

Organic Chemistry is the study of carbon-containing compounds and their properties.

Organic molecules are based on carbon atoms, which can form four bonds. This allows them to create a huge variety of structures, including chains, rings, and complex 3D shapes.

Key Concepts in Organic Chemistry:

- Hydrocarbons:** Hydrocarbons are compounds made up only of **hydrogen** and **carbon** atoms. There are two main types:
 - Alkanes:** Saturated hydrocarbons (single bonds only). General formula: C_nH_{2n+2} . Example: Methane (CH_4).
 - Alkenes:** Unsaturated hydrocarbons (contain at least one double bond). General formula: C_nH_{2n} . Example: Ethene (C_2H_4).
- Crude Oil and Fractional Distillation:** Crude oil is a mixture of hydrocarbons. It can be separated by **fractional distillation**, which works because different hydrocarbons have different boiling points. The process separates crude oil into fractions like petrol, diesel, and kerosene.
- Combustion:**
 - Complete combustion** occurs when a hydrocarbon burns in plenty of oxygen, producing carbon dioxide and water.
Example: $CH_4 + 2O_2 \rightarrow CO_2 + 2H_2O$
 - Incomplete combustion** occurs when there isn't enough oxygen, producing carbon monoxide (a toxic gas) or carbon (soot).
- Functional Groups:** Organic compounds are classified based on their **functional groups**, which determine their chemical properties. Key functional groups include:
 - Alcohols:** $-OH$ (hydroxyl group). Example: Ethanol (C_2H_5OH).
 - Carboxylic acids:** $-COOH$. Example: Ethanoic acid (CH_3COOH).
- Polymers:** Polymers are large molecules made by joining many small molecules (monomers) together. **Addition polymers** are formed from **alkenes** through a process called **polymerisation**.

Worksheet: Organic Chemistry

Section 1: Multiple Choice Questions (MCQs)

1. What is the general formula for alkanes?
 - a) C_nH_{2n}
 - b) C_nH_{2n+2}
 - c) C_nH_{3n}
 - d) C_nH_{4n+1}
2. Which of the following is **NOT** a product of complete combustion of a hydrocarbon?
 - a) Carbon dioxide
 - b) Carbon monoxide
 - c) Water
 - d) Heat
3. What is the name of the process used to separate crude oil into different fractions?
 - a) Crystallisation
 - b) Chromatography
 - c) Fractional distillation
 - d) Filtration
4. Which of these is an example of an alkene?
 - a) Methane
 - b) Ethane
 - c) Ethene
 - d) Propane

Section 2: Short Answer Questions

1. **What is the difference between an alkane and an alkene?**
(Write 2 points)
2. **Write the balanced equation for the complete combustion of ethane (C_2H_6).**
3. **Describe the process of fractional distillation.**
(Give 3 key steps involved)
4. **Name the monomer that makes up polyethene and describe what happens during polymerisation.**

Section 3: Structured Questions

- Alcohols and Carboxylic Acids:**
 - Draw the structure of ethanol and label the functional group.
 - What happens when ethanol reacts with oxygen in the air?
 - Write the word equation for the reaction between ethanol and oxygen.
- Crude Oil and Environmental Impact:**
 - Why is the combustion of fossil fuels a concern for the environment?
 - Suggest one alternative energy source to reduce reliance on fossil fuels.

Answers

Section 1: Multiple Choice Questions (MCQs)

- What is the general formula for alkanes?
 - b) C_nH_{2n+2}
- Which of the following is NOT a product of complete combustion of a hydrocarbon?
 - b) Carbon monoxide
- What is the name of the process used to separate crude oil into different fractions?
 - c) Fractional distillation
- Which of these is an example of an alkene?
 - c) Ethene

Section 2: Short Answer Questions

- What is the difference between an alkane and an alkene?
 - Alkanes are saturated hydrocarbons (contain only single bonds between carbon atoms).
 - Alkenes are unsaturated hydrocarbons (contain at least one double bond between carbon atoms).
- Write the balanced equation for the complete combustion of ethane (C_2H_6).
 $2C_2H_6 + 7O_2 \rightarrow 4CO_2 + 6H_2O$
- Describe the process of fractional distillation.
 - Crude oil is heated until it evaporates.
 - The vapours rise through a fractionating column, which is cooler at the top.
 - Different fractions condense at different levels based on their boiling points, separating them.
- Name the monomer that makes up polyethene and describe what happens during polymerization.
 - Monomer: Ethene (C_2H_4).

- During polymerization, ethene molecules (monomers) join together in long chains by breaking the double bond in each ethene molecule, forming a polymer.
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Section 3: Structured Questions

1. Alcohols and Carboxylic Acids: a) Draw the structure of ethanol and label the functional group:
CH₃CH₂OH

Functional group: -OH (hydroxyl group).

- b) What happens when ethanol reacts with oxygen in the air?

- Ethanol undergoes combustion to produce carbon dioxide and water

2. c) Write the word equation for the reaction between ethanol and oxygen.
Ethanol+Oxygen→Carbon Dioxide+Water

3. Crude Oil and Environmental Impact:

- a) Why is the combustion of fossil fuels a concern for the environment?

- It releases carbon dioxide, a greenhouse gas, contributing to global warming and climate change. Additionally, incomplete combustion can release toxic gases like carbon monoxide.

- b) Suggest one alternative energy source to reduce reliance on fossil fuels.

- Solar power, wind energy, hydroelectric energy, or nuclear power.