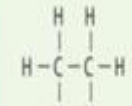
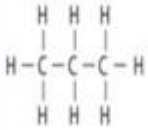
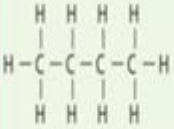
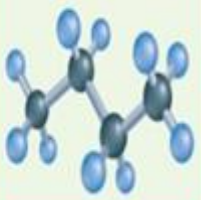
Hydrocarbons

Structure	Saturation	General Formula	Type of Bonding	Naming	Simplest Structure
alkanes	**saturated** – all carbon atoms hold the highest allowed amount of hydrogen atoms	C_nH_{2n+2}	Contains all single carbon to hydrogen bonds	ends with the suffix ~ane	 methane
alkenes	**unsaturated** – carbon atoms do not hold the highest allowed amount of hydrogen atoms	C_nH_{2n}	Contains at least one carbon to carbon double bond	ends with the suffix ~ene	 ethylene or ethene
alkynes	**unsaturated**	C_nH_{2n-2}	Contains at least one carbon to carbon triple bond	ends with the suffix ~yne (sometimes referred to as acetylenes)	ethyne or acetylene

First Ten of the Alkanes Series

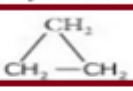
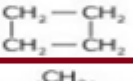
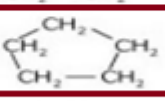
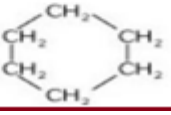
Name	Molecular Formula	Condensed Structural Formula
Methane	CH_4	CH_4
Ethane	C_2H_6	CH_3CH_3
Propane	C_3H_8	$CH_3CH_2CH_3$
Butane	C_4H_{10}	$CH_3CH_2CH_2CH_3$
Pentane	C_5H_{12}	$CH_3CH_2CH_2CH_2CH_3$
Hexane	C_6H_{14}	$CH_3CH_2CH_2CH_2CH_2CH_3$
Heptane	C_7H_{16}	$CH_3CH_2CH_2CH_2CH_2CH_2CH_3$
Octane	C_8H_{18}	$CH_3(CH_2)_6CH_3$
Nonane	C_9H_{20}	$CH_3(CH_2)_7CH_3$
Decane	$C_{10}H_{22}$	$CH_3(CH_2)_8CH_3$

Simple Alkanes

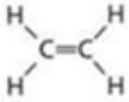
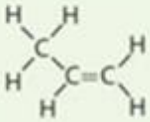
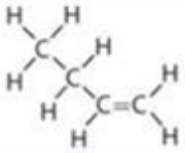
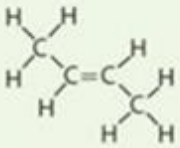
Molecular Formula	Structural Formula	Ball-and-Stick Model
Ethane (C_2H_6)		
Propane (C_3H_8)		
Butane (C_4H_{10})		

Common Alkyl Groups

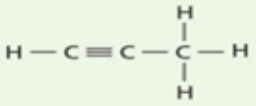
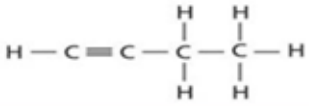
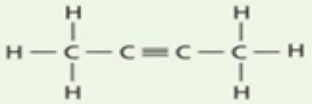
Name	Methyl	Ethyl	Propyl
Condensed structural formula	CH_3-	CH_3CH_2-	$CH_3CH_2CH_2-$

Name	Molecular Formula	Structural Formulas: Expanded[a]	Structural Formulas: Condensed
cyclopropane	C_3H_6		
cyclobutane	C_4H_8		
cyclopentane	C_5H_{10}		
cyclohexane	C_6H_{12}		

Examples of Alkenes

Name	Ethene	Propene	1-Butene	2-Butene
Molecular formula	C_2H_4	C_3H_6	C_4H_8	C_4H_8
Structural formula				
Condensed structural formula	$CH_2=CH_2$	$CH_3CH=CH_2$	$CH_3CH_2CH=CH_2$	$CH_3CH=CHCH_3$

Examples of Alkynes

Name	Molecular Formula	Structural Formula	Condensed Structural Formula
Ethyne	C_2H_2		$CH\equiv CH$
Propyne	C_3H_4		$CH\equiv CCH_3$
1-Butyne	C_4H_6		$CH\equiv CCH_2CH_3$
2-Butyne	C_4H_6		$CH_3C\equiv CCH_3$

Organic Compounds and their Functional Groups

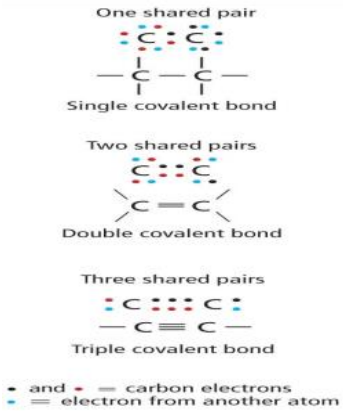
Compound Type	General Formula	Functional Group
Halocarbon		Halogen
Alcohol		Hydroxyl
Ether		Ether
Amine		Amino
Aldehyde		Carbonyl
Ketone		Carbonyl
Carboxylic acid		Carboxyl
Ester		Ester
Amide		Amide

CHAPTER 15: Organic Chemistry & The Chemistry of Life

Part 1: Hydrocarbons

Organic compounds contain the element carbon, which is able to form straight chains and branched chains.

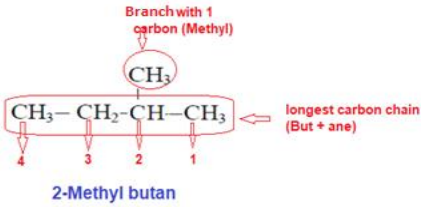
- **Hydrocarbons** are organic substances composed of carbon and hydrogen.
- The major sources of hydrocarbons are petroleum and natural gas.
- **Petroleum** can be separated into components by the process of fractional distillation.
- **Alkanes** contain only single bonds between carbon atoms.
- Alkanes and other organic compounds are best represented by structural formulas and can be named using systematic rules determined by the International Union of Pure and Applied Chemistry (IUPAC).
- Alkanes that contain hydrocarbon rings are called **cyclic alkanes.**
- **Alkenes and alkynes** are hydrocarbons that contain at least one double or triple bond, respectively.
- **Alkenes and alkynes** are nonpolar compounds with greater reactivity than alkanes but with other properties similar to those of alkanes.



