Class: 10th

Subject: Chemistry

Chapter 11: Organic Chemistry

Important MCQs:

1. Originally, the term "organic chemistry" referred to the study of compounds obtained from:

(a) Minerals

(b) Water

(c) Living organisms ✅

(d) Gases

2. According to the Vital Force Theory, organic compounds could only be produced:

(a) From synthetic chemicals

(b) In the presence of sunlight

(c) By living organisms only ✅

(d) Inside laboratories

3. Who disapproved the Vital Force Theory by synthesizing urea in 1828?

(a) Lavoisier

(b) Jacob Berzelius

(c) Wohler ✅

(d) Kolbe

4. Which compound was used by Wohler to prepare urea in the lab?

(a) Acetic acid

(b) Ammonium cyanate ✅

(c) Sodium bicarbonate

(d) Glucose

5. Who synthesized acetic acid in the lab in 1845, further rejecting the Vital Force Theory?

(a) Lavoisier

(b) Berzelius

(c) Wohler

(d) Kolbe ✅

6. Which two elements are essential constituents of all organic compounds?

(a) Carbon and Oxygen

(b) Carbon and Nitrogen

(c) Carbon and Hydrogen ✅

(d) Hydrogen and Oxygen

7. Why are carbonates, bicarbonates, and carbides not considered organic compounds?

(a) They do not contain carbon

(b) They are too reactive

(c) Their properties are different from those of organic compounds ✅

(d) They are not found in nature

8. Which branch of chemistry deals with the study of hydrocarbons and their derivatives?

(a) Physical chemistry

(b) Analytical chemistry

(c) Organic chemistry ✅

(d) Inorganic chemistry

9. Which of the following represents the actual number of atoms in a molecule of a compound?

(a) Structural formula

(b) Molecular formula ✅

(c) Condensed formula

(d) Dot and cross formula

10. What does the molecular formula of butane (C_4H_{10}) indicate?

(a) 4 hydrogen atoms and 10 carbon atoms

(b) Only carbon atoms

(c) 4 carbon and 10 hydrogen atoms in one molecule ✅

(d) Total of 4 atoms

11. Which formula shows the exact arrangement of atoms in a molecule using single, double, or triple bonds?

(a) Molecular formula

(b) Dot and cross formula

(c) Condensed formula

(d) Structural formula ✅

12. Which formula displays the sharing of electrons between atoms in a molecule?

(a) Structural formula

(b) Dot and cross formula ✅

(c) Condensed formula

(d) Molecular formula

13. Open chain compounds are also called:

(a) Aromatic compounds

(b) Aliphatic compounds ✅

(c) Alicyclic compounds

(d) Cyclic compounds

14. Which of the following is a straight-chain compound?

(a) Isobutane

(b) Naphthalene

(c) n-Butane ✅

(d) Benzene

15. Branched chain compounds are those in which:

(a) Carbon atoms form a ring

(b) Carbon atoms link only in straight lines

(c) A branch exists along the carbon chain ✅

(d) Hydrogen atoms form branches

16. Which of the following is a homocyclic compound containing only carbon atoms?

(a) Cyclohexane ✅

(b) Glucose

(c) Ethanol

(d) Pyridine

17. Aromatic compounds are identified by the presence of:

(a) Triple bonds

(b) Straight chains

(c) Benzene ring ✅

(d) Hydroxyl groups

18. Cyclic compounds that contain atoms other than carbon in their rings are called:

(a) Aromatic compounds

(b) Alicyclic compounds

(c) Heterocyclic compounds ✅

(d) Homocyclic compounds

19. What is the main reason behind the large number of organic compounds?

(a) High melting point

(b) Catenation ✅

(c) High density

(d) Water solubility

20. The ability of carbon to form long chains or rings by bonding with other carbon atoms is called:

(a) Polymerization

(b) Cyclization

(c) Catenation ✅

(d) Hybridization

21. Compounds with the same molecular formula but different structural arrangements are called:

(a) Allotropes

(b) Isomers ✅

(c) Polymers

(d) Alkanes

22. Which factor increases the number of organic compounds by allowing carbon to form single, double, or triple bonds?

(a) Electronegativity

(b) Multiple bonding ✅

(c) Isomerism

(d) Hydrogen bonding

