

CHEMISTRY CHAPTER 7(XII)

Short Questions:

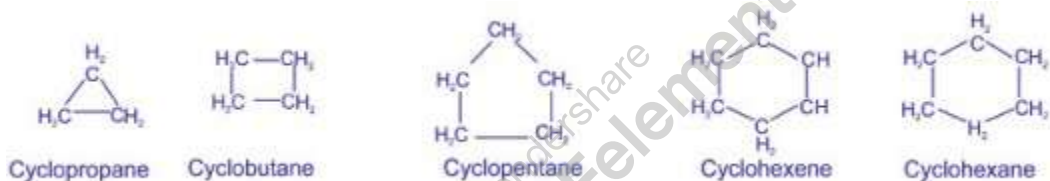
1. What is thermal cracking?

Ans: Breaking down of large molecules by heating at high temperature and pressure is called Thermal Cracking. It is particularly useful in the production of unsaturated hydrocarbons such as ethene and propene.



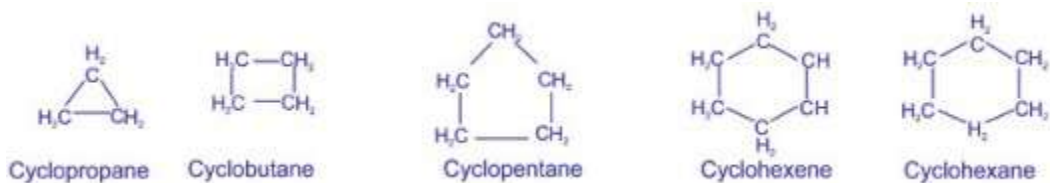
2. Define homocyclic compounds. Give examples.

Ans: The compounds in which the ring consists of only carbon atoms, Homocyclic or carbocyclic compounds. Homocyclic compounds are further classified as : 1. Alicyclic compounds 2. Aromatic compounds



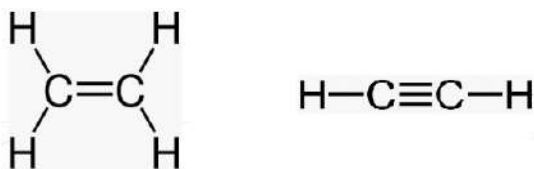
3. What are alicyclic compounds? Give two examples.

Ans: The homocyclic compounds which contain a ring of three or more carbon atoms and resembling aliphatic compounds are called alicyclic compounds. The saturated alicyclic hydrocarbons have the general formula C_nH_{2n} . Typical examples of alicyclic compounds are given below.



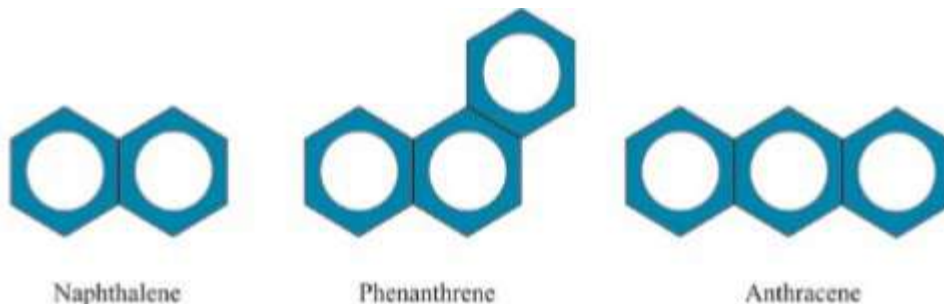
4. Mention shapes angles of Ethene and Ethyne.

Ans: Carbon atoms in ethene are sp^2 hybridized, the shape of the molecule is trigonal planar with a bond angle of 120° . ethyne molecule has sp hybridized carbon atoms and its shape is linear with 180° bond angle.



5. What are fused ring aromatic compounds?

Ans: Those in which the benzene rings are fused together at ortho positions so that the adjacent rings have a common carbon to carbon bonds, e.g. naphthalene, phenanthrene and anthracene.