Naming branched-chain alkanes

- Count the number of carbon atoms in the longest continuous chain.
- Number each carbon in the parent chain, starting with the carbon closest to the substituent group. This gives all the substituent groups with the lowest position numbers possible.
- Name each alkyl group substituent.
- If the same alkyl group appears more than once as a branch on the parent structure, use a prefix to indicate how many times does it appear.
- When different alkyl groups are attached to the same parent chain, and place their names in alphabetical order.
- Write the entire name, using hyphens to separate numbers from words and commas to separate numbers.

Ex:



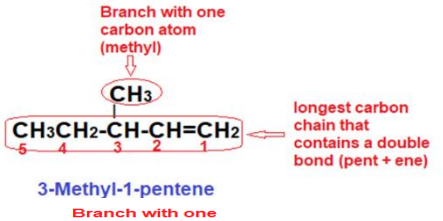
2-Methyl butan

Cycloalkanes

- Cyclic hydrocarbons with only single bonds are called cycloalkanes.
- The relationship between numbers of carbon and hydrogen atoms in cycloalkanes can be expressed as C_nH_{2n}

Alkenes

- Unsaturated hydrocarbons that contain at least one or more double covalent Bonds between carbon atoms are called alkenes. C_nH_{2n}
- When naming branched-chain alkenes, follow the same rules as for alkanes, with two exceptions.
- The parent chain is always the longest chain that contains double bond, whether it is the longest chain or not.
- The position of the double bond, not the branches, determine the numbering.
- Use a prefix to designate the number of double bonds.



3-Methyl-1-pentene

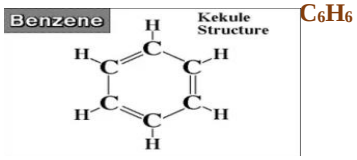
Alkynes

Straight-chain and branched-chain alkynes are named in the same way as alkenes, except the ending is –yne. C_nH_{2n-2}

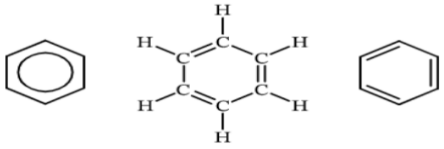
3-Methyl-1-Butyne

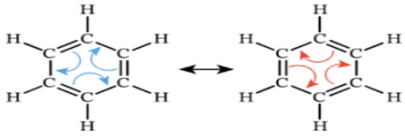
Aromatic Hydrocarbons

- Organic compounds that contain benzene rings as part of their structure are called aromatic compounds.
- Aromatic was originally used because many benzenes related compounds were found in pleasant-smelling oils that came from plants and plant parts.



C_6H_6





1 **Organic compounds contain the element**

CH 15

A Carbon **B** Nitrogen

C Oxygen **D** Halogen

Organic compounds contain the element carbon →A

2 **Hydrocarbons contain only____**

CH 15

A Carbon.

B Carbon, hydrogen, and oxygen.

C Carbon and hydrogen.

D Carbon, hydrogen, and halogen.

Hydrocarbons contain only Carbon and hydrogen. →C

3 **The major sources of hydrocarbons are …**

CH 15

A Solar radiation.

B Nuclear radiations

C Petroleum and natural gas.

D Metallic and nonmetallic elements.