23. Which type of bonding is commonly found in organic compounds?

(a) Ionic bonding

(b) Metallic bonding

(c) Covalent bonding ✅

(d) Coordinate bonding

24. Why are organic compounds generally poor conductors of electricity?

(a) They are highly volatile

(b) They contain covalent bonds ✅

(c) They dissolve in water

(d) They are composed of metals

25. What is a unique property of organic compounds that is rarely found in inorganic compounds?

(a) Solubility in water

(b) High melting point

(c) Isomerism ✅

(d) High conductivity

26. Which two main groups of organic compounds are synthesized by animals?

(a) Carbohydrates and vitamins

(b) Proteins and fats ✅

(c) Oils and cellulose

(d) Gums and rubber

27. Which process converts dead plants into coal over millions of years?

(a) Combustion

(b) Polymerization

(c) Carbonization ✅

(d) Oxidation

28. What is the major product of destructive distillation of coal used in road surfacing?

(a) Coke

(b) Coal tar

(c) Pitch ✅

(d) Ammonical liquor

29. Which gas is the main component of natural gas?

(a) Ethane

(b) Propane

(c) Methane ✅

(d) Butane

30. Which substance is used as fuel in automobiles in the form of CNG?

(a) Petroleum

(b) Coal gas

(c) Natural gas ✅

(d) Ammonia

31. Which component of coal distillation is used to prepare nitrogenous fertilizers?

(a) Coke

(b) Coal gas

(c) Ammonical liquor ✅

(d) Pitch

32. Which fraction from coal is a mixture of more than 200 organic compounds?

(a) Coke

(b) Ammonical liquor

(c) Coal gas

(d) Coal tar ✅

33. What is the main use of coke obtained from destructive distillation of coal?

(a) Source of vitamins

(b) Reducing agent in metal extraction ✅

(c) Preparation of perfumes

(d) Fertilizer production

34. What is the method used to separate different components of petroleum?

(a) Crystallization

(b) Chromatography

(c) Fractional distillation ✅

(d) Sublimation

35. Which organic compound is synthesized by plants through photosynthesis?

(a) Sucrose

(b) Glucose ✅

(c) Protein

(d) Cellulose

36. Which plants store oils in their seeds?

(a) Mango and banana

(b) Wheat and maize

(c) Sunflower and rapeseed ✅

(d) Apple and grapes

37. Which scientist first synthesized urea in laboratory in 1828?

(a) Jacob Berzelius

(b) Wohler ✅

(c) Lavoisier

(d) Kolbe

38. What are coal, petroleum, and natural gas collectively called?

(a) Natural elements

(b) Renewable fuels

(c) Fossil fuels ✅

(d) Organic rocks

39. Which natural fibres are made up of organic compounds?

(a) Cotton, silk, wool ✅

(b) Nylon, dacron, acrylic

(c) Plastic and rubber

(d) Leather and wood

40. Which of the following is a use of organic compounds?

(a) Road construction only

(b) Only as food

(c) In everything from food to fuel to medicines ✅

(d) Only in plastic production

41. Alkanes are also called:

(a) Unsaturated hydrocarbons

(b) Aromatic hydrocarbons

(c) Paraffins ✅

(d) Alkenes

42. What is the general formula of alkanes?

(a) C_nH_{2n}

(b) C_nH_{2n-2}

(c) C_nH_{2n+2} ✅

(d) C_nH_{2n+1}

43. Which of the following is the correct general formula for alkyl radicals?

(a) C_nH_{2n+2}

(b) C_nH_{2n-2}

(c) C_nH_{2n}

(d) C_nH_{2n+1} ✅

44. Alkyl radicals are formed by:

(a) Adding a hydrogen atom to alkene

(b) Removing an oxygen atom from alcohol

(c) Removing a hydrogen atom from alkane ✅

(d) Replacing a carbon atom in alkane

45. Which of the following is a property of homologous series?

(a) Same molecular mass

(b) Different chemical properties

(c) Irregular change in melting point

(d) Same general formula and gradual increase in physical properties ✅

46. Which of the following determines the characteristic properties of an organic compound?

(a) Alkyl group

(b) Hydrogen atom

(c) Functional group ✅

(d) Carbon chain

47. What is the functional group of alcohols?

(a) -COOH

(b) -C=O

(c) -OH ✅

(d) -CHO

48. The general formula of alcohols is:

(a) RCHO

(b) ROH ✅

(c) RCOOH

(d) RCOR'

