

CHAPTER 7

FUNDAMENTAL PRINCIPLES OF ORGANIC CHEMISTRY

MULTIPLE CHOICE QUESTIONS

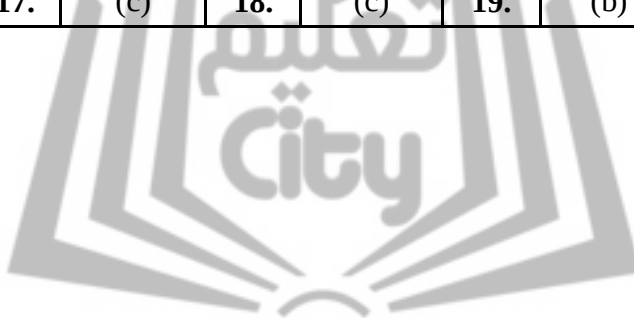
- The state of hybridization of carbon atom in methane is:
 - sp^3
 - sp^2
 - sp
 - dsp^2
- The chemist who synthesized urea from ammonium cyanate was:
 - Berzelius
 - Kolbe
 - Wholer
 - Lavoisier
- Which set of hybrid orbitals has planar triangular shape:
 - sp^3
 - sp
 - sp^2
 - dsp^2
- The reaction $C_8H_{18} \xrightarrow{\Delta} C_3H_6 + \text{Fragments}$ is:
 - Catalytic oxidation
 - Isomerization
 - Synthesis
 - Cracking
- The octane number is 100% in petroleum:
 - Neo-octane
 - n-Hexane
 - Neo-pentane
 - Iso-octane
- Concept of octane number was introduced by:
 - Kekule
 - Edgar
 - Wholer
 - Dalton
- Which of the following form of coal has maximum %age of carbon:
 - Peat
 - Bituminous
 - Sub-bituminous
 - Anthracite

8. Which of the following is the use of light naphtha:
- (a) Non-polar solvent (b) Lubricant
(c) Roofing (d) Polar solute
9. Carbon atom of HCHO (methanal, formaldehyde) is:
- (a) sp hybridized (b) sp^2 hybridized
(c) sp^3 hybridized (d) Not hybridized
10. A double bond consist of:
- (a) Two sigma bonds (b) One sigma and one pi bond
(c) One sigma and two pi bond (d) Two pi bonds
11. Alkanoic acid is another name of:
- (a) Aldehyde (b) Ketones
(c) Carboxylic acid (d) Alcohols
12. An isomer of ethanol is:
- (a) Dimethyl ether (b) Diethyl ether
(c) Ethylene glycol (d) Methanol
13. Ethers shows the phenomenon of:
- (a) Position isomerism (b) Functional group isomerism
(c) Metamerism (d) Cis-trans isomerism
14. Isomerism exhibited by ethanol and dimethyl ether is:
- (a) Position isomerism (b) Metamerism
(c) Functional group isomerism (d) Chain isomerism
15. Which one of the following does not show geometric isomerism:
- (a) $ClHC = CHCl$ (b) $H_3C - HC = CHCH_3$
(c) $H_2C = CHCl$ (d) $BrClC = CClBr$
16. In t-butyl alcohol, the tertiary carbon is bonded to:
- (a) Two H-atoms (b) Three H-atoms
(c) One H-atom (d) No H-atom
17. Which one is the functional group of esters:
- (a) $\begin{array}{c} O \\ || \\ -C- X \end{array}$ (b) $\begin{array}{c} O \\ || \\ -C- OH \end{array}$
(c) $\begin{array}{c} O \\ || \\ -C- OR \end{array}$ (d) $\begin{array}{c} O \\ || \\ -C- H \end{array}$

18. Which of the following has zero dipole moment:
(a) 2-methyl-1-propene (b) 1-butene
(c) Trans-2-butene (d) Cis-2-butene
19. Fractional distillation of petroleum yields only about _____ of gasoline.
(a) 40% (b) 20%
(c) 70% (d) 10%
20. Which of the following compounds will exhibit cis-trans (isomerism):
(a) Butanal (b) 2-butyne
(c) 2-butanol (d) 2-butene

answers

1.	(a)	2.	(c)	3.	(c)	4.	(d)	5.	(d)
6.	(b)	7.	(d)	8.	(a)	9.	(b)	10.	(b)
11.	(c)	12.	(a)	13.	(c)	14.	(c)	15.	(c)
16.	(d)	17.	(c)	18.	(c)	19.	(b)	20.	(d)