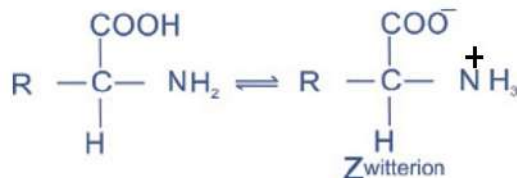


6. Branched hydrocarbons are better as a fuel as compared to straight chain. Explain.

Ans: Straight chain hydrocarbons e.g., n-Octane have low octane number and burn rapidly in internal combustion engine producing sharp metallic sound called knocking. Branched chain hydrocarbons e.g., Isooctane on the other hand are a good quality fuel as they do not cause knocking. This is because branched chain hydrocarbons have a higher octane number and burn smoothly.

7. Define tautomerism. Give an example.

Ans: The type of isomerism arises due to shifting of proton from one atom to other in the same molecule.



8. What is octane number and how it can be improved?

Ans: Percentage by volume of Isooctane relative to that of n-Heptane in a fuel is called octane number. Octane number is improved by making Isooctane through the process of reforming and adding it to a low octane number fuel.

9. How does cracking and reforming differ from each other?

Ans:

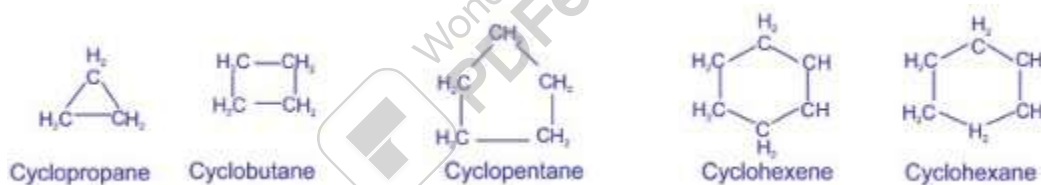
	Cracking	Reforming
1.	Conversion of long chain hydrocarbons having higher boiling points to lower hydrocarbons which are more volatile	Conversion of straight chain hydrocarbons which are low quality fuel to branched chain hydrocarbons which are good quality fuel
2.	It is used to increase the amount of hydrocarbons suitable for making gasoline	It is used to improve the octane number of fuel
3.	It is done using heat, steam or heating hydrocarbons in presence of a catalyst	It is done in by heating hydrocarbons in presence of a catalyst.

10. What are alicyclic and aromatic compounds? Give one example in each case.

Ans:

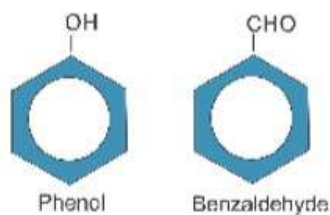
Alicyclic Compounds

The homocyclic compounds which contain a ring of three or more carbon atoms and resembling aliphatic compounds are called alicyclic compounds. The saturated alicyclic hydrocarbons have the general formula C_nH_{2n} . Typical examples of alicyclic compounds are given below.



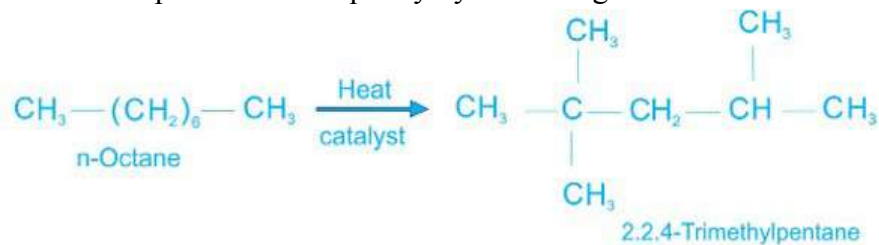
Aromatic Compounds

These carbocyclic compounds contain at least one benzene ring, six carbon atoms with three alternate double and single bonds. These bonds are usually shown in the form of a circle. Typical examples of aromatic compounds are given below. The aromatic compounds may have a side-chain or a functional group attached to the ring.