49. Which of the following is an example of an ether?

(a) CH_3-CH_2-OH

(b) H_3C-O-CH_3 ✅

(c) CH_3COOH

(d) H-C=O

50. What is the functional group of aldehydes?

(a) -C-OH

(b) -C=O

(c) -CHO ✅

(d) -COOR

51. The general formula of ketones is:

(a) RCHO

(b) RCOR' ✅

(c) RCOOH

(d) ROR

52. Which compound contains a carboxyl group?

(a) CH_3OH

(b) CH_3CH_2CHO

(c) CH_3COOH ✅

(d) $CH_3CH_2NH_2$

53. Esters are represented by which functional group?

(a) RCOOH

(b) ROR

(c) RCOOR' ✅

(d) RCHO

54. Which functional group is found in amines?

(a) -OH

(b) $-NH_2$ ✅

(c) -CHO

(d) -COOH

55. Which of the following represents an alkyne?

(a) $H_2C=CH_2$

(b) $HC\equiv CH$ ✅

(c) CH_3-CH_3

(d) CH_3-O-CH_3

56. Which reagent is used in the bromine water test for unsaturation?

(a) Alkaline $KMnO_4$

(b) Bromine in carbon tetrachloride ✅

(c) Sodium hydroxide

(d) Fehling's solution

57. What is the result of Baeyer's test for unsaturated compounds?

(a) White precipitate

(b) Evolution of hydrogen

(c) Fruity smell

(d) Disappearance of pink color ✅

58. Which gas is evolved when sodium reacts with alcohol?

(a) Oxygen

(b) Hydrogen ✅

(c) Carbon dioxide

(d) Nitrogen

59. Which gas is evolved when carboxylic acid reacts with sodium bicarbonate?

(a) Hydrogen

(b) Oxygen

(c) Carbon dioxide ✅

(d) Nitrogen

Exercise Short Questions:

1. What is meant by the term catenation? Give an example of a compound that displays catenation.

Answer:

Catenation is the ability of an element (mainly

carbon) to form long chains or rings by bonding with itself.

- **Example**: Carbon forms long chains in ethane (C_2H_6), propane (C_3H_8), etc.

2. How is coal formed?

Answer:

Coal is formed by the decomposition of dead plants buried deep in the Earth's crust under high pressure and temperature over millions of years.

- This process is called carbonization.

3. What is the importance of natural gas?

Answer:

- **Natural gas is used as:**
  - Domestic fuel (e.g., CNG, LPG)
  - Industrial fuel
  - Source of hydrogen gas and fertilizers
- It is a clean and efficient source of energy.

4. Justify that organic compounds are used as food.

Answer:

Organic compounds like carbohydrates, proteins, fats, and vitamins are essential for human nutrition.

- These provide energy and help in body growth and repair.

5. How are alkyl radicals formed? Explain with examples.

Answer:

Alkyl radicals are formed by removing one hydrogen atom from an alkane.

- **Example:**

Methane (CH_4) ⇒ Methyl (CH_3•)

Ethane (C_2H_6) ⇒ Ethyl (C_2H_5•)

6. What is the difference between n-propyl and isopropyl radicals? Explain with structure.

- n-Propyl ($CH_3–CH_2–CH_2$•): Straight chain with the free valency at the end carbon.
- Isopropyl ($CH_3–CH$•$–CH_3$): Branched chain with free valency at the middle carbon.