SOLVED EXERCISE

Q.1 Fill in the blanks:

- (i) Organic compounds having same molecular formula but different _____ are called isomers.
- (ii) The state of hybridization of carbon atom in _____ is sp^2 .
- (iii) Alkenes show _____ due to restricted rotation around a carbon-carbon double bond.
- (iv) Heating an organic compound in the absence of oxygen and in the presence of _____ as a catalyst is called catalytic cracking.
- (v) A group of atoms which confers characteristic properties to an organic compound is called _____.
- (vi) 2-butene is _____ of 1-butene.
- (vii) Carbonyl functional group is present in both _____ and ketones.
- (viii) A heterocyclic compound contains an atom other than _____ in its ring.
- (ix) The quality of gasoline can be checked by finding out its _____.
- (x) A carboxylic acid contains _____ as a functional group.

answers

(i)	structures	(ii)	ethene	(iii)	geometrical isomerism
(iv)	$SiO_2 + Al_2O_3$	(v)	functional group	(vi)	positional isomer
(vii)	aldehyde	(viii)	carbon	(ix)	octane number
(x)	$-COOH$				

Q.2 Indicate True or False:

- (i) There are three possible isomers for pentane.
- (ii) Alkynes do not show the phenomenon of cis-trans isomerism.
- (iii) Organic compounds cannot be synthesized from inorganic compounds.
- (iv) All close chain compounds are aromatic in nature.

- (v) The functional group present in amides is called an amino group.
- (vi) Government of Pakistan is trying to use coal for power generation.
- (vii) Crude petroleum is subjected to fractional sublimation in order to separate it into different fractions.
- (viii) A bond between carbon and hydrogen serves as a functional group for alkanes.
- (ix) o-nitrotoluene and p-nitrotoluene are the examples of functional group isomerism.
- (x) Almost all the chemical reactions taking place in our body are inorganic in nature.

answers

(i)	True	(ii)	True	(iii)	False	(iv)	False	(v)	False
(vi)	True	(vii)	False	(viii)	False	(ix)	False	(x)	False

Q.3 Multiple choice questions. Encircle the correct answer:

- (i) The state of hybridization of carbon atom in methane is:
 - (a) sp^3
 - (b) sp^2
 - (c) sp
 - (d) dsp^2
- (ii) In t-butyl alcohol, the tertiary carbon is bonded to:
 - (a) Two hydrogen atoms
 - (b) Three carbon atoms
 - (c) One hydrogen atom
 - (d) None of these
- (iii) Which set of hybrid orbitals has planar triangular shape:
 - (a) sp^3
 - (b) sp
 - (c) sp^2
 - (d) dsp^2
- (iv) The chemist who synthesized urea from ammonium cyanate was:
 - (a) Berzelius
 - (b) Kolbe
 - (c) Wholer
 - (d) Lavoisier
- (v) Linear shape is associated with which set of hybrid orbitals:
 - (a) sp
 - (b) sp^2
 - (c) sp^3
 - (d) dsp^2
- (vi) A double bond consists of:
 - (a) Two sigma bonds
 - (b) One sigma and one pi bond

- (c) One sigma and two pi bonds (d) Two pi bonds
- (vii) Ethers show the phenomenon of:
- (a) Position isomerism (b) Functional group isomerism
- (c) Metamerism (d) Both (b) and (c)
- (viii) Select from the following the one which is alcohol:
- (a) $\text{CH}_3\text{—CH}_2\text{—OH}$ (b) $\text{CH}_3\text{—O—CH}_3$
- (c) CH_3COOH (d) $\text{CH}_3\text{—CH}_2\text{—Br}$

answers

(i)	(a)	(ii)	(b)	(iii)	(c)	(iv)	(c)	(v)	(a)
(vi)	(b)	(vii)	(b) & (c)	(viii)	(a)				

Q.4 How organic compounds are classified? Give suitable example of each type.

Ans. Descriptive question. See text book for details.

Q.5 What are homocyclic and heterocyclic compounds? Give one example of each.

Ans. For details. See text book.

Q.6 Write the structural formulas of the two possible isomers of C_4H_{10} .

