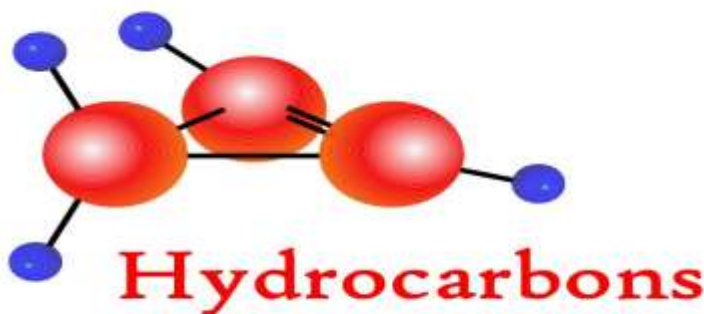


Questions & Answers

12 Advanced **CHEMISTRY**

Chapter – 7

Hydrocarbons



Ramah Primary and Secondary School

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Term - 3

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Chapter-7

Hydrocarbons



1. Explain why carbon forms many compounds?

- a carbon atom has four electrons in its outer energy level.
- a carbon atom can form **four covalent bonds** with atoms of carbon or with other elements.
- Carbon can form **single, double, or triple** covalent bonds.
- Also, because carbon forms four bonds, it forms complex, branched-chain structures, ring structures, and even cage like structures.
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2. Use different types of models (ball-and-stick model, space-filling model) and formulas (molecular formula, structural formula) to represent a hydrocarbon

Representations: Models and hydrocarbons

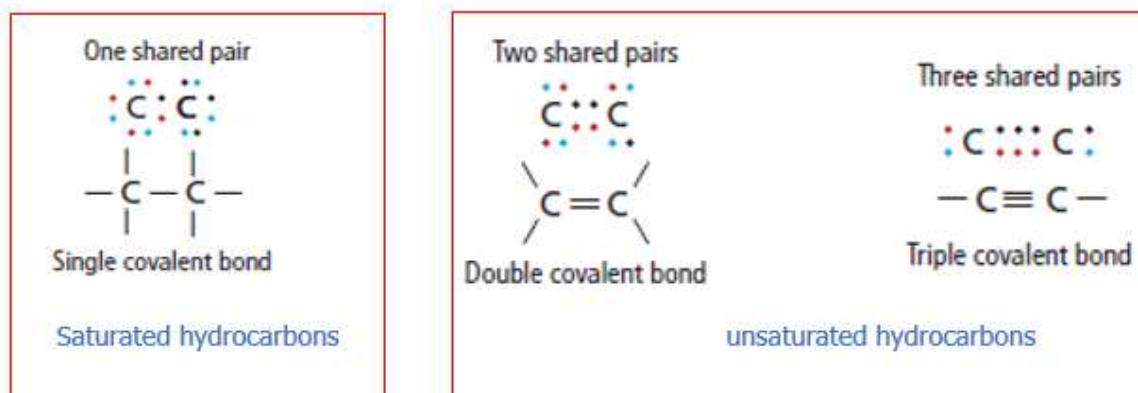
- Organic compound are commonly represented in three ways:
 1. Chemical formula
 2. Structural formula
 3. Space-filling model

Name	Chemical formula	Structural formula	Space-filling model	Common uses
methane	CH ₄	$\begin{array}{c} \text{H} \\ \\ \text{H}-\text{C}-\text{H} \\ \\ \text{H} \end{array}$		<ul style="list-style-type: none">• Natural gas heaters
propane	C ₃ H ₈	$\begin{array}{ccccc} \text{H} & \text{H} & \text{H} & & \\ & & & & \\ \text{H}-\text{C} & -\text{C} & -\text{C}-\text{H} \\ & & & & \\ \text{H} & \text{H} & \text{H} & & \end{array}$		<ul style="list-style-type: none">• Camp fuel (fuel tank)

3. Explain, using Lewis's diagram and ball-stick model, the difference between saturated and unsaturated hydrocarbons

Lewis structures and structural formulas

- Carbon can bond to other carbon atoms in double and triple bonds. These **Lewis structures** and **structural formulas** show two ways to denote double and triple bonds



4. Define hydrocarbons

Hydrocarbon, any of a class of organic chemical compounds composed only of the elements carbon (C) and hydrogen (H).

5. Define homologous series and its properties

A series of compounds that differ from one another by a repeating unit is called a **homologous series**.