The major sources of hydrocarbons are petroleum and natural gas. →C

4 **Alkanes contain only…bonds between carbon atoms.**

CH 15

A Single **B** Double **C** Triple **D** Hydrogen

Alkanes contain only single bonds between carbon atoms. →A

5 **Which of the following is propane?**

CH 15

A CH_4 **B** CH_3-CH_3

C CH_3-CH_2-CH_3 **D** CH_3-CH_2- CH_2-CH_3

Propane is CH_3-CH_2-CH_3 →C

6 **What is the name of CH_3-CH_2- CH_2-CH_3?**

CH 15

A Methane **B** Ethane

C Propane **D** Butane

The name of CH_3-CH_2- CH_2-CH_3 is Butane. →D

7 **The hydrocarbon, C_6H_{14}, is an example of a(n)**

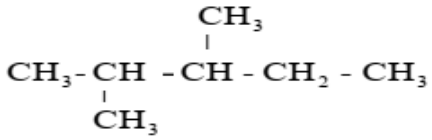
CH 15

A Alkane **B** Cycloalkane

C Alkyne **D** Aromatic

C_6H_{14}, is an example of an Alkane C_nH_{2n+2}. →A

8 **The correct IUPAC name of the compound**



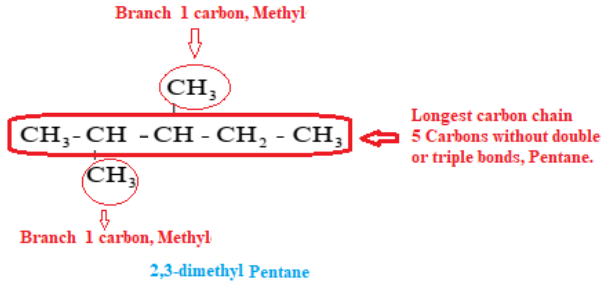
CH 15

A 3,4-dimethylpentane

B 2,3-dimethylpentane

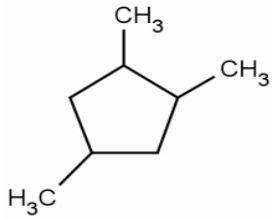
C 2,3-dimethylbutane

D 2,2,3-trimethylbutane



→B

9 **Name the cycloalkane given below**



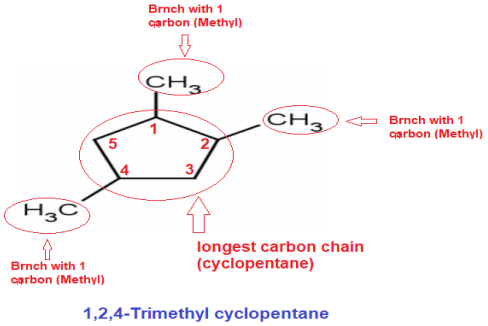
CH 15

A 1,2,4-trimethylcyclohexane

B 1,2,4-trimethylcyclopentane

C 1,2,4-dimethylcyclopentane

D 1,3,5-trimethylcyclopentane



→B

10 **Which of the following is 2-pentene?**

CH 15

A CH_3-CH_2- CH = CH_2

B CH_3-CH = CH - CH_3

C CH_3-CH_2- CH_2- CH = CH_2

D CH_3- CH_2- CH = CH - CH_3

2-pentene is CH_3- CH_2- CH = CH - CH_3 →D

11 **The hydrocarbon, C_4H_8, is an example of a(n)**

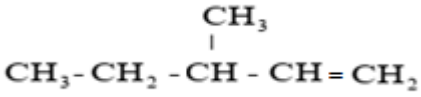
CH 15

A Alkane **B** Alkene

C Alkyne **D** Aromatic

C_4H_8, is an example of an Alkene C_nH_{2n}. →B

12 **The correct IUPAC name of the following compound**



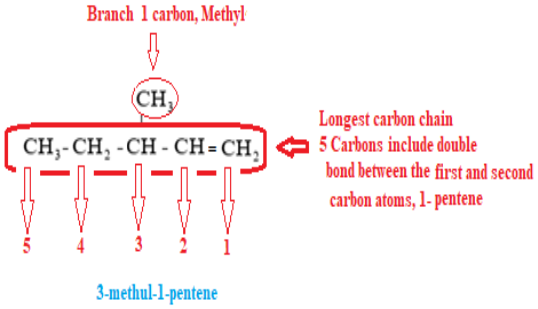
CH 15

A 3-methylpentane

B 3-methyl-1-pentene

C 3-methylbutene

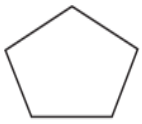
D 3-methyl-2-pentene



→B

13 **Which of the following is the best way to represent the structure of Cyclohexene?**

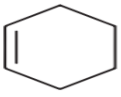
CH 15

A 

B 

C 

D 

C_6H_{12}, is cyclohexene  →B

14 **Which of the following is alkyne?**

CH 15

A C_6H_{14} **B** C_6H_{12}

C C_6H_{10} **D** C_6H_6

alkyne is C_nH_{2n-2} →C

15 **Which of the following is propyne?**

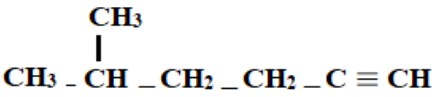
CH 15

A CH_3-CH_2-CH_3 **B** CH_3-CH = CH_2

C CH_3-C ≡ CH **D** CH_3-CH_2- C ≡ CH

Propyne is CH_3-C ≡ CH →C

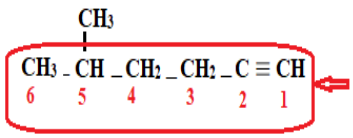
16 **The correct IUPAC name of the compound**



CH 15

A 5-methyl-1-pentyne
B 2-methyl-5-pentyne
C 5-methyl-1-hexyne
D 2-methyl-5-hexyne

Branch 1 carbon, Methyl



Longest carbon chain 6 carbons, contain 1 triple bond between first and second carbons, 1- hexyne. →C

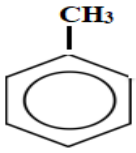
17 **Which of the following is the best way to represent the structure of benzene?**

CH 15

A 
B 
C 
D 

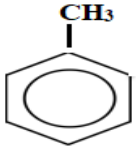
C_6H_6, is benzene  →D

18 **What is the name of the following compound**



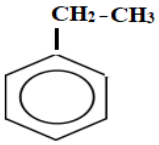
CH 15

A Benzene
B Propylbenzene.
C Ethylbenzene.
D Toluene.



Methylbenzene or Toluene. →D

19 **What is the name of the following compound**

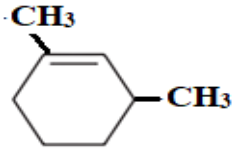


CH 15

A Benzene
B Propylbenzene.
C Ethylbenzene.
D Toluene.

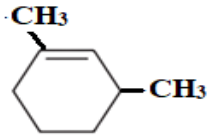
Ethylbenzene. →C

20 **What is the name of the following compound**



CH 15

A 2,4-dimethylhexene
B 1,5-dimethylcyclohexene
C 2,4-dimethylceclohexane
D 1,3-dimethylceclohexene



Is 1,3-dimethylceclohexene →D

21 **The compound CH3CH=CHCH=CH2 is called…**

CH 15

A 1,3-pentadiene. **B** 1,3-butadiene.
C 1,3-pentene. **D** 1,3-butene.

$CH_3CH=CHCH=CH_2$ is1,3-pentadiene. →A

22 **Alkanes are …**

CH 15

A Insoluble in water because they are polar.
B Soluble in water because they are nonpolar.
C Insoluble in water because they are nonpolar.
D Soluble in water because they are polar.