📌 **Structures**:

n-Propyl ⇒ $CH_3–CH_2–CH_2•$

isopropyl ⇒ $CH_3–CH•–CH_3$

7. Explain different radicals of butane.

Answer:

- Butane (C_4H_{10}) has two isomeric radicals:

1. n-Butyl ($CH_3–CH_2–CH_2–CH_2•$)
2. sec-Butyl ($CH_3–CH_2–CH•–CH_3$)
3. isobutyl ($(CH_3)_2CH–CH_2•$)
4. tert-Butyl ($(CH_3)_3C•$)

8. Define functional group with an example.

Answer:

A functional group is an atom or group of atoms that determines the chemical properties of an organic compound.

- **Example**:

In alcohols, –OH is the functional group.

$CH_3–OH$ (methyl alcohol)

9. What is an ester group? Write down the formula of ethyl acetate.

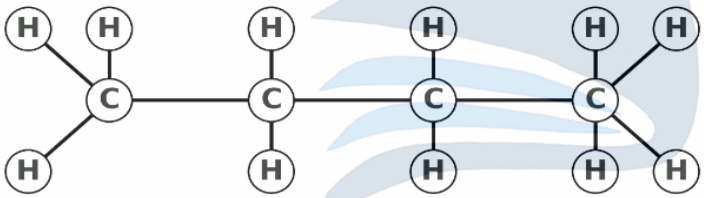
Answer:

Ester group is a functional group represented by –COOR, where R is an alkyl group.

- Ethyl acetate = $CH_3COOC_2H_5$

10. Write down the dot and cross formulae of propane and n-butane.

Dot and Cross Formula of n-Butane (C4H10)



- **Propane (C_3H_8):**

Consists of 3 carbon atoms with single bonds and 8 hydrogen atoms shared via dot and cross.

- **n-Butane (C_4H_{10}):**

Consists of 4 carbon atoms in a straight chain with 10 hydrogen atoms.

11. Define structural formula. Draw the structural

formulae of n-butane and isobutane.

Answer:

A structural formula shows the arrangement of atoms in a molecule.

- n-Butane: $CH_3–CH_2–CH_2–CH_3$
- Isobutane: $(CH_3)_2CH–CH_3$

12. Write classification of coal.

Answer:

- **Types of Coal:**

1. Peat (lowest carbon)
2. Lignite (brown coal)
3. Bituminous (soft coal)
4. Anthracite (hard coal; highest carbon content)

13. What are heterocyclic compounds? Give two examples.

Answer:

Organic compounds in which the ring contains at least one non-carbon atom (like N, O, S) are called

heterocyclic compounds.

- Examples:

Furan (O-containing)

Pyridine (N-containing)

14. Why are benzene and other homologous compounds of benzene called aromatic compounds?

Answer:

- **Benzene and its homologues are called aromatic compounds because:**

They contain alternating double bonds in a ring (called conjugation).

They produce a pleasant smell.

They follow Hückel's Rule (4n + 2 π electrons).

Exercise Long Questions:

🌟 **Q1. (a) How is coal formed? What are the different types of coal?**

(a) Formation of Coal:

Coal is formed through a natural process called carbonization, which takes millions of years.

Step-by-step Process:

- Millions of years ago, dense forests and plants grew in swampy areas.
- When these plants died, they sank into the ground and got buried under layers of soil and mud.
- Over time, with high pressure, temperature, and absence of air, these plant remains gradually turned into coal.
- This slow transformation of plant material into coal is known as carbonization.

(b) Types of Coal:

Coal is classified into four main types based on its carbon content, moisture, and heat-producing ability:

1. Peat:

- The first stage of coal formation

- Contains high moisture and low carbon
- Produces less heat

2. Lignite:

- Also called brown coal
- Has more carbon than peat
- Used as a domestic fuel

3. Bituminous:

- A soft black coal
- High carbon and low moisture
- Used in industries and households

4. Anthracite:

- The purest form of coal
- Contains the highest amount of carbon (about 95%)
- Produces the most heat and burns cleanly
- Used in metallurgy and heating

🌟 **Q2. (a) What is destructive distillation of coal?**

(a) Destructive Distillation of Coal:

Destructive distillation is a process in which coal is heated strongly in the absence of air, which prevents combustion. This thermal decomposition breaks down coal into several useful products.

- It is done in a closed vessel called a retort or distillation chamber.
- The aim is to extract valuable by-products from coal.

