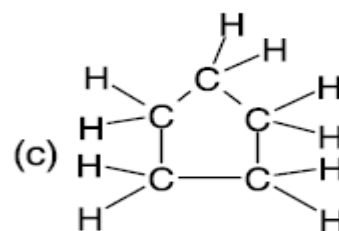
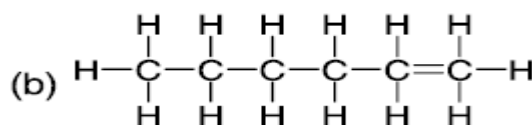
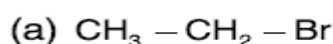


Carbon and Its compounds

Five marks Questions

- An organic compound 'A' is widely used as preservative in pickles and has a molecular formula $C_2H_4O_2$. This compound reacts with ethanol to form a sweet smelling compound 'B'.
 - Identify the compound 'A'.
 - Write the chemical equation for its reaction with ethanol to form compound 'B'.
 - How can we get compound 'A' back from 'B'?
 - Name the process and write corresponding chemical equation.
 - Which gas is produced when compound 'A' reacts with washing soda? Write the chemical equation.
- Two carbon compounds A and B have the molecular formula C_3H_8 and C_3H_6 respectively. Which one of the two is most likely to show addition reaction? Justify your answer. Explain with the help of a chemical equation, how an addition reaction is useful in vegetable ghee industry.
- Why does carbon form largest number of compounds?
 - Why are some of these called saturated and other unsaturated compounds?
 - Which of the above are strong z?
 - Write the names of the compounds.

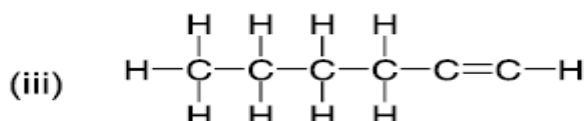
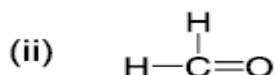
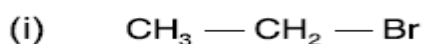


- How will you convert (Write equation)
 - Sodium ethoxide from ethyle Alcohol.
 - Easter from ethyl alcohol
 - Ethane from ethyl Alcohol
 - Acetic acid from ethyl alcohol
 - Chloro methane from methane.
- A mixture of oxygen and ethyne is burnt for welding. Why do you think a mixture of ethyne and air is not used?

Three marks question

- What would be the electron dot structure of a molecule of sulphur which is made up of eight atoms of sulphur.

7. How would you name the following compounds ?



8. How would you distinguish experimentally between an alcohol and a carboxylic acid ?

9. Why melting and boiling points of carbon compounds are very low ?

10. Why diamond is hard but graphite is smooth and slippery.

Two marks questions

11. What are catalysts ?

12. Why the ethanoic acids are called glacial acid ?

13. What is saponification ? Why it is called so ?

14. A boy heated a mixture of fat and sodium hydroxide solution. He added this mixture to a solution of sodium chloride in water. A soft white solid substance was produced.

(i) Name the soft white solid.

(ii) What is the name of the process the boy carried out ?

(iii) Why did he add the mixture to the sodium chloride solution ?

15. How is it that we can use detergents for washing clothes even when the water is hard, but not soaps ? What change has been made in the composition of detergents to make them biodegradable ?

One marks Questions

16. Which bonding is mostly shown by carbon in its compounds ?

17. Why carbon compounds are poor conductor of electricity ?

18. How does the conductivity vary in diamond and graphite ?

19. How can diamond be obtained from pure carbon ?

20. Why is hard water not suitable for washing clothes with soap ?

21. Write a formula and structure of Alkene having carbon 4 carbon atoms.

22. What is homologous series ?

23. How do Alcohols affect living beings ?

24. Draw the structure for Butane and Hexane ?

25. Why the saturated hydrocarbon give clean flame while unsaturated carbon compound give yellow flames ?

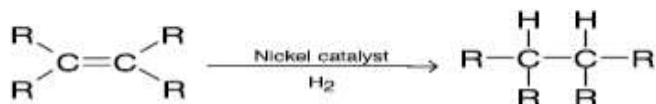
Answer of Five Marks Question:

1. (i) Compound 'A' Acetic Acid, CH_3COOH
- (ii) $\text{CH}_3\text{COOH} + \text{C}_2\text{H}_5\text{OH} \longrightarrow \text{CH}_3\text{COOC}_2\text{H}_5 + \text{H}_2\text{O}$
- (iii) By complete oxidation of compound 'B'.
- (iv) $[\text{CH}_3\text{COOC}_2\text{H}_5 \xrightarrow{\text{NaOH}} \text{C}_2\text{H}_5\text{OH} + \text{CH}_3\text{COOH}]$ process-complete oxidation.
- (v) $2\text{CH}_3\text{COOH} + \text{Na}_2\text{CO}_3 \longrightarrow 2\text{CH}_3\text{COONa} + \text{H}_2\text{O} + \text{CO}_2$

Gas produced – CO_2 (carbon dioxide).

2. The compound B having molecular formula of C_3H_6 will show addition reaction.

Reason : In this compound, one valency per carbon atom remains unsatisfied. This can be satisfied if this compound undergoes addition reaction so that it becomes a stable saturated compound. This reaction is commonly used in the hydrogenation of vegetable oils by using a nickel catalyst. This helps in converting unsaturated vegetable oils (which are unstable) into saturated fats (which are more stable)



3. (i) Carbon has the unique ability to form bonds with other atoms of carbon giving rise to large molecules. This property is called catenation. Carbon has a valency of four and it has a small size. This enables carbon to form very strong bonds with other elements.
- (ii) Compounds of carbon, which are linked by only single bonds between the carbon atoms are called saturated compounds. Compound of carbon having double or triple bonds between their carbon atoms are called unsaturated compounds.
- (iii) Unsaturated are more reactive and strong.
- (iv) (a) Bromo ethane
(b) Hexene
(c) Cyclo Pentane.
4. (i) $2\text{Na} + 2\text{CH}_3\text{CH}_2\text{OH} \longrightarrow 2\text{CH}_3\text{CH}_2\text{O}^-\text{Na}^+ + \text{H}_2$
(sodium ethoxide)
- (ii) $\text{CH}_3\text{COOH} + \text{CH}_3\text{CH}_2\text{OH} \xrightarrow{\text{Acid}} \text{CH}_3\text{C}(\text{O})\text{OCH}_2\text{CH}_3$
(Ethanoic acid) (Ethanol)
- (iii) $\text{CH}_3\text{CH}_2\text{OH} \xrightarrow[\text{H}_2\text{SO}_4]{\text{Hot conc}} \text{CH}_2 = \text{CH}_2 + \text{H}_2\text{O}$
- (iv) $\text{CH}_3\text{CH}_2\text{OH} \xrightarrow[\text{or oxidified } \text{K}_2\text{Cr}_2\text{O}_7 + \text{Heat}]{\text{Alkaline } \text{KMnO}_4 + \text{Heat}} \text{CH}_3\text{COOH}$
- (v) $\text{CH}_4 + \text{Cl}_2 \longrightarrow \text{CH}_3\text{Cl} + \text{HCl}$ (in the presence of sunlight)

5. Ethyne burns in pure oxygen producing a very hot flame which produces a very high temperature 3000°C. The oxygen-acetylene flame is used for the welding of metals



A mixture of ethyne and air is not used because all the carbon of ethyne does not burn completely in air and some of the carbon particles escape unburnt and make the flame sooty.

6. A sulphur molecule with 8 atoms of sulphur has a crown shape or puckered ring structure. In the electron dot structure of S₈ molecule, each sulphur atom has : Atomic number = 16

Electronic configuration : $\text{K} \begin{array}{c} \text{L} \\ 2 \end{array} \text{M} \begin{array}{c} \text{N} \\ 8 \end{array} \text{O} \begin{array}{c} \text{P} \\ 6 \end{array}$

Number of valence electron in each sulphur atom = 6

So it needs two more electrons to complete its octet. Hence each sulphur atom shares two of its electron. One each with the other two sulphur atoms forming a six-membered ring structure as shown below.