A homologous series has a fixed numerical relationship among the numbers of atoms.
(General formula)

6. Define the following

organic compound

carbon-containing compound, with the exceptions of carbon oxides, carbides, and carbonates

hydrocarbon

compounds containing only the elements carbon and hydrogen the simplest organic compounds.

saturated hydrocarbon

a hydrocarbon having only single bonds

unsaturated hydrocarbon

a hydrocarbon that has at least one double or triple bond between carbon atoms

fractional distillation

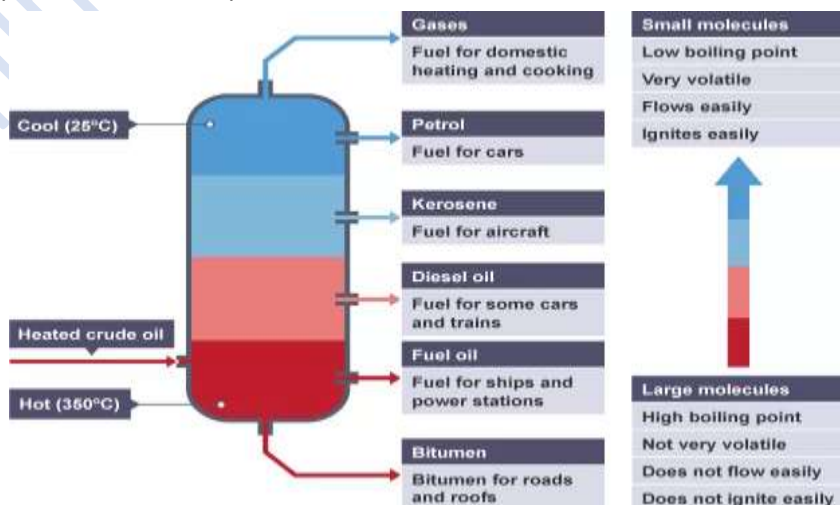
separation of petroleum into simpler components

cracking

process by which heavier fractions of petroleum are broken into smaller molecules.

7. Explain the process of fractional distillation

1. Temperature is controlled to remain near 400° at the bottom of the fractionating tower.
2. Petroleum boils and gradually moves toward the top.
3. Vapors travel up through the column.
4. Hydrocarbons with more carbon atoms condense closer to the bottom or the tower and are drawn off.
5. Hydrocarbons with fewer carbon atoms remain in the vapor phase until they reach regions of cooler temperatures farther up the column.

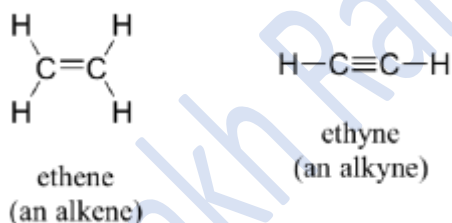


8. Compare and contrast the models in the table below.

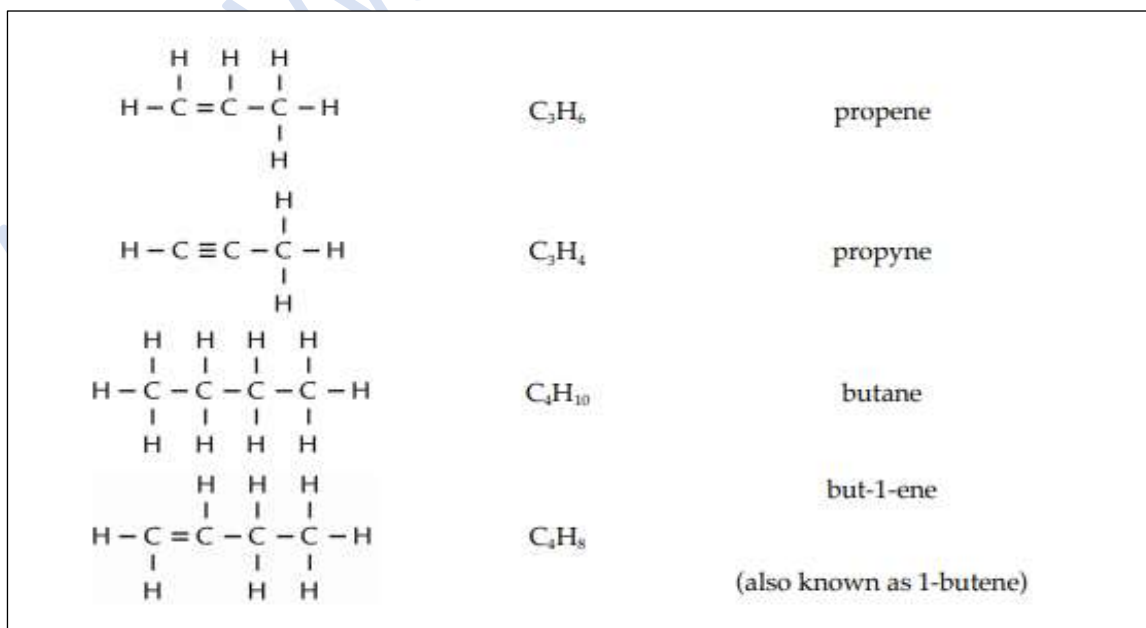
Type of Model	Description of Model
1. Molecular formula	gives no information about the geometry of the molecule
2. Structural formula	shows the general arrangement of atoms but not the exact geometry
3. Space-filling model	gives a more realistic picture of what a molecule would look like if you could see it
4. Ball-and-stick model	demonstrates the geometry of the molecule more clearly

9. Differentiate between Alkenes and Alkynes

Alkenes are hydrocarbons that contain one or more double bonds, while **alkynes** contain one or more triple bonds.