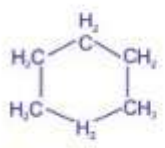


11. Define reforming of petroleum.

Ans: Conversion of straight chain hydrocarbons which are low quality fuel to branched chain hydrocarbons which are good quality fuel by heating in presence of a catalyst is called reforming. It is used to improve the fuel quality by increasing its octane number.



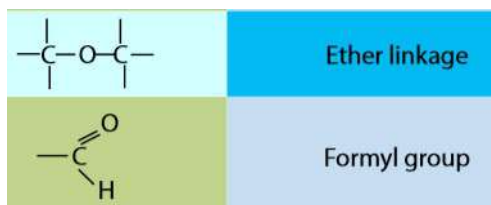
12. Differentiate between homocyclic and heterocyclic compounds.

Ans:

	Homocyclic Compounds	Heterocyclic Compounds
1.	The compounds in which the ring consists of only one type of atoms.	The compounds in which the ring consists of atoms of more than one kind
2.	Organic homocyclic compounds have ring made of carbon atoms only.	Generally one or more atoms of elements such as nitrogen (N), oxygen (O) or sulphur (S) are present in the ring.
3.	<div style="display: flex; justify-content: space-around; align-items: center;"> <div style="text-align: center;">  <p>Cyclohexane</p> </div> <div style="text-align: center;">  <p>Phenol</p> </div> </div>	<div style="text-align: center;">  <p>Pyridine</p> </div>

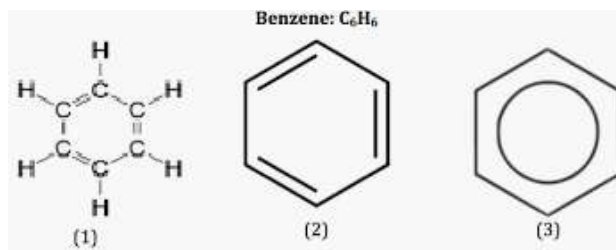
13. Define functional group. Give two examples of functional groups containing oxygen.

Ans: An atom or a group of atoms or a double bond or a triple bond whose presence imparts specific properties to organic compounds is called a functional group, because they are the chemically functional parts of molecules.



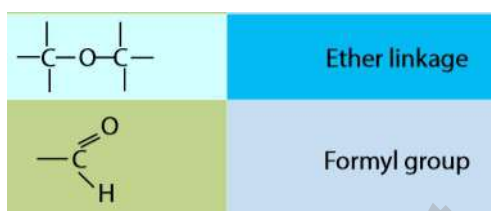
14. What are aromatic hydrocarbons? Give two examples.

Ans: The compounds of carbon and hydrogen containing at least one benzene ring, six carbon atoms with three alternate double and single bonds. These bonds are usually shown in the form of a circle. Typical examples of aromatic hydrocarbons are given below.



15. Define functional group isomerism. Give one example.

Ans: An atom or a group of atoms or a double bond or a triple bond whose presence imparts specific properties to organic compounds is called a functional group, because they are the chemically functional parts of molecules.

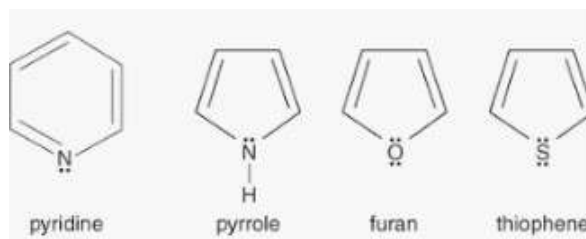


16. What is carbonization or destructive distillation of coal?

Ans: Carbonization or destructive distillation is when coal is heated in the absence of air (temperature ranging from 500-1000° C); it is converted into coke, coal gas and coal tar. Coal tar contains a large number of organic compounds, which separate out on fractional distillation.