S.N.	Test	Alcohol	Carboxylic acid
1.	Ph-test (added blue litmus)	No effect	Acids turns blue litmus red.
2.	NaHCO ₃	No effect	Brisk effervescence due to evolution of CO ₂ gas
3.	Alkaline Potassium permanganate (Add KMnO ₄ and heated)	Pink colour of KMnO ₄ is discharged	No effect.

9. Melting and Boiling points of carbon are always high in case of ionic compounds but carbon, in most of its compounds shows covalent bonding so forces of attraction between these molecules are not strong and hence these show low melting points and boiling points.
10. (i) In diamond, each carbon atom is bonded to four other carbon atoms forming a rigid three dimensional structure.
 (ii) In graphite, each carbon atom is bonded to three other carbon atoms in the same plane giving a hexagonal array.
 (iii) The hexagonal arrays being placed in layers one above the other.
11. Catalysts are substances that cause a reaction to occur or proceed at a different rate without the reaction itself being affected.
12. The ethanoic acid is called glacial acetic acid because the melting point of pure ethanoic acid is 290 K and hence it often freezes during winter in cold climates.
13. Esters react in the presence of an acid or a base to give back the alcohol and carboxylic acid. This reaction is known as saponification because it is used in the preparation of soap.
14. (i) Soap (ii) Saponification
 (iii) The boy added the mixture of the sodium chloride solution to decrease the solubility of the soap.

15. Hard water contains Ca^{2+} and Mg^{2+} ions. The hardness of water is due to the presence of Ca^{2+} and Mg^{2+} ions. A detergent does not give any precipitate with these ions. On the other hand, soap forms precipitates with these ions. The precipitates are thus thrown out of the solution. That is why. We can use detergents for washing clothes even when the water is hard, but not soaps.
- The detergents are now made by molecules in which there is minimum branching. These are biodegraded more easily than branched-chain detergents.
17. The carbon compounds are poor conductor of electricity because the forces of attraction between these molecules are not very strong. Since these compounds are largely non-conductors of electricity.
18. Diamond, having no free electron left, is a poor conductor of electricity whereas graphite has one free electron and is hence good conductor of electricity.
19. By subjecting the pure carbon to very high pressures and temperature.
20. Hard water contains bicarbonates, chlorides and sulphates of calcium and magnesium which react with soap molecules forming insoluble precipitates called scum. Hence strength of soap molecules are lost in the chemical reaction and they are not available for cleaning action.
22. Homologous series : is a group of organic compounds having similar structure and similar chemical properties in which the successive compound differs by CH_2 groups.
23. It causes mental confusion, drowsiness, lowering of the normal inhibitions and finally stupor.
24. (i) Butane (ii) Hexane
- Formula : C_4H_{10} Formula : C_6H_{14}
- $$\begin{array}{cccc} \text{H} & \text{H} & \text{H} & \text{H} \\ | & | & | & | \\ \text{H}-\text{C}-\text{C}-\text{C}-\text{C}-\text{H} \\ | & | & | & | \\ \text{H} & \text{H} & \text{H} & \text{H} \end{array}$$
- $$\begin{array}{cccccc} \text{H} & \text{H} & \text{H} & \text{H} & \text{H} & \text{H} \\ | & | & | & | & | & | \\ \text{H}-\text{C}-\text{C}-\text{C}-\text{C}-\text{C}-\text{C}-\text{H} \\ | & | & | & | & | & | \\ \text{H} & \text{H} & \text{H} & \text{H} & \text{H} & \text{H} \end{array}$$
25. The unsaturated compound hydrocarbon has more percentage of carbon so some unburnt carbon particles are left and the flame formed is yellow.