(b) Products Obtained from Destructive Distillation of Coal:

1. Coal Gas:

- A mixture of hydrogen, methane, and carbon monoxide
- Used as a fuel for lighting and heating

2. Ammoniacal Liquor:

- Contains ammonia dissolved in water
- Used to make fertilizers and ammonium salts

3. Coal Tar:

- A thick black liquid

- Contains many organic compounds
- Used in road surfacing, paints, and medicines

4. Coke:

- A hard, porous substance rich in carbon
- Used as a fuel and in the extraction of metals like iron from ore

🌟 **Q3. Write a detailed note on functional groups of alkenes and alkynes. How are they identified from other compounds?**

❖ **Introduction:**

In organic chemistry, functional groups are specific atoms or bonds in a molecule that determine its chemical properties and reactivity. Alkenes and alkynes are hydrocarbons that have distinct functional groups due to the presence of double or triple bonds.

🧪 **Functional Group of Alkenes:**

- Alkenes are unsaturated hydrocarbons.
- They contain at least one double bond (C=C)

between carbon atoms.

- The general formula of alkenes is C_nH_{2n}.

📌 **Example:**

Ethene: $H_2C=CH_2$

Propene: $CH_3–CH=CH_2$

🔍 **Identification:**

- Alkenes undergo addition reactions due to the double bond.
- When treated with bromine water, the reddish-brown color of bromine disappears — a test for unsaturation.

🧪 Functional Group of Alkynes:

- Alkynes are also unsaturated hydrocarbons.
- They contain at least one triple bond (≡) between carbon atoms.
- The general formula of alkynes is C_nH_{2n-2}.

📌 **Example:**

Ethyne (acetylene): HC≡CH

Propyne: $CH_3–C≡CH$

🔍 **Identification:**

- Alkynes also decolorize bromine water and react with ammoniacal silver nitrate to form a white precipitate.
- These reactions help to distinguish them from saturated compounds.

🌟 **Q4. Give some uses of organic compounds in our daily life.**

❖ **Introduction:**

Organic compounds are carbon-based substances that play a vital role in our everyday life. They are found in natural and synthetic forms and are essential in food, medicine, clothing, and more.

🧪 **Important Uses of Organic Compounds:**

1. Food and Energy:

Organic compounds such as carbohydrates, proteins, and fats provide energy and nutrition.

Glucose, an organic sugar, is a key energy source

for the body.

2. Medicines:

Most pharmaceutical drugs are organic compounds.

Examples: Paracetamol, Aspirin, Antibiotics, etc.

3. Clothing and Fabrics:

Cotton, wool, silk (natural fibers) and nylon, polyester (synthetic fibers) are made of organic compounds.

4. Fuels:

Organic compounds like methane, petrol, diesel, and alcohols are used as fuels for cooking, vehicles, and machines.

5. Plastics and Polymers:

- Made from organic compounds like ethylene and propylene.
- Used in packaging, containers, pipes, toys, etc.

6. Cosmetics and Perfumes:

Perfumes, soaps, shampoos, creams are made using organic chemicals such as esters and

alcohols.

7. Pesticides and Fertilizers:

Many insecticides, herbicides, and fertilizers are organic compounds that help in agriculture.

🌟 **Q5. Write down the characteristics of homologous series.**

❖ **Introduction:**

A homologous series is a group of organic compounds having the same functional group and similar chemical properties. Each successive member differs by a CH_2 unit in molecular structure. For example, methane (CH_4), ethane (C_2H_6), and propane (C_3H_8) belong to the homologous series of alkanes.

🌟 **Characteristics of Homologous Series:**

1. General Formula:

All members of a homologous series can be represented by a common general formula.

Examples:

- Alkanes ⇒ C_nH_{2n+2}
- Alkenes ⇒ C_nH_{2n}
- Alkynes ⇒ C_nH_{2n-2}

2. 🧪 Similar Chemical Properties:

- All compounds in a homologous series have the same functional group.
- Therefore, they show similar types of chemical reactions.

Example: All alcohols (–OH group) undergo similar oxidation reactions.

3. 🔁 Gradual Change in Physical Properties:

- Physical properties like boiling point, melting point, solubility, etc., change gradually with an increase in molecular mass.
- As the number of carbon atoms increases, the boiling point also increases.