17. What are heterocyclic compounds? Give names and formulas of two heterocyclic compounds.

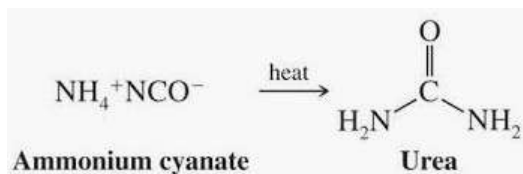
Ans: The compounds in which the ring consists of atoms of more than one kind are called heterocyclic compounds or heterocycles. In heterocyclic compounds generally one or more atoms of elements such as nitrogen (N), oxygen (O) or sulphur (S) are present. The atom other than carbon viz, N, O, or S, present in the ring is called a hetero atom.



18. Name the organic compound first of all prepared in the laboratory and how?

Ans: Friedrich Wohler obtained the first synthetic organic compound urea (NH₂)₂CO, an organic compound in the urine of mammals, from ammonium cyanate NH₄CNO on heating. His

work therefore resulted in rejection of vital force theory which stated that organic compounds can not be synthesized in laboratory.

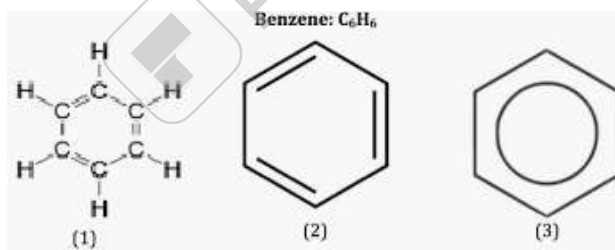


19. Give an idea about the knocking in the internal combustion engine.

Ans: Straight chain hydrocarbons e.g., n-Heptane have low octane number and burn rapidly in internal combustion engine producing sharp metallic sound called knocking. Tetraethyl lead $(\text{C}_2\text{H}_5)_4\text{Pb}$, is an efficient antiknock agent but has one serious disadvantage; its combustion product, lead oxide, is reduced to metallic lead which is discharged into the air through the exhaust pipe and causes air pollution. These days quality of fuel is improved by increasing its octane number i.e., the percentage of branched chain hydrocarbons, through reforming. Branched chain hydrocarbons e.g., Isooctane do not cause knocking as they burn smoothly in internal combustion engine.

20. What are aromatic compounds? Explain with an example.

Ans: The compounds of carbon and hydrogen containing at least one benzene ring, six carbon atoms with three alternate double and single bonds. These bonds are usually shown in the form of a circle. Typical examples of aromatic hydrocarbons are given below.



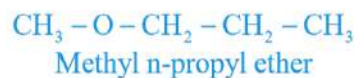
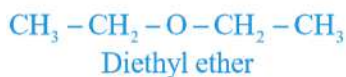
21. Write the functional group of aldehyde and ketone. Give one example.

Ans:

	Functional Group	Example
Aldehyde	$\begin{array}{c} \text{O} \\ \parallel \\ -\text{C}-\text{H} \end{array}$ Formyl	$\begin{array}{cc} \text{O} & \text{O} \\ \parallel & \parallel \\ \text{H}-\text{C}-\text{H} & \text{CH}_3-\text{C}-\text{H} \\ \text{Formaldehyde} & \text{Acetaldehyde} \end{array}$
Ketone	$\begin{array}{c} \diagup \\ \text{C}=\text{O} \\ \diagdown \end{array}$ Carbonyl	$\begin{array}{cc} \text{O} & \text{O} \\ \parallel & \parallel \\ \text{CH}_3-\text{C}-\text{CH}_3 & \text{CH}_3-\text{C}-\text{CH}_2-\text{CH}_3 \\ \text{2-Propanone (Propanone)} & \text{2-Butanone (Butanone)} \end{array}$

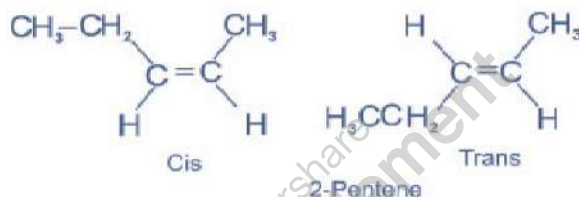
22. Define Metamerism with an example.

