scholareye.xyz

CLASS 10 • CHEMISTRY

CHAPTER 11

Organic Chemistry

Complete Exercise Solutions
Short & Extensive Questions with Explanations

14	12	26
Short Questions	Extensive Questions	Solved Answers

scholareye.xyz

Learn smart. Prepare better. Succeed.

A Short Questions

14 questions — complete solutions

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 (specifically carbon) to form long chains, branched chains, or ring structures by bonding with other atoms of the same element.

EXPLANATION

Carbon atoms have a unique property of forming strong covalent bonds with each other.

EXAMPLE

Propane (C_3H_8) or Butane (C_4H_{10}), where carbon atoms are linked in a chain.

2 How is coal formed?

✓ ANSWER

Coal is formed from the remains of dead plants and trees that were buried deep under the earth's surface millions of years ago.

EXPLANATION

Over time, high pressure and high temperature (a process called carbonization) transformed these plant remains into coal.

3 What is the importance of natural gas?

✓ ANSWER

Natural gas (mainly methane) is a highly important fossil fuel used for domestic and industrial heating, cooking, and generating electricity. It is also used as Compressed Natural Gas (CNG) for vehicles and as a raw material in the manufacturing of fertilizers (like urea) and plastics.

4 Justify that organic compounds are used as food.

✓ ANSWER

Organic compounds like carbohydrates (sugars and starches), proteins, fats, and vitamins are the fundamental building blocks of food. Our bodies rely on these organic molecules for energy and growth. For example, glucose ($C_6H_{12}O_6$) is a primary energy source, and amino acids (organic compounds) build proteins.

5 How are alkyl radicals formed? Explain with examples.

✓ ANSWER

Alkyl radicals are formed by the removal of one hydrogen atom from an alkane (a saturated hydrocarbon). They are highly reactive species with an unpaired electron.

EXAMPLE

Methane (CH_4) loses one hydrogen to form the methyl radical ($\bullet CH_3$). Ethane (C_2H_6) loses one hydrogen to form the ethyl radical ($\bullet C_2H_5$).

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

✓ ANSWER

The difference lies in the point of attachment of the radical to the main chain.

EXPLANATION

- **n-propyl:** The radical is formed by removing a hydrogen from the end carbon of propane. Structure: CH_3–CH_2–CH_2•
- **Isopropyl:** The radical is formed by removing a hydrogen from the middle carbon of propane. Structure: CH_3–$CH(•)$–CH_3

7 **Explain different radicals of butane.**

✓ ANSWER

Butane (C_4H_{10}) can form four different alkyl radicals depending on which hydrogen atom is removed:

1. **n-butyl:** Removed from terminal carbon CH_3–CH_2–CH_2–CH_2•
2. **sec-butyl:** Removed from an internal carbon CH_3–CH_2–$CH(•)$–CH_3
3. **isobutyl:** Removed from terminal carbon of isobutane CH_3–$CH(CH_3)$–CH_2•
4. **tert-butyl:** Removed from the central carbon of isobutane $(CH_3)_3C$•

8 Define functional group with an example.

✓ ANSWER

A functional group is an atom or group of atoms within a molecule that determines the characteristic chemical properties and reactivity of that molecule.

EXAMPLE

The hydroxyl group (–OH) is the functional group for alcohols. The carboxyl group (–COOH) is the functional group for carboxylic acids.

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

✓ ANSWER

An ester group is an organic compound derived from an acid where the –OH is replaced by an –OR group. The functional group is –COO–.

FORMULA OF ETHYL ACETATE

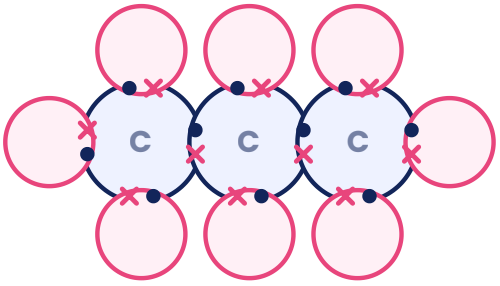
$CH_3COOC_2H_5$

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

✓ ANSWER

Propane (C_3H_8): Carbon (4 valence electrons) shares electrons with Hydrogen (1 valence electron). The central carbon shares with two carbons and two hydrogens. The terminal carbons share with one carbon and three hydrogens. (All atoms achieve noble gas configuration).