Alkanes are Insoluble in water because they are nonpolar. →C

23 **The separation of oil into simpler components by condensation at different temperatures…**

CH 15

A Cracking. **B** Fractional distillation.
C Polymerization **D** Vaporization

Petroleum can be separated into components by the process of fractional distillation. →B

24 **How many bonds carbon can make with other atoms?**

CH 15

A 2 **B** 3 **C** 4 **D** 5

Carbon can make with other atoms with 4 bonds →C

25 **Which of the following compounds is saturated…**

CH 15

A C_2H_4 **B** C_2H_2
C C_4H_{10} **D** C_3H_4

C_4H_{10}, Because its alkane C_nH_{2n+2} →C

26 **Which of the following compounds is unsaturated…**

CH 15

A C_2H_6 **B** C_3H_8
C C_3H_4. **D** C_4H_{10}

C_3H_4, Because its alkyne C_nH_{2n-2} →C

27 **Which of the following has the highest boiling Point?**

CH 15

A C_2H_6 **B** C_3H_8
C C_4H_{10}. **D** C_5H_{12}

C_5H_{12}, Because it has larger molar mass →D

Part 2: Substituted Hydrocarbons

• In an **organic** molecule, a **functional group** is an atom or group of atoms that always reacts in a certain way.
• Addition of a functional group to a hydrocarbon always produces a substance with different chemical and physical properties

Halocarbons*(Alkyl Halides) *R-X

• Any organic compound that contains a **halogen** substituent is called a **halocarbon.**
• **An alkyl halide** is an organic compound containing a halogen atom covalently bonded to an aliphatic carbon atom.
R = number of carbon atoms (**C ≥ 1**) or an alkyl group, **X** = Halogen (F, Cl, Br, I) it's the functional group
IUPAC name
Longest chain = Alkane, x = Halo, F Fluoro, Cl Chloro, Br Bromo, I Iodo
• An **aryl halide** is an organic compound containing a halogen bonded to an aromatic group.
x = Halo, F Fluoro, Cl Chloro, Br Bromo, I Iodo **IUPAC name = Halo benzene**

• Halocarbons have higher boiling points because they have an increasing tendency to form temporary dipoles. Dipoles attract each other and require more energy to separate. A plastic is a polymer that can be heated and molded while relatively soft.

Alcohols R-OH

• An oxygen-hydrogen group covalently bonded to a carbon atom is called a hydroxyl group. -OH
• An organic compound in which a hydroxyl group replaces a hydrogen is called an alcohol.
• Denatured alcohol is ethanol with small amounts of noxious materials added to it.
• Alcohol names are based on the alkane names, with the ending –ol. (Alkanol)

Ethers R-O-R'

An ether is an organic compound containing an oxygen bonded to two carbon atoms.
• Ethers have no hydrogen atoms bonded to their oxygen atoms, so they cannot form hydrogen bonds with each other.
• Ethers are volatile and have low boiling points.

Amines R-NH₂

Amines contain nitrogen atoms bonded to carbon atoms in aliphatic chains or aromatic rings.
• Amines are primary, secondary, or tertiary depending on if there are one, two, or three hydrogen atoms replaced by organic groups.

Aldehydes 

Aldehydes are organic compounds in which the carbonyl group is located at the end of the carbon chain and is bonded to a carbon atom on one side and a hydrogen on the other side. Aldehydes are named with the **suffix –al (alkanal).**

ketones 

A ketone is an organic compound in which the carbon of the carbonyl group is bonded to two other carbon atoms.
• Ketones are named by changing the –e at the end of the alkane name to –one (Alkanone), and including a number before the name to indicate the position of the ketone group.
• Ketones and aldehydes share many chemical and physical properties because their structures are similar.

Carboxylic acids RCOOH

Carboxylic acids are organic compounds that have a carboxyl group. Carboxyl groups are carbonyls bonded to a hydroxyl group.
Carboxylic acids are named by changing the –**ane to –anoic acid (Alkanoic acid).**

Esters RCOOR'

An ester is any organic compound with a carboxyl group in which the hydrogen in the hydroxyl group is replaced by an alkyl chain. To name an ester, write the alkyl group followed by the name of the acid with the –oic acid ending replaced with –oate (Alkyl alkanoate).

Amides

• An amide group is an organic compound in which the – OH group of a carboxylic acid is replaced by a nitrogen atom bonded to other atoms.

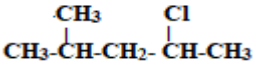
28 **The standard formula of Alkyl Halides…**
CH 15
A R–X **B** R–OH.
C R–COOH **D** R–O –R'
The standard formula of Alkyl Halides is R-X. →A

29 **Which of the following is haloalkane**
CH15
A CH_3Br **B** CH_3OH **C** CH_3NH_2 **D** $(CH_3)_2O$
CH_3Br is haloalkane →A

30 **The IUPAC name of CH_3-CH_2Cl is …**
CH 15
A Chloromethane **B** Chloropropane
C Chloroethane **D** 2-Chloropropane
CH_3-CH_2Cl is Chloroethane. →C

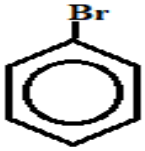
31 **The IUPAC name of CH_3-CH_2-CH_2-Cl is …**
CH 15
A Chloromethane **B** 1-Chloropropane
C Chloroethane **D** 2-Chloropropane
CH_3-CH_2-CH_2Cl is 1-Chloropropane →B

32 **The IUPAC name of the following compound**



CH 15
A 2-methyl-4-chloropentane **B** 1-Chloropentane
C 2-chloro-4-methyl pentane **D** 2-Chloropentane
2-chloro-4-methyl pentane →C

33 **What is The IUPAC name of the following compound**

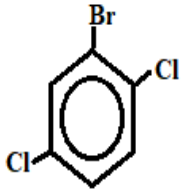


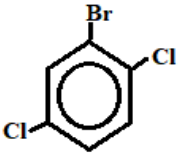
CH 15
A Bromohexane **B** Bromohexene
C Bromohexyne **D** Bromobenzene
Bromobenzene →D

34 **What is The IUPAC name of the following compound**

CH 15

A 1-bromo-2,5-dichlorobenzene
B 3-bromo-1,4-dichlorobenzene
C 2-bromo-1,4-dichlorobenzene.
D 6-bromo-1,4-dichlorobenzene





2-bromo-1,4-dichlorobenzene. →C

35 **Which of the following have the highest boiling point?**

CH 15

A CH_3Cl
B CH_3CH_2Cl
C $CH_3-CH_2-CH_2-Cl$
D $CH_3-CH_2-CH_2-CH_2-Cl$

$CH_3-CH_2-CH_2-CH_2-Cl$, because it has the highest molar mass and it proportional to boiling point →D

36 **Which compound has the highest boiling point?**

CH 15

A 1-fluorobutane
B 1-chlorobutane
C 1-bromobutane
D 1-iodobutane

1-Iodobutane, because it has the highest molar mass and it proportional to boiling point →D

