence of amides
10.	**Conc. sulphuric acid test** A little of the substance is treated with 2 ml of conc. sulphuric acid and warmed.	The substance chars with smell of burnt sugar	May be carbohydrates
11.	**Neutral $FeCl_3$ test** To a little of the substance dissolved in water or alcohol, about 2 ml of neutral ferric chloride is added.	No violet or blue or green colour is obtained	Absence of phenol

	II. Test for functional groups		
1.	**Test for acids** **Ester test** A little of the substance is mixed with a few drops of alcohol and 2 drops of conc. sulphuric acid. The mixture is gently warmed and poured into a beaker containing dilute sodium carbonate solution.	No fruity odour is noted	Absence of carboxylic acids
2.	**Test for phenols** **Liebermann's reaction** A little of the substance is mixed with a few crystals of sodium nitrate and 3 or 4 drops of conc. sulphuric acid. This is gently warmed and poured into water. To this sodium hydroxide is added and stirred well.	No red solution is obtained	Absence of phenol
3.	**Test for carbohydrates** **a) Molisch's test** To a little of the substance in water a few drops of an alcoholic solution of 1-naphthol are added. To this mixture, conc. sulphuric acid is added along the sides of the test tube without shaking. **b) Tollen's reagent test** To a little of the substance add about 2 ml of Tollen's reagent. This is shaken well and heated in a boiling water bath. **c) Fehling's test** 1 ml of Fehling solution (A) is mixed with 1 ml of Fehling solution (B). The mixture is added to a little of the substance dissolved in water, shaken well and heated in a boiling water bath.	Violet ring is obtained at the junction of the two layers and this spreads slowly Black precipitate or bright silver mirror is formed Red precipitate is obtained	Presence of carbohydrate Presence of carbohydrate Presence of reducing sugars
4.	**Test for Aldehyde and**		

	Ketone **a) Schiff's reagent test** To a little of the substance Schiff's reagent is added and shaken well. **b) Legal's test** To a little of the substance a few drops of freshly prepared sodium nitroprusside and a few drops of 10% sodium hydroxide is added.	No violet colour is formed No wine red or blue colour is formed	Absence of aromatic aldehyde Absence of ketone
5.	**Test for amides** **Sodium hydroxide test** A little of the substance is heated with 5 ml of 10% sodium hydroxide solution till no more ammonia is evolved. It is then cooled and acidified with conc. hydrochloric acid.	No characteristic change	Absence of amides
6.	**Test for amines** **Action on nitrous acid** A little of the substance is dissolved in about 3 ml of dilute hydrochloric acid. To this a strong solution of sodium nitrate is added drop wise cooling the mixture in ice cold water.	No characteristic change	Absence of aromatic primary amine (aniline)

Report:

1. Element present - Absence of special elements like nitrogen, sulphur and other halogens.
2. Aromatic / Aliphatic - Aliphatic
3. Saturated / Unsaturated - Saturated
4. Functional group present - Carbohydrate

The given organic compound is aliphatic saturated carbohydrate.

MODEL ANALYSIS-4

Benzoic acid (Monocarboxylic acid)

S. No.	Experiment	Observation	Inference
	I. Preliminary test		
1.	**Colour and appearance** Colour and appearance of the substance is noted.	Colourless solid	May be acids or amides or carbohydrates
2.	**Odour of the substance** Odour of the given substance is noted.	No characteristic odour	Absence of amine, phenols, aldehyde and ketone.
3.	**Solubility test** Solubility of the given organic substance is tested in the following solvents. In water	 Soluble in the hot condition	 May be aromatic acids or amides
4.	**Preparation of the sodium fusion extract:** A piece of dry sodium metal is fused well in an ignition tube. To this, a little of the substance is added and the tube is heated gently until the reaction subsides and then heated to redness. The red hot end of the tube is plunged in 10 ml of distilled water in a mortar. The contents are ground well, boiled in a china dish and filtered. The filtrate is called sodium fusion extract. This is used for the following tests.		
	a) Test for nitrogen To about 2 ml of the extract a strong solution of freshly prepared ferrous sulphate is added. The solution is boiled, cooled and then dilute hydrochloric acid is added. **b) Test for sulphur** To about 1 ml of the extract 1 or 2 drops of freshly prepared sodium nitroprusside solution is added. **c) Test for halogens** To about 1 ml of the extract added 1 or 2 drops of dilute nitric acid and 1 or 2 drops of	 No blue or green precipitate or solution is obtained No violet colouration No precipitate	 Absence of nitrogen Absence of sulphur Absence of halogens