4. Successive Members Differ by $–CH_2–$ Unit:

- Each member of the series differs from the next by one methylene group ($–CH_2–$).

- This also leads to a difference of 14 u (atomic mass units) in their molecular masses.

5. Prepared by Similar Methods:

Members of the same homologous series can often be prepared by the same synthetic methods or reactions in laboratories.

6. Same Functional Group:

All compounds in a homologous series contain the same functional group, which is responsible for their similar reactivity.

🌟 Q6. Why are organic compounds numerous?

❖ Introduction:

Organic compounds are carbon-based substances. Their number is very large, with over millions of known organic compounds today. They are far more numerous than inorganic compounds. This abundance is mainly due to the unique properties of carbon.

🔍 Reasons Why Organic Compounds Are So Numerous:

1. 🔗 Catenation (Self-Linking Property):

- Carbon has the unique ability to form long chains and rings by bonding with other carbon atoms.
- This property is called catenation.
- Chains can be straight, branched, or cyclic, leading to countless combinations.

2. ⚛ Tetravalency of Carbon:

- Carbon has 4 valence electrons, so it can form 4 covalent bonds with other atoms.
- This allows it to bond with hydrogen, oxygen, nitrogen, halogens, and even other carbon atoms in multiple ways.

3. 🧪 Formation of Isomers:

Organic compounds can form structural isomers, meaning the same molecular formula can produce many different structures with different properties.

Example: Butane has two isomers: n-butane and isobutane.

4. 🌟 Variety of Functional Groups:

- Organic compounds can contain a wide range of functional groups like –OH, –COOH, $–NH_2$, –CHO, etc.
- These groups give rise to variety in structure and function.

5. 🧬 Complex Structures Possible:

- Carbon can form single, double, and triple bonds, allowing for complex and stable molecules.
- Examples include proteins, DNA, plastics, and medicines, which are all organic in nature.

6. 🧪 Combination with Other Elements:

Carbon easily combines with H, O, N, Cl, S, and P, etc., to form compounds with diverse chemical properties.

🌟 **Q7. What are amines? Explain the different types of amines giving an example of each type.**

🔍 **Also**: How is the primary amino group identified?

❖ Definition of Amines:

- Amines are organic compounds that are derived from ammonia (NH_3) by replacing one or more hydrogen atoms with alkyl (R) or aryl (Ar) groups.
- They contain nitrogen atoms with a lone pair.
- They are basic in nature and are widely used in dyes, drugs, plastics, and fertilizers.

🧪 General Structure of Amines:

Amines are classified based on how many hydrogen atoms in ammonia (NH_3) are replaced:

Type General Formula Example

- **Primary** (1°) $R–NH_2$ Methylamine ($CH_3–NH_2$)
- **Secondary** (2°) $R_2–NH$ Dimethylamine ($CH_3–NH–CH_3$)
- **Tertiary** (3°) $R_3–N$ Trimethylamine $(CH_3)_3N$

🔢 Types of Amines with Explanation:

1. Primary Amine (1°):

One hydrogen atom of ammonia is replaced by one

alkyl or aryl group.

Formula: $R–NH_2$

Examples:

Methylamine ⇒ $CH_3–NH_2$

Aniline ⇒ $C_6H_5–NH_2$

2. Secondary Amine (2°):

Two hydrogen atoms are replaced by two alkyl/aryl groups.

Formula: $R_2–NH$

Examples:

- Dimethylamine ⇒ $CH_3–NH–CH_3$
- Diphenylamine ⇒ $C_6H_5–NH–C_6H_5$

3. Tertiary Amine (3°):

All three hydrogen atoms are replaced by three alkyl/aryl groups.

Formula: $R_3–N$

Examples:

Trimethylamine ⇒ $(CH_3)_3N$

Triphenylamine ⇒ $(C_6H_5)_3N$

🧪 Identification of Primary Amino Group ($-NH_2$):

✅ Carbylamine Test (Isocyanide Test):

This is a specific test to identify primary amines.