10. Name the following hydrocarbons



11. Answer the following

Isomers

- Which pair(s) of isomers represent structural isomers? **B C E**
- Which pair(s) of isomers represent stereoisomers? **A and D**
- Which pair(s) of isomers represent geometric isomers? **A**
- Which pair(s) of isomers represent optical isomers? **D**
- Which pair(s) of isomers would you expect to have different melting points, boiling points, and densities?

A B C and E

- Which pair(s) of isomers would you expect to have different chemical properties? (Include properties related to chemical reactions where chirality is important.)

A B C D and E

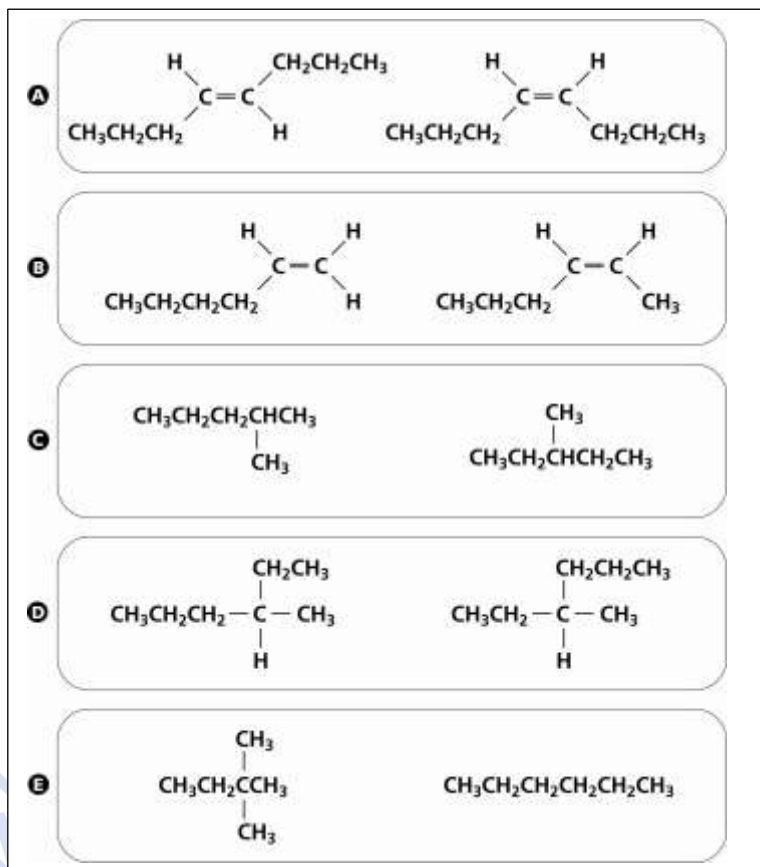
- Which pair(s) of isomers would rotate the plane of polarized light in opposite directions? **D**

- Name the isomers in pair E.

2,2-dimethylbutane (on the left) and hexane (on the right)

- Which isomer in pair A is in the *cis*- form, the one on the left or the one on the right? **the isomer on the right**

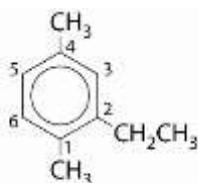
- Which pair(s) of isomers have an asymmetric carbon? **D**



12. Classify the properties of aromatic and aliphatic compounds.

	Structural Characteristics	Reactivity
Aromatic Compounds	contain single benzene rings, sometimes two or more benzene rings fused together	less reactive
Aliphatic Compounds	contain single, double, and triple bonds	more reactive

13.Number the substituted benzene ring in the structure below, then name the structure.



2-Ethyl-1,4-dimethylbenzene

MCQ- Questions and Answers

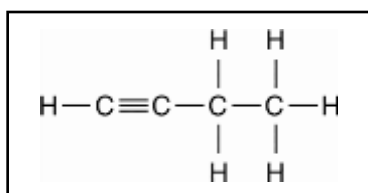
- Chemists have identified a substance in a laboratory as decane. How many hydrogen atoms can be found bonded to the carbon atoms in the sample of decane?

A 10
B 20
☒ C 22
D 24
- What is the suffix for the name of a carbon-chain molecule containing a double bond?