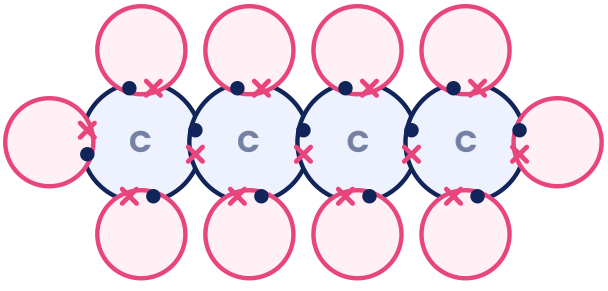
Propane, C_3H_8



• electron of carbon × electron of hydrogen

n-Butane (C_4H_{10}): The two central carbons share one electron pair with each other, and each shares with a terminal carbon and two hydrogens. Terminal carbons share with one carbon and three hydrogens.

n-Butane, C_4H_{10}



• electron of carbon × electron of hydrogen

11 **Define structural formula. Draw the structural formulae of n-butane and isobutane.**

✓ ANSWER

A structural formula shows the exact arrangement of atoms and the bonds connecting them in a molecule.

STRUCTURAL FORMULAE

n-butane (straight chain)

CH_3-CH_2-CH_2-CH_3

isobutane (branched chain)

CH_3-$CH(CH_3)$-CH_3

12 **Write classification of coal.**

✓ ANSWER

Coal is classified into four main types based on carbon content and age:

1. **Peat** (lowest carbon, highest moisture)
2. **Lignite** (brown coal)
3. **Bituminous** (soft coal, high carbon)
4. **Anthracite** (hard coal, highest carbon content)

13 **What are heterocyclic compounds? Give two examples.**

✓ ANSWER

Heterocyclic compounds are cyclic (ring) compounds that contain at least one atom other than carbon (such as Nitrogen, Oxygen, or Sulfur) in the ring structure.

EXAMPLES

Pyridine (contains Nitrogen) and **Furan** (contains Oxygen).

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

✓ ANSWER

They are called aromatic compounds because they possess a planar ring structure with alternating double and single bonds (delocalized pi electrons), which makes them highly stable. Historically, the term “aromatic” was used because many of these compounds have distinct, pleasant smells. They follow Hückel’s rule (4n+2 pi electrons).

B Extensive Questions

12 questions — detailed answers

1 **(a) How is coal formed? What are the different types of coal? (b) Write down the composition and uses of different types of coal.**

✓ ANSWER

(a) Formation: Coal is formed through the carbonization of buried plant matter over millions of years under high pressure and temperature.

Types: Peat, Lignite, Bituminous, and Anthracite.

(b) Composition & Uses:

Type	Composition	Use
Peat	High moisture, low carbon (~60%)	Fuel where wood is scarce
Lignite	Brown, soft, ~70% carbon	Electricity generation, fuel
Bituminous	Soft, black, ~80–90% carbon	Main fuel for electricity; used to make coke for steel
Anthracite	Hard, glossy, highest carbon (>90%)	Smokeless fuel, domestic heating

2 **(a) What is destructive distillation of coal? (b) Name the different types of the products obtained by the destructive distillation of coal.**

✓ ANSWER

(a) Destructive distillation: It is the process of heating coal to a high temperature (about 1000°C) in the absence of air to break down its complex organic molecules.

(b) Products:

1. Coal gas
2. Coal tar
3. Ammoniacal liquor (Ammonia solution)
4. Coke (solid residue)

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

✓ ANSWER

Alkenes contain a carbon-carbon double bond (C=C). **Alkynes** contain a carbon-carbon triple bond (C≡C).

Identification — both are unsaturated compounds:

- **Bromine water test:** Both decolorize bromine water (from orange to colorless) via addition reactions.
- **Baeyer's Reagent (Alkaline $KMnO_4$):** Both decolorize it.
- **To differentiate them from each other:** Alkynes (terminal) react with ammoniacal silver nitrate or cuprous chloride to form a precipitate, while alkenes do not.

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

✓ ANSWER

Organic compounds are foundational to daily life:

- **Food:** Carbohydrates, proteins, fats, vitamins.
- **Fuels:** Natural gas, LPG, petrol, diesel.
- **Medicines:** Aspirin, paracetamol, antibiotics.
- **Clothing:** Cotton, wool, silk, and synthetic fibers like nylon and polyester.
- **Polymers/Plastics:** Bags, bottles, furniture.
- **Cleaning:** Soaps and detergents.

5 **Write down the characteristics of homologous series.**

✓ ANSWER

1. All members share the same general formula (e.g., Alkanes: C_nH_{2n+2}).
2. All members possess the same functional group.
3. Successive members differ by a $–CH_2–$ unit and 14 atomic mass units.
4. They show a gradual change in physical properties (melting/boiling points increase down the series).
5. They exhibit similar chemical properties.