Reaction:

Primary amine + chloroform + alcoholic KOH ’n Isocyanide (foul smell)

Chemical Equation:

$R-NH_2 + CHCl_3 + 3KOH \Rightarrow R-NC + 3KCl + 3H_2O$

Observation: A foul (pungent) smell of isocyanide is produced.

This test confirms the presence of a primary amino group only.

🌟 Q8. Describe the functional group of an alcohol. How are alcoholic groups identified?

❖ Definition of Alcohol:

Alcohols are organic compounds that contain one or more hydroxyl groups (-OH) attached to a saturated carbon atom (sp^3 hybridized carbon).

The general formula of alcohols is:

$C_nH_{2n+1}OH$ (for monohydric alcohols)

🔬 **Functional Group of Alcohol:**

- The functional group of alcohol is the **hydroxyl** group (-OH).
- This group is responsible for the physical and chemical properties of alcohols.
- Alcohols are neutral compounds but may form hydrogen bonds due to the -OH group.

➤ **Structure of Functional Group:**

R–OH

(where R = alkyl group)

➤ **Example:**

- Ethanol (C_2H_5OH) is the simplest alcohol after methanol.
- In ethanol, the -OH group is bonded to an **ethyl** group (C_2H_5–).

🧪 **Types of Alcohols (Based on -OH Attachment):**

Type Structure Example

- **Primary** (1°) -OH on a carbon attached to 1 other carbon Ethanol (CH_3CH_2OH)
- **Secondary** (2°) -OH on a carbon attached to 2 other carbons Isopropanol ($CH_3CHOHCH_3$)
- **Tertiary** (3°) -OH on a carbon attached to 3 other carbons Tert-butyl alcohol ($(CH_3)_3COH$)

🔍 Identification of Alcoholic Group (-OH):

Alcoholic groups can be identified by chemical tests based on their reactivity.

1. Sodium Metal Test:

Principle: Alcohol reacts with active metals like sodium (Na) to produce hydrogen gas (H_2).

Chemical Reaction:

$$2R{-}OH + 2Na \rightarrow 2R{-}ONa + H_2\uparrow$$

Observation:

Effervescence (bubbling) due to hydrogen gas confirms the presence of –OH group.

2. Esterification Test:

Principle: Alcohol reacts with carboxylic acids in the presence of concentrated H_2SO_4 to form esters (sweet-smelling compounds).

Chemical Reaction:

$R–OH + R'–COOH \Rightarrow R'–COOR + H_2O$

Observation:

Formation of a fruity smell confirms the presence of alcohol.

3. Ceric Ammonium Nitrate Test:

Principle: Alcohols react with ceric ammonium nitrate to give a color change.

Observation:

A yellow solution turns red in the presence of an alcohol.

🌟 **Q9: Differentiate between Aldehydic and Ketonic Functional Groups. How are both identified?**

🔹 1. Aldehydic Functional Group (–CHO)

❖ **Definition:**

Compounds that contain the –CHO group are called

aldehydes.

- **Structure:**

The aldehydic group consists of a carbon atom double-bonded to an oxygen atom and single-bonded to a hydrogen atom.

- **General Formula:**

R–CHO

(where R is a hydrogen atom or an alkyl group)

- **Examples:**
  - **Formaldehyde**: HCHO
  - **Acetaldehyde**: CH_3CHO

- **2. Ketonic Functional Group (–CO–)**

❖ **Definition:**

Compounds that contain the –CO– group (called carbonyl group) between two alkyl groups are known as ketones.

- **Structure**:

The carbonyl carbon is double-bonded to an oxygen atom, and single-bonded to two carbon atoms (alkyl

groups).

🔸 **General Formula:**

R–CO–R'

(where R and R' are same or different alkyl groups)

🔸 **Examples**:

- **Acetone** (dimethyl ketone): CH_3COCH_3
- **Ethyl methyl ketone**: $CH_3COC_2H_5$

📝 **Summary:**

Aldehydes: –CHO group at the end ’n reacts with Tollen’s and Fehling’s tests.

Ketones: –CO– group in the middle ’n does not react with Tollen’s or Fehling’s tests.