37 **The standard formula of Alcohols is …**

CH 15

A R–X **B** R–OH.
C R–COOH **D** R–O –R'

The standard formula of Alcohols is R-OH. →B

38 **Which of the following is belong to alcohols?**

CH 15

A CH_3CH_2Cl **B** $CH_3CH_2–OH$
C $CH_3–COOH$ **D** $CH_3–O–CH_3$

$CH_3CH_2–OH$, because the functional group alcohols is OH →B

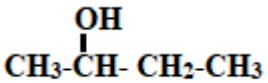
39 **The IUPAC name of $CH_3-CH_2-CH_2–OH$ is …**

CH 15

A 1-propanal **B** 1-propanol
C 2-propanal **D** 2-propanol

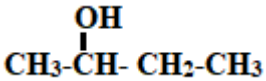
The IUPAC name of $CH_3-CH_2-CH_2–OH$ is 1-propanol because it an alcohol. →B

40 **What is the IUPAC name of the following compound**



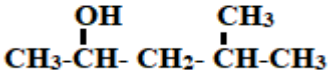
CH 15

A 1-butanol
B 1-butanal
C 2-butanone
D 2-butanol



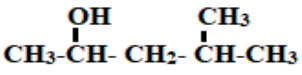
Is 2-butanol →D

41 **What is the IUPAC name of the following compound**



CH 15

A 2-methyl-1-pentanol
B 2-methyl-4-pentanol
C 3-methyl-2-pentanol
D 4-methyl-2-pentanol

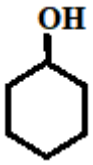


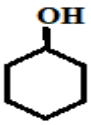
Is 4-methyl-2-pentanol →D

42 **What is the IUPAC name of the following compound**

CH 15

A Hexanol
B Hexenol
C Cyclohexenol
D Cyclohexanol



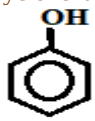


Is Cyclohexanol →D

43 **What is the name of the following compound**

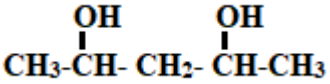
CH 15

A Hexanol
B Phenol
C Cyclohexenol
D Cyclohexanol



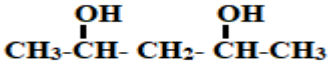
Is Phenol →B

44 **What is the name of the following compound**



CH 15

A 1,2-pentandiol **B** 2,2-pentandiol
C 2,3-pentandiol **D** 2,4-pentandiol



is 2,4-pentandiol →D

45 **Which of the following have the highest boiling point?**

CH 15

A CH_3OH
B CH_3CH_2OH
C $CH_3-CH_2-CH_2-OH$
D $CH_3-CH_2-CH_2-CH_2-OH$

$CH_3-CH_2-CH_2-CH_2-OH$, because it has the highest molar mass and it proportional to boiling point →D

46 **Which of the following have the highest boiling point?**

CH 15

A 1-propanal **B** 1-butanol
C 1-pentanol **D** 1-hexanol

1-Hexanol, because it has the highest molar mass and it proportional to boiling point →D

47 **The standard formula of ether is …**

CH 15

A R–X **B** R–OH.

C R–COOH **D** R–O –R'

The standard formula of ether is R–O –R'. →D

48 **Which of the following is ether**

CH 15

A CH_3-CH_2OH **B** CH_3-O-CH_3

C CH_3COOH **D** CH_3COOCH_3

CH_3-O-CH_3 is ether →B

49 **The name of CH_3- CH_2-O-CH_3 is …**

CH 15

A 2-propanone **B** 1-propanol

C Propanal **D** Ethyl methyl ether

The name of CH_3- CH_2-O-CH_3 is ethyl methyl ether because its ether. →D

50 **Which of the following is diethyl ether is**

CH 15

A CH_3- CH_2-O-CH_3 **B** CH_3 -O-CH_3

C CH_3- CH_2-O- CH_2-CH_3 **D** CH_3- CH_2- CH_2-O- CH_2-CH_3

CH_3- CH_2-O- CH_2-CH_3, is diethyl ether →C

51 **Which is used as an anesthetic in operations?**

CH 15

A CH_3- CH_2-O-CH_3

B CH_3 -O-CH_3

C CH_3- CH_2-O- CH_2-CH_3

D CH_3- CH_2- CH_2-O- CH_2-CH_3

Ethyl ether (Diethyl ether CH_3- CH_2-O- CH_2-CH_3 is used as an anesthetic in operations. →C

52 **The standard formula of amine is …**

CH 15

A R–X **B** R–OH.

C R–COOH **D** R–NH_2

The standard formula of amine is R–NH_2. →D

53 **The IUPAC name of $CH_3CH_2NH_2$ is …**

CH 15

A Methenamine **B** Ethanamine

C Propanamine **D** Butanamine

The IUPAC name of $CH_3CH_2NH_2$ is Ethanamine. →D

54 **Dogs are used to find human remains using their distinctive remains because of?**

CH 15

A Alcohol **B** Ether **C** Ester **D** Amines

Dogs are used to find human remains using their distinctive remains because of amines. →D

55 **The reason for the smell of dead and decayed organisms is?**

CH 15

A Alcohols **B** Ethers **C** Aldehydes **D** Amines

The reason for the smell of dead and decayed organisms is amines →D

56 **The standard formula of aldehyde is …**

CH 15

A R–CHO **B** R–OH.