Ans: This type of isomerism arises due to the unequal distribution of carbon atoms on either side of the functional group. Such compounds belong to the same homologous series. For example, diethyl ether and methyl n-propyl ether are metamers.



23. Explain cis-trans isomerism. Give an example.

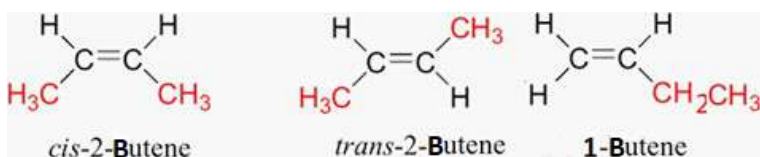
Ans: Such compounds which possess the same structural formula, but differ with respect to the positions of the identical groups in space are called cis - trans isomers and the phenomenon is known as the cis-trans or geometric isomerism.



24. 2-Butene shows geometric isomerism but 1-Butene does not. Why?

Ans: The conditions for cis – trans isomerism are

1. Restricted rotation of carbon atoms due to a double bond.
2. Two different groups attached to each carbon atom making the double bond.



2-Butene meets both these conditions therefore shows geometric or cis-trans isomerism. 1-Butene has two hydrogen atoms on first carbon atom therefore it does not fulfill the second condition necessary for geometric isomerism hence has no cis or trans isomers.

25. Why is there no free rotation around a double bond but free rotation around a single bond?

Ans: A single bond is a sigma bond formed by the head to head overlap of half filled orbitals. The electrons of this bond are on the line joining the nuclei and allow rotation of atoms on nuclear axis in alkanes. A double bond consists of a sigma and a pi bond. A pi bond is formed by the parallel overlap of the half filled orbitals and its electron cloud lies above and below the

nuclear axis. This parallel overlap of the orbitals in a pi bond restricts rotation of the double bonded carbon atoms in alkenes.

26. What are the important conditions of cis-trans isomerism?

Ans: The conditions for cis – trans isomerism are

1. Restricted rotation of carbon atoms due to a double bond.
2. Two different groups attached to each carbon atom making the double bond.

27. What is importance of gasoline and gas oil?

Ans: Gasoline fraction of petroleum has hydrocarbons from C_4H_{10} to $C_{13}H_{28}$ with a boiling point range of 40 to 220 °C. Gasoline is used as a motor fuel. Gas oil fraction ranges from $C_{12}H_{26}$ to $C_{18}H_{38}$ with boiling points above 275 °C. This fraction is used as diesel and heating fuel.

28. What are the uses of Asphalt and Kerosene?

Ans: Asphalt of the petroleum coke is the solid fraction of crude oil and is obtained as residue after fractional distillation. It is used for paving, roofing and a fuel reducing agent. Kerosene fraction ranges from C_8H_{18} to $C_{14}H_{30}$. Its boiling point ranges from 175 – 325 °C and it is used as a heating agent.

29. Define homologous series.

Ans: A series of chemically similar organic compounds having same general formula is called a homologous

Homologous Series	General Formula
Alkanes	C_nH_{2n+2}
Alkenes	C_nH_{2n}
Alkynes	C_nH_{2n-2}

Fundamental Concepts of Organic Chemistry

LONG QUESTIONS:

1. Explain reforming of petroleum with the help of suitable examples.
2. Define sp^3 and sp^2 Hybridization. Give one example in each case.
3. Explain sp^2 Hybridization along with describing structure of Ethene.
4. Write a note on classification of organic compounds.

5. Differentiate between homocyclic and heterocyclic compounds with two examples in each case.
6. Define isomerism. Explain the term Metamerism by giving two examples.
7. What is orbital Hybridization? Explain sp^3 mode of hybridization.
8. What is sp Hybridization? Explain the structure of acetylene according to this theory.
9. What do you know about Cracking of petroleum? OR Define cracking and give its types.
10. Explain the structure of Ethene on the basis of sp^2 Hybridization.