	silver nitrate solution is added.		
5.	**Test for aliphatic or aromatic character**		
	a) Ignition test A little of the substance is burnt in a nickel spatula. **b) Nitration test** A little of the substance is heated with 1 ml of conc. nitric acid and 1 ml of conc. sulphuric in a test tube and poured into cold water in a beaker.	Burns with a luminous smoky flame Yellow solution is obtained	Presence of aromatic compound Presence of aromatic compound
6.	**Test for saturation or unsaturation**		
	a) Bromine–water test A little of the substance is shaken up with 1 ml of water and bromine water is added drop by drop. **b)Potassium permanganate test** A little of the substance is treated with a dilute solution of potassium permanganate.	No decolourisation takes place readily No decolourisation takes place readily	Presence of saturated compound Presence of saturated compound
7.	**Sodium carbonate test** A little of the substance is added to 1 ml of a strong solution of sodium carbonate.	Vigorous effervescence takes place evolving carbon dioxide gas	Presence of acids
8.	**Sodium hydroxide test:** To a little of the substance about 2 ml of 10% sodium hydroxide solution is added and boiled gently.	Dissolves readily in the cold condition and the substance is regenerated on adding dilute hydrochloric acid	Presence of acids
9.	**Soda-Lime test** A little of the substance is heated with powdered soda lime and heated strongly.	No ammonia gas is evolved	Absence of amides
10.	**Conc. sulphuric acid test** A little of the substance is treated with 2 ml of conc. sulphuric acid and warmed.	No characteristic change	Absence of carbohydrates

11.	**Neutral $FeCl_3$ test** To a little of the substance dissolved in water or alcohol, about 2 ml of neutral ferric chloride is added.	No violet or blue or green colour is obtained	Absence of phenol
	II. Test for functional groups		
1.	**Test for acids** **a) Ester test** A little of the substance is mixed with a few drops of alcohol and 2 drops of conc. sulphuric acid. The mixture is gently warmed and poured into a beaker containing dilute sodium carbonate solution.	A pleasant fruity odour is noted	Presence of carboxylic acid
	b) Phenolphthalein test To about 2 ml of sodium hydroxide solution, 1 drop of dilute phenolphthalein indicator is added pink colour appears. To this, the substance dissolved in water or alcohol is added drop by drop in excess.	Pink colour disappears	Presence of carboxylic acid
	c) Fluorescein test A small amount of the substance is mixed with few drops of resorcinol in a dry test tube. 3 drops of conc. sulphuric acid is added. Shake well, boil gently and then pour into 100 ml of cold water taken in a beaker. Stir well and then sodium hydroxide solution is added in drops.	No intense greenish yellow fluorescence is produced	Presence of monocarboxylic acid
2.	**Test for phenols** **Liebermann's reaction** A little of the substance is mixed with a few crystals of sodium nitrate and 3 or 4 drops of conc. sulphuric acid. This is gently warmed and poured into water. To this sodium hydroxide is added and stirred well.	No red solution is obtained	Absence of phenol

3.	**Test for carbohydrates** **Molisch's test** To a little of the substance in water a few drops of an alcoholic solution of 1-naphthol are added. To this mixture, conc. sulphuric acid is added along the sides of the test tube without shaking.	No violet ring is obtained	Absence of carbohydrate
4.	**Test for Aldehyde and Ketone** **a) Schiff's reagent test** To a little of the substance Schiff's reagent is added and shaken well. **b) Legal's test** To a little of the substance a few drops of freshly prepared sodium nitroprusside and a few drops of 10% sodium hydroxide is added.	No violet colour is formed No wine red or blue colour is formed	Absence of aromatic aldehyde Absence of ketone
5.	**Test for amides** **Sodium hydroxide test** A little of the substance is heated with 5 ml of 10% sodium hydroxide solution till no more ammonia is evolved. It is then cooled and acidified with conc. hydrochloric acid.	No characteristic change	Absence of amides
6.	**Test for amines** **Action on nitrous acid** A little of the substance is dissolved in about 3 ml of dilute hydrochloric acid. To this a strong solution of sodium nitrate is added drop wise cooling the mixture in ice cold water.	No characteristic change	Absence of aromatic primary amine (aniline)

Report:

1. Element present - Absence of special elements like nitrogen, sulphur and other halogens.
2. Aromatic / Aliphatic - Aromatic
3. Saturated / Unsaturated - Saturated
4. Functional group present - Monocarboxylic acid

The given organic compound is aromatic saturated monocarboxylic acid.