C R–COOH **D** R–O –R'

The standard formula of aldehyde is R–CHO. →A

57 **Used for preservation for long years?**

CH 15

A Formaldehyde **B** Acetaldehyde

C Benzaldehyde **D** Pentanaldehyde

Formaldehyde is used for preservation for long years. →A

58 **Which of the following is aldehyde**

CH 15

A CH_3-CH_2OH **B** CH_3-CHO

C CH_3COOH **D** CH_3COOCH_3

CH_3-CHO is aldehyde →B

59 **The functional group in aldehydes is?**

CH 15

A Amine **B** Carbonyl

C Amide **D** Hydroxyl

The functional group in aldehydes is Carbonyl. →B

60 **The IUPAC name of CH_3CH_2CHO is …**

CH 15

A 1-propanol **B** Propanal

C Propanoic acid **D** 2-propanone

The IUPAC name of CH_3CH_2CHO is propanal. →B

61 **HCHO is …**

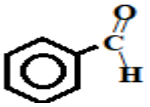
CH 15

A Propanaldehyde **B** Formaldehyde

C Acetaldehyde **D** Benzaldehyde

HCHO is formaldehyde. →B

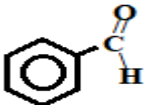
62 **What is the name of the following compound**



CH 15

A Propanaldehyde **B** Formaldehyde

C Acetaldehyde **D** Benzaldehyde



is Benzaldehyde →D

63 **Solubility of aldehydes in water is less than the solubility of?**

CH 15

A Alcohols **B** Proteins

C Ethers **D** Peptides

Solubility of aldehydes in water is less than the solubility of alcohols. →A

64 **The standard formula of ketone is …**

CH 15

A R–CHO **B** R–OH.

C R–CO-R' **D** R–O –R'

The standard formula of ketone is R–CO-R'. →C

65 **The functional group in ketones is?**

CH 15

A Amine **B** Carbonyl

C Amide **D** Hydroxyl

The functional group in ketone is Carbonyl. →B

66 **Which of the following is aldehyde**

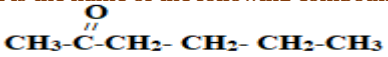
CH 15

A CH_3-CH_2OH **B** CH_3-CHO

C CH_3COOH **D** CH_3COCH_3

CH_3COCH_3 is ketone. →D

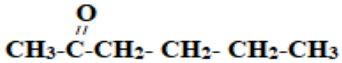
67 **What is the name of the following compound**



CH 15

A 1-Butanone **B** 2-Butanone

C 1-pentanone **D** 2-pentanone



is 2-pentanone. →D

68 **Which of the following is acetone**

CH 15

A CH_3-CH_2- CH_2OH **B** CH_3-CH_2-CHO

C CH_3- CH2-COOH **D** CH_3COCH_3

CH_3COCH_3 is acetone. →D

69 **The standard formula of Carboxylic acids is …**

CH 15

A R–CHO **B** R–OH. **C** R–COOH **D** R–O –R'

The standard formula of carboxylic acids is R–COOH. →C

70 **Which of the following is Carboxylic acid**

CH 15

A CH_3-CH_2- CH_2OH **B** CH_3-CH_2-CHO

C CH_3- CH_2-COOH **D** CH_3COCH_3

CH_3- CH_2-COOH is carboxylic acids. →C

71 **Ants defend themselves by excreting which acid?**

CH 15

A Ethanoic **B** Methanoic

C Butanoic **D** Propanoic

Ants defend themselves by excreting methanoic (formic) acid. →B

72 **The acid found in vinegar?**

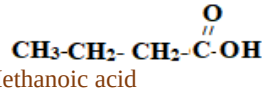
CH 15

A Methanoic **B** Ethanoic

C Butanoic **D** Propanoic

The acid found in vinegar is ethanoic (acetic) acid. →B

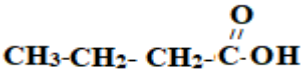
73 **What is the name of the following compound**



CH 15

A Methanoic acid **B** Ethanoic acid

C Butanoic acid **D** Propanoic acid



Is butanoic acid. →C

74 **Which of the following has the highest boiling Point?**

CH 15

A Methanoic acid **B** Ethanoic acid

C Butanoic acid **D** Propanoic acid

Butanoic acid has the highest boiling point, because it has the highest molar mass. →C

75 **Which of the following have the highest boiling point?**

CH 15

A CH_3-OH

B CH_3-CHO

C CH_3-O-CH_3

D CH_3-COOH

CH_3-COOH, because carboxylic acids has the highest boiling points. →D

76 **The standard formula of esters is …**

CH 15

A R–CHO **B** R–OH.

C R–COOH **D** R–COO –R'

The standard formula of esters is R–COO –R'.→C

77 **Which of the following is ester**

CH 15

A CH_3-CH_2OH **B** CH_3-CHO

C CH_3-COOH **D** CH_3-$COOCH_3$

CH_3-$COOCH_3$ is ester. →D

78 **The condensed formula of methyl propanoate is…**

CH 15

A $CH_3(CH_2)_2COOCH_3$

B $CH_3(CH_2)_3COOCH_3$

C $HCOCH_2CH_2CH3$

D $CH_3CH_2COOCH_3$

$CH_3CH_2COOCH_3$ is methyl propanoate →D

79 **To which organic group the following general formula belongs R-CO-NHR'**

CH 15

A Alcohols **B** Esters

C Amines **D** Amides

R-CO-NHR' is amides. →D

80 **Which of the following is amide?**

CH 15

A CH_3COCH_3 **B** $CH_3CH_2COOCH_2NH_2$

C CH_3NH_2 **D** CH_3-CO-$NHCH_2CH_3$

CH_3-CO-$NHCH_2CH_3$is amides. →D

Part 3: Reactions in organic compounds

substitution reaction is one in which one atom or a group of atoms in a molecule is replaced by another atom or group of atoms.

•R-CH_3 + X_2 → R-CH_2-X (Alkyl halide) + HX. (X = F, Cl, Br, I)

•R-CH_2X+ OH^- → R-CH_2OH (Alcohol) + X^-. (X = F, Cl, Br, I)

•R-CH_2X+ NH_3 → R-CH_2NH_2 (Amine) + HX. (X = F, Cl, Br, I)

Addition Reactions

•R-CH=CH_2 + H_2 → R-CH_2-CH_3 (Alkane) (Hydrogenation)

•R-CH=CH_2 + HX → R-CH_2X-CH_3 (Alkyl halides)

•R-CH=CH_2 + H_2O → R-CH_{OH}-CH_3 (Alcohol)

Condensation Reactions= dehydration reaction. (***ESTERIFICATION***)

In a condensation reaction, two smaller organic molecules combine to form a more complex molecule, accompanied by the loss of a small molecule such as water.