Ans. Two possible isomers of C_4H_{10} are:

- (i) $\text{H}_3\text{C—CH}_2\text{—CH}_2\text{—CH}_3$ (n-butane)
- (ii) $\text{H}_3\text{C—CH—CH}_3$ (iso-butane)
 $\quad\quad\quad |$
 $\quad\quad\quad \text{CH}_3$

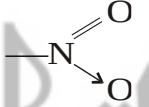
Q.7 Why is ethene an important industrial chemical?

- Ans.** (i) It is used for the preparation of chemicals of industrial use like glycols (anti-freezer), ethanol, ethyl halides.
- (ii) It is used as general anaesthetic in hospitals.

Q.8 What is meant by a functional group? Name typical functional groups containing oxygen.

Ans. **Functional Group:** A single bond, double bond, triple bond, and atom or group of atoms that imparts specific characteristics to an organic compound is called as functional group.

Oxygen containing typical functional groups are:

- | | | |
|-----------------------|--|------------|
| (i) Hydroxal group | —OH | |
| (ii) Ether linkage |  | |
| (iii) Aldehydic group | $\begin{array}{c} \text{O} \\ \\ \text{—C—H} \end{array}$ | (Formyl) |
| (iv) Ketonic group | $\begin{array}{c} \text{O} \\ \\ \text{—C—R} \end{array}$ | (Carbonyl) |
| (v) Carboxyl group | $\begin{array}{c} \text{O} \\ \\ \text{—C—OH} \end{array}$ | |
| (vi) Nitro group |  | |

Q.9 What is an organic compound? Explain the importance of Wohler's work in the development of organic chemistry.

Ans. Detailed question. See text book.

Q.10 Write a short note on cracking of hydrocarbons.

Ans. See text book for answer.

Q.11 Explain reforming of petroleum with the help of suitable example.

Ans. See text book for detailed answer.

Q.12 Describe important sources of organic compounds.

Ans. See text book for detailed answer.

Q.13 What is orbital hybridization? Explain sp^3 , sp^2 and sp modes of hybridization of carbon.

Ans. Descriptive question. See text book.

Q.14 Explain the type of bonds and shapes of the following molecules using hybridization approach.



Ans.

(i) $\text{CH}_3 - \text{CH}_3$:

Ethane is 2nd member of alkanes having all sigma bonds, each carbon is sp^3 hybridized. It has tetrahedral geometry or shape.

(ii) $\text{CH}_2 = \text{CH}_2$:

Ethene is 2nd member of alkenes having 7 sigma bonds and 1-pi bond. Each carbon is sp^2 hybridized. Its molecule has triangular shape.

(iii) $\text{CH} \equiv \text{CH}$:

Ethyne is first member of alkynes having 3 sigma and 2-pi bonds molecule has linear shape.

(iv) HCHO :

Formaldehyde is first member of aldehyde having 3-sigma and 1-pi bond. Carbon atom is sp^2 hybridized and molecule has triangular shape.

(v) $\text{CH}_3 - \text{Cl}$:

Methyl chloride have all sigma bonds. The carbon is sp^3 hybridized. Its molecule have tetrahedral shape.

Q.15 Why there is no free rotation around a double and a free rotation around a single bond? Discuss cis-trans isomerism.

Ans.

In case of double bond, the unhybrid orbitals form π -bond by overlapping in parallel fashion due to which free rotation is restricted around double bond, while in case of single bond which is formed by linear overlapping of hybrid orbitals free rotation is possible due to ease of rotation around single sigma bond.

Cis-trans isomerism see in text book.



1. The first organic compound prepared in the laboratory was urea (Fredrick Wholer in 1828).
2. Anthracite contains 91% carbon and peat contains 59.9% carbon.
3. Octane number of iso-octane is 100.
4. The quality of petrol is checked by its octane number.
5. Dimethyl ether and ethanol are functional group isomers of each other.
6. Fractional distillation of petroleum gives 20% of gasoline.
7. Hetrocyclic compounds contains N, S, O alongwith carbon atoms in the ring.
8. Molecular formula of cyclo alkanes and alkenes is the same.
9. Pyridine, furan, thiophene and pyrrole are hetrocyclic compounds.
10. sp^3 hybrid orbitals are non-coplanar.
11. Acetaldehyde and acetone are functional group isomers of each other.
12. 1-butene and 2-butene are position isomers.
13. An atom or group of atoms which confers characteristic properties to an organic compound is called functional group.