A -ane
☒ B -ene
C -yne
D -amide
- Before Friedrich Wohler, chemists thought that organic compounds created by living organisms could not be synthesized in the laboratory. They thought that organisms possessed a mysterious force that enabled them to create carbon compounds. This idea that chemists accepted was called _____.

A organism force theory
☒ B vitalism
C hydrocarbonism
D vivalism

Use the structural formula below to answer question 4.



4 The model shows the structural formula of 1-butyne. Which of these is the proper condensed structural formula for 1-butyne?

- ☒ A $\text{CH} \equiv \text{CCH}_2\text{CH}_3$
- B $\text{CH}_2 = \text{CHCH}_2\text{CH}_3$
- C $\text{CH}_3\text{C} \equiv \text{CCH}_3$
- D $\text{CH}_3\text{C} \equiv \text{CH}$

5 The process of fractional distillation involves boiling crude oil in order to _____.

- A increase its stored energy
- ☒ B separate it into its usable components
- C create petroleum oil
- D change its viscosity

6 Many aromatic compounds, such as benzopyrene, are carcinogenic, meaning that _____.

- A they may cause tuberculosis
- B they are not very water soluble
- ☒ C they may cause cancer
- D their molecular structure is similar to that of human genes

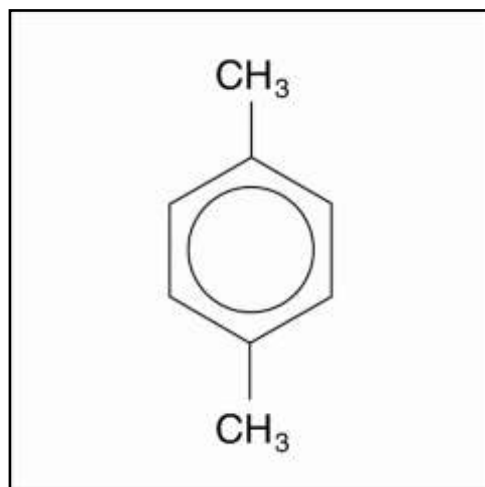
7 An ether has a functional group of _____.

- A $-\text{CHO}$
- B $-\text{CO}-$
- ☒ C $-\text{O}-$
- D $-\text{OH}$

8 When lubricating oil is poured into water, the two liquids separate almost instantly. This happens because the lubricating oil molecules have greater _____.

- A attraction toward the water molecules
- B mass weight than the water molecules
- ☒ C attraction toward other lubricating oil molecules
- D charge than the water molecules

Use the compound below to answer question 9.



- 9 This compound may be classified as aromatic because _____.
- A it has two methyl groups
 - B it contains a propene ring
 - C it has 10 carbon atoms
 - ☒ D it has a benzene ring

Circle the letter of the choice that best completes the statement.

1. Hydrocarbons contain only
 - a. carbon.
 - b. carbon and hydrogen.
 - c. carbon, hydrogen, and oxygen.
 - d. hydrogen and oxygen.
2. In a branched alkane, each branch attached to the main chain is called a(n)
 - a. asymmetric carbon.
 - b. cycloalkane.
 - c. acetylene group.
 - d. substituent group.
3. Cyclohexane is an example of
 - a. a straight-chain alkane.
 - b. a parent chain.
 - c. a cyclic hydrocarbon.
 - d. an alkene.
4. In polarized light, the light waves vibrate in
 - a. one plane.
 - b. two planes.
 - c. three planes.
 - d. all possible planes.

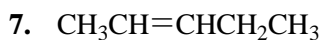
5. The boiling of petroleum to separate components is called

- a. cracking.
- b. knocking.
- c. **fractional distillation.**
- d. optical rotation.

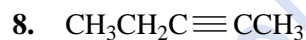
Circle the letter of the correct name for each of the following structures.



- a. propane
- b. **pentane**
- c. hexane



- a. **2-pentene**
- b. 3-pentene
- c. 4-pentene

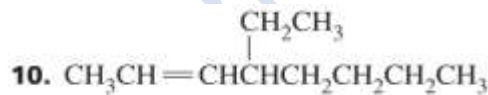


- a. 4-pentyne
- b. 3-pentane
- c. **2-pentyne**

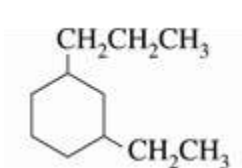
Use the IUPAC rules to name the following structures.



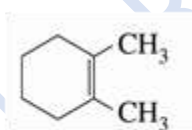
3-methylheptane



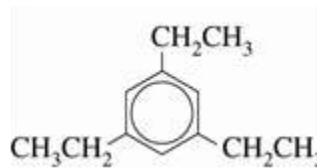
4-ethyl-2-octene



1-ethyl-3-propylcyclohexane



1,2-dimethylcyclohexene



1,3,5-triethylbenzene