R-COOH + R-OH → R-COO-R (Ester) + H_2O

A reaction that eliminates two hydrogen atoms is called a ***dehydrogenation reaction.*** R-CH_2-CH_3 → R-CH=CH_2

Oxidation Reactions ([O] = oxidation)

•R-CH_3+ [O] → R-CH_2OH (Alcohol)

•R-OH + [O] → R-CHO (Aldehyde) → R-COOH (Carboxylic acid)

•R-CHOH-R (secondary alcohols) + [O] → R-CO-R (Ketone)

•$CH_3COH(CH_3)_2$ (Tertiary alcohols) + [O] → NR

Converts alcohol into alkene called **elimination**

•R- CH_2-CH_2OH+ H_2SO_4 (conc) → R-CH=CH_2 (Alkene)

81 **Which of the following is substitution reaction?**

CH 15

A CH_3-OH + [O] → HCOOH

B CH_3-CHO + H_2 → CH_3-CH_2OH

C CH_4 + Cl_2 → CH_3Cl + HCl

D CH_2=CH_2 → CH_3-CH_3

CH_4 + Cl_2 → CH_3Cl + HCl is substitution reaction. →C

82 **Which of the following is addition reaction?**

CH 15

A CH_3-OH + [O] → HCOOH

B CH_3-CHO + [O] → CH_3-COOH

C CH_4 + Cl_2 → CH_3Cl + HCl

D CH_2=CH_2 + H_2 → CH_3-CH_3

CH_2=CH_2 + H_2 → CH_3-CH_3 is addition reaction. →D

83 **In the reaction** CH_3-Cl + OH^- → A + Cl^-, A is

CH 15

A CH_3OH **B** HCHO

C HCOOH **D** CH_4

CH_3-Cl + OH^- → CH_3OH + Cl^- →A

84 **What is the organic product of the following reaction: $CH_2=CH_2 + H_2O \rightarrow$**

CH 15

A CH_3COOH **B** CH_2CHO

C $HCOOCH_3$ **D** CH_3CH_2OH

$CH_2=CH_2 + H_2O \rightarrow CH_3CH_2OH$ →D

85 **The oxidation of ethanol CH_3CH_2OH, produce**

CH 15

A CH_3CH_3 **B** CH_3CHO

C $HCOOCH_3$ **D** CH_3CH_2Cl

$CH_3CH_2OH + [O] \rightarrow CH_3CHO$ →B

86 **The oxidation of ethanal CH_3CHO, produce**

CH 15

A CH_3CH_3 **B** CH_3COH

C $HCOOCH_3$ **D** CH_3COOH

$CH_3CHO + [O] \rightarrow CH_3COOH$ →D

87 **What is the organic product of the following reaction: $HCOOH + CH_3OH \rightarrow$**

CH 15

A CH_3COOH **B** CH_2CHO

C $HCOOCH_3$ **D** CH_3CH_2OH

$HCOOH + CH_3OH \rightarrow HCOOCH_3 + H_2O$ →C

88 **The oxidation of 2-propanol $CH_3CHOHCH_3$, produce**

CH 15

A CH_3CH_3 **B** CH_3COH

C $HCOOCH_3$ **D** CH_3COCH_3

$CH_3CHOHCH_3 + [O] \rightarrow CH_3COCH_3$ →D

89 **Which of the following is true**

CH 15

A $(CH_3)COH + [O] \rightarrow CH_3COOCH_2CH_3$

B $(CH_3)COH + [O] \rightarrow (CH_3)_3CO$

C $(CH_3)COH + [O] \rightarrow CH_3\ CH_2\ CH_2COOH$

D $(CH_3)COH + [O] \rightarrow NR$

$(CH_3)COH + [O] \rightarrow NR$ →D

90 **What is the organic product of the following reaction: $CH_3\ CH_2OH + H_2SO_4 \rightarrow$**

CH 15

A CH_3COOH **B** CH_2CHO

C $CH_2=CH_2$ **D** CH_3CH_2OH

$CH_3\ CH_2OH + H_2SO_4 \rightarrow CH_2=CH_2$ →C

Part 4: Chemistry of Life

Carbohydrates are compounds that contain multiple hydroxyl groups as well as carbonyl groups. Considered a source of energy in human body. General chemical formula of Carbohydrates is $(CH_2O)n$.

- **Monosaccharides** are the simple sugars, composed of five or six carbon atoms. **Glucose** is a six-carbon sugar ($C_6H_{12}O_6$ that is present in high concentration in blood. **Disaccharides** are formed when two monosaccharides are bonded together, like sucrose (glucose + fructose)**.** Glycogen **is** an important **polysaccharide** found in animals that is used to store energy **Starch and cellulose** are also important polysaccharides found in starch

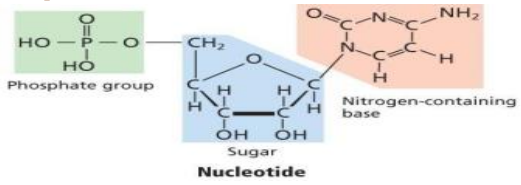
A lipid is a large, nonpolar biological molecule.

- **Fatty acids,** the building blocks of lipids, are long-chain carboxylic acids.
- **Saturated fats** contain only single bonds**. Unsaturated fats** contain one or more double bonds.
- **Triglycerides** are formed when three fatty acids are bonded to a glycerol backbone
- **Saponification** is the hydrolysis of a triglyceride using an aqueous solution of a strong base to form carboxylate salts and glycerol.
- **Phospholipids** are triglycerides in which one fatty acid is replaced by a polar phosphate group.
- Cell membranes are made up of a double layer of phospholipids, called a lipid bilayer
- **Steroids** are lipids that have multiple cyclic rings in their structures.

Proteins are organic polymers made of amino acids linked together in a specific order, not just random chains of amino acids.