6 Why are organic compounds numerous?

✓ ANSWER

Organic compounds are numerous (millions are known) primarily due to:

1. **Catenation:** Carbon's ability to form long chains and rings.
2. **Tetravalency:** Carbon forms four strong covalent bonds, allowing complex branching.
3. **Isomerism:** Compounds with the same molecular formula can have different structural arrangements.
4. **Bonding versatility:** Carbon bonds readily with H, O, N, S, P, and halogens.

7 **What are amines? Explain the different types of amines giving an example of each type. How primary amino group is identified?**

✓ ANSWER

Amines are organic derivatives of ammonia (NH_3) where one or more hydrogen atoms are replaced by alkyl or aryl groups.

Type	Description	Example
Primary (1°)	One H replaced (R–NH_2)	Methylamine (CH_3NH_2)
Secondary (2°)	Two H replaced (R_2NH)	Dimethylamine ($(CH_3)_2NH$)
Tertiary (3°)	Three H replaced (R_3N)	Trimethylamine ($(CH_3)_3N$)

Identification of primary amines:

Primary amines are identified by the **Nitrous Acid test** (reacting with HNO_2), which produces nitrogen gas (bubbles) and an alcohol. Another test is the **Hinsberg test**.

8 **Describe the functional group of an alcohol. How are alcoholic groups identified?**

✓ ANSWER

The functional group of an alcohol is the hydroxyl group (**–OH**) attached to an sp^3 hybridized carbon.

Identification:

1. **Sodium metal test:** Alcohols react with active sodium metal to produce hydrogen gas (bubbles).
2. **Esterification:** Reacting alcohol with a carboxylic acid in the presence of an acid catalyst produces a sweet-smelling ester.
3. **Oxidation:** Primary alcohols oxidize to aldehydes, secondary to ketones.

9 **Differentiate between aldehydic and ketonic functional groups. How are both identified from each other?**

✓ ANSWER

Aldehyde (–CHO)	Ketone (–CO–)
The carbonyl carbon is bonded to at least one hydrogen.	The carbonyl carbon is bonded to two carbon atoms.
Located at the end of the carbon chain.	Located within the carbon chain.

Identification:

They are differentiated using **Tollens' test** or **Fehling's test**.

- Aldehydes are easily oxidized, so they give a positive test (Tollens' forms a silver mirror; Fehling's forms a red precipitate of Cu_2O).
- Ketones are resistant to oxidation under these mild conditions and give a negative test.

10 **Encircle the functional groups in the following compounds. Also give the names of the functional groups?**

NOTE

Since a circle cannot be drawn physically here, the functional group in each formula is **highlighted** and named.

✓ ANSWER

#	Compound	Functional group
(i)	CH_3 – **C(=O)** – CH_3	**Ketone** (Carbonyl group)
(ii)	CH_3 – **C(=O) – H**	**Aldehyde** (Formyl group)
(iii)	**HO – C(=O)** – CH_2 – CH_3	**Carboxylic Acid** (Carboxyl group)
(iv)	**H – C(=O)** – CH_2 – CH_3	**Aldehyde** (Formyl group)
(v)	H_2**C = C**H – CH_3	**Alkene** (Double bond)
(vi)	CH_3 – **O – C(=O)** – CH_3	**Ester** (Ester linkage)

11 What are the general properties of organic compounds?

✓ ANSWER

1. They are generally covalent compounds.
2. They have low melting and boiling points compared to ionic compounds.
3. They are usually non-electrolytes (do not conduct electricity).
4. They are generally insoluble in water but soluble in organic solvents (like ether, benzene).
5. They are flammable.
6. They show isomerism (same formula, different structures).
7. Their reactions are usually slow and require catalysts.

12 Write a detailed note on classification of organic compounds.

✓ ANSWER

Organic compounds are broadly classified based on their carbon skeleton:

1. **Open Chain (Acyclic/Aliphatic):** Carbon atoms form open chains (straight or branched). Example: Alkanes, Alkenes, Alkynes.
2. **Closed Chain (Cyclic):** Carbon atoms form rings. It is further divided into:
   - **Homocyclic:** The ring consists entirely of carbon atoms.
     - *Alicyclic:* Aliphatic ring (e.g., Cyclohexane).
     - *Aromatic:* Benzene and its derivatives (contains delocalized electrons).
   - **Heterocyclic:** The ring contains at least one atom other than carbon (e.g., O, N, S). Example: Pyridine, Furan.

Thank You!

You have completed the Chapter 11 Organic Chemistry exercise. Keep revising, keep practising — success follows consistency.

scholareye.xyz

- ✦ More solved exercises & MCQs
- ✦ Exam-focused preparation material
- ✦ Free tools for every aspirant