🌟 **Q10: Encircle the functional groups in the following compounds. Also give the names of the functional groups.**

Answer:

1. Identify and encircle the functional groups present in given organic compounds.

2. Write the names of those functional groups.

🧪 What is a Functional Group?

A functional group is a specific group of atoms within a molecule that is responsible for the characteristic chemical reactions of that compound.

(i) $CH_3–CO–CH_3$

Functional group: –CO– (a carbonyl group between two alkyl groups)

Name: Ketone

(ii) $CH_3–CO–H$

Functional group: –CHO (a carbonyl group with hydrogen)

Name: Aldehyde

(iii) $HO–CH_2–CH_2–COOH$

Functional groups:

–OH (Hydroxyl group) ⇒ Alcohol

–COOH (Carboxylic group) ⇒ Carboxylic acid

✅ This compound contains two functional groups: Alcohol and Carboxylic Acid

(iv) $H–CO–CH_2–CH_3$

Functional group: –CHO (carbonyl group with hydrogen)

Name: Aldehyde

(v) $H_2C=CH-CH_3$

Functional group: C=C (carbon–carbon double bond)

Name: Alkene

(vi) $CH_3-O-CO-CH_3$

Functional group: –COO– (carbonyl + ether linkage)

Name: Ester

🌟 **Q11: What are the general properties of organic compounds?**

Answer:

Organic compounds are carbon-based compounds mainly found in living organisms. They have certain general physical and chemical properties.

🔹 **General Properties of Organic Compounds:**

1. Combustibility

Organic compounds usually burn in air and produce

carbon dioxide and water.

➡ $C + O_2 \Rightarrow CO_2$

2. Covalent Bonding

- Most organic compounds are made up of covalent bonds, not ionic.
- ➡ They share electrons between atoms.

3. Low Melting and Boiling Points

They usually have low melting and boiling points because:

➡ Weak forces of attraction between molecules (Van der Waals forces).

4. Solubility

- Insoluble in water (polar solvent)
- Soluble in organic solvents like ether, alcohol, and benzene.

5. Slow Reaction Rate

Organic compounds generally react slowly because of covalent bonds which are strong and require more energy to break.

6. Isomerism

Many organic compounds show isomerism (same molecular formula but different structures).

➡ **Example**: Butane and Isobutane

7. Non-Electrolytes

Most organic compounds do not conduct electricity because they do not form ions in solution.

8. Large Molecular Size

Organic compounds can form long chains or ring structures due to carbon's tetravalency.

🌟 **Q12: Write a detailed note on classification of organic compounds.**

Answer:

Organic compounds are classified based on their structure, functional groups, and carbon chain type.

🔹 Main Classification:

1. Open Chain Compounds (Acyclic Compounds)

These have straight or branched chains of carbon atoms.

📌 **Example:**

- Ethane ($CH_3–CH_3$)
- Butane ($CH_3–CH_2–CH_2–CH_3$)

2. Closed Chain Compounds (Cyclic Compounds)

Carbon atoms form a ring. They are further classified into:

(a) Alicyclic Compounds

Ring compounds that behave like alkanes.

📌 **Example**: Cyclohexane

(b) Aromatic Compounds

Contain a benzene ring (C_6H_6) or similar structure.

📌 **Example**: Benzene, Toluene

(c) Heterocyclic Compounds

Ring contains carbon + at least one non-carbon atom (like N, O, S).

📌 **Example**: Pyridine (contains nitrogen), Furan (contains oxygen)

🔹 Functional Group Classification:

Organic compounds are also classified by functional groups, which determine their chemical behavior.

🔹 Saturated vs Unsaturated Compounds:

Saturated: Single bonds only (Alkanes)

📌 **Example**: Methane (CH_4)

Unsaturated: At least one double/triple bond (Alkenes/Alkynes)

📌 **Example**: Ethene (C_2H_4), Ethyne (C_2H_2)

Note:

This chapter is designed to provide a solid foundation of knowledge, with the goal of deepening understanding and encouraging further exploration of the subject. The content has been carefully selected to support effective learning and inspire students to engage with the topic more deeply.

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Purpose: To contribute to education by offering insightful, valuable content that enhances learning and understanding.

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