- Amino acids are organic molecules that have both an amino group and an acidic carboxyl group.
- The amide bond that joins the two amino acids is called a peptide bond.
- Denaturation is the process in which a protein's natural three-dimensional structure is disrupted.
- An enzyme is a biological catalyst.
- A catalyst lowers the activation energy of a reaction by stabilizing the transition states.
- The most abundant structural protein in most animals is collagen, which makes up skin, ligaments, tendons, and bones
- insulin hormone is protein and is used as chemical messenger molecules that carry signals from pancreas to blood
- A ***nucleic acid*** is a nitrogen-containing biological polymer that is involved in the storage and transmission of genetic information.
- The monomer that makes up a nucleic acid is called a nucleotide.
- Types of nucleic acid: DNA and RNA
- The structure of RNA differs from DNA in three ways.

- RNA contains adenine, cytosine, guanine, and uracil (but never thymine).
- RNA contains sugar ribose instead of sugar deoxyribose.
- DNA is a double helix while RNA is a single strand.



RNA allows cells to use genetic information found in DNA

91 **Organic compound that is considered a source of energy in human body?**

CH 15

A Hydrocarbons **B** Hormones

C Enzymes **D** Carbohydrates

Carbohydrates is considered a source of energy in human body. →D

92 **General chemical formula of Carbohydrates is…**

CH 15

A $(CHO)n$. **B** $(C_2HO)n$. **C** $(CHO_2)n$. **D** $(CH_2O)n$.

General chemical formula of Carbohydrates is $(CH_2O)n$. →D

93 **Which of the following is considered the common name of blood sugar?**

CH 15

A Fructose **B** Glucose **C** Galactose **D** Sucrose

Glucose is a six-carbon sugar ($C_6H_{12}O_6$ that is present in high concentration in blood. →B

94 **Belongs to Disaccharides?**

CH 15

A Sucrose **B** Cellulose **C** Starch **D** Fructose

Disaccharides are formed when two monosaccharides are bonded together, like sucrose →A

95 **Glucose + Fructose produce …**

CH 15

A Sucrose **B** Cellulose
C Starch **D** Fructose

Glucose + Fructose = Sucrose →A

96 **The sugar that available in milk is…**

CH 15

A Sucrose **B** Cellulose
C Galactose **D** Lactose

The sugar that available in milk is Lactose. →D

97 **Polysaccharide carbohydrates storing energy in liver….**

CH 15

A Sucrose **B** Cellulose
C Galactose **D** Glycogen

Glycogen Polysaccharide carbohydrates storing energy in liver. →D

98 **The monomer of cellulose is**

CH 15

A Sucrose **B** Cellulose
C Galactose **D** Glucose

The monomer of cellulose is glucose. →D

99 **Make up most of the structure of cell membrane …**

CH 15

A Lipids **B** Proteins
C Amino acids **D** Starch

Most of the structure of cell membrane is made up of lipids. →A

100 **Steroid that is important structural component of cell membrane …**

CH 15

A Glycogen **B** Cholesterol
C Starch **D** Keratin

Cholesterol is a Steroid that is important structural component of the cell membrane. →B

101 **Which of the following has only single-bonded carbons …**

CH 15

A Phospholipids **B** Steroids
C Saturated fats **D** Unsaturated fats

Saturated fats has only single-bonded carbons. →C

102 **Unsaturated fatty acid contains ...carbon atoms.**

CH 15

A Single covalent -Bonded **B** Double covalent -Bonded
C Metallic bonded **D** Ionic bonded

Unsaturated fatty acid contains Double covalent -Bonded carbon atoms. →B

103 **Process in which Triglyceride is hydrolyzed by an aqueous solution of strong base to form carboxylate salt and glycerol is …**

CH 15

A Condensation **B** Oxidation
C Saponification **D** Elimination

Saponification Process in which Triglyceride is Hydrolyzed by an aqueous solution of strong base to form carboxylate salt and glycerol. →C

104 **Sodium salts are formed from Triglycerides through the process of**

CH 15

A Lipids **B** Glyceride
C Saponification **D** Steroids

Sodium salts are formed from Triglycerides through the process of saponification. →C

105 **The building block of protein is ..**

CH 15

A Carboxylic acids **B** Glucose
C Starch **D** Amino acids

Amino acids is the building block of proteins. →D

106 **Enzymes are made of ...**

CH 15

A Nucleic acids **B** Fatty acids
C Starch **D** Amino acids

Enzymes are made of amino acids. →D

107 **Amino acids have...**

CH 15

A Amino & Acidic carboxyl
B Amino &Carbonyl
C Carbonyl & carboxyl
D Amino & hydroxyl

Amino acids have Amino & Acidic carboxyl. →A

108 **Which of the following is not a function of protein?**

CH 15

A Speed up a reaction
B Transport minerals
C Structural support
D Purify body fluids

Functions of protein are: Speed up a reaction, transport minerals, and structural support. →D

109 **Biological polymer that is involved in the storage and translation of genetic information**

CH 15

A Fatty acid **B** Amino acid
C Nucleic acid **D** Carboxylic acids

Nucleic acid is a biological polymer that is involved in the storage and translation of genetic information →C

110 **The building block of nucleic acid is …**

CH 15

A Steroids **B** Nucleotide
C Amino acid **D** Lipids

Nucleotide is the building block of nucleic acid. →B

111 **Which of the following nitrogenous base not found in DNA?**

CH 15

A Cytosine (C) **B** Uracil (U)
C Guanine (G) **D** Thymine (T)

Nucleotides in DNA consist of from four nitrogen bases, adenine (A), thymine (T), cytocine (C), and guanine (G). →B

112 **RNA does not have**

CH 15

A Cytosine (C) **B** Uracil (U)
C Guanine (G) **D** Thymine (T)

Nucleotides in RNA consist of from four nitrogen bases, adenine (A), uracil (U)cytocine (C), and guanine (G). →D

113 **Which is NOT a difference between RNA and DNA?**

CH 15

A DNA is a double helix; RNA a single strand.
B DNA is a nucleic acid; RNA is not.
C DNA has thymine; RNA has uracil.
D DNA contains deoxyribose sugar; RNA contains ribose sugar.

Both DNA and RNA are nucleic acids. →B