4. (a) $2\text{CH}_3\text{CH}_2\text{OH} + 2\text{Na} \longrightarrow 2\text{CH}_3\text{CH}_2\text{ONa} + \text{H}_2$
- (b) $\text{CH}_3\text{COOC}_2\text{H}_5 + \text{NaOH} \longrightarrow \text{CH}_3\text{COONa} + \text{C}_2\text{H}_5\text{OH}$
- (c) $\text{CH}_3\text{CH}_2\text{OH} \xrightarrow{\text{Hot conc. H}_2\text{SO}_4} \text{H}_2\text{C} = \text{CH}_2 + \text{H}_2\text{O}$
- (d) $\text{CH}_3\text{COOH} + \text{C}_2\text{H}_5\text{OH} \xrightarrow{\text{conc. H}_2\text{SO}_4} \text{CH}_3\text{COOC}_2\text{H}_5 + \text{H}_2\text{O}$
- (d) $2\text{CH}_3\text{COOH} + \text{Na}_2\text{CO}_3 \longrightarrow 2\text{CH}_3\text{COONa} + \text{H}_2\text{O} + \text{CO}_2$

10th Additional question Carbon and its compound**Very short answer questions (1 mark)**

1. Name two elements which do not acquire octet configuration during bond formation.
2. Why are unsaturated hydrocarbons more reactive than saturated hydrocarbons ?
3. Which of the following compounds has a branched chain.
(i) Normal butane (ii) Isobutane
4. What is the difference between two consecutive homologues in terms of (i) molar mass (ii) number and kind of atoms per molecule ?
5. Write the molecular formula of the fourth member of the homologous series of alcohols.
6. An ester has the formula $\text{CH}_3\text{COOC}_3\text{H}_7$ write the parent alcohol and the parent acid from which it is produced ?
7. What is saponification ?
8. Define catenation.
9. Name the gas evolved when acetic acid is poured over sodium carbonate ?
10. What are miscelles ?

Short answer questions (2-3 marks)

1. Define isomers. Write structural formula of isomers of butane.
2. What is meant by functional group ? Identify the functional group present in
(i) $\text{CH}_3\text{CH}_2\text{COOH}$ (ii) $\text{CH}_3\text{COCH}_2\text{CH}_3$
3. Name the major component of CNG and biogas. Draw its electron dot structure.
4. An organic compound X is an essential component of wine and bear. Oxidation of x yields an organic acid Yy which is present in vinegar.
(i) Name the compounds X and Y. (ii) Write their formulae.
5. What type of reactions take place between ethane and chlorine and between ethene and chlorine ?
6. What is fermentation ? Name the enzymes required for fermentation of sugarcane juice to ethanol.
7. What is hydrogenation ? Write one of its industrial application.
8. Which gas is produced when ethanol reacts with sodium metal ? Write the chemical equation.
9. Define decarboxylation and give an example.
10. Describe the bond that keeps two hydrogen atoms together in a molecule.

Long answer questions (5 marks)

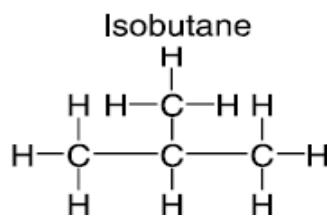
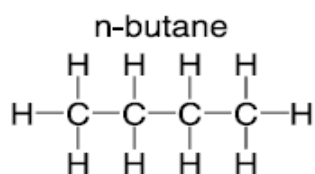
1. State 3 properties in which covalent compounds differ from ionic compounds. Identify the type of bond in MgO , CO_2 , N_2 , NaCl .
2. Differentiate between soaps and detergents on the basis of their chemical constitution. Explain why soaps are not effective cleansing agents in hard water ?
3. (a) How would you distinguish between ethanol and ethanoic acid ? Give one physical and one chemical test.
(b) Write one chemical property with equation which is similar in both.

Answers :**Very short answer.**

- Hydrogen and Helium.
- Due to presence of double and triple bonds.
- Isobutane $\text{H}_3\text{C}-\overset{\text{CH}_3}{\underset{\text{H}}{\text{C}}}-\text{CH}_3$.
- Difference in molar mass = 14 u. Number and kind of atoms one carbon atom and two hydrogen atoms ($-\text{CH}_2$ group)
- $\text{C}_4\text{H}_9\text{OH}$
- Acid : CH_3COOH
Alcohol : $\text{C}_3\text{H}_7\text{OH}$
- Hydrolysis of fats or oil with alkali to makes soap.
- The ability of carbon atoms to link with one another to form long chains or rings of atoms is known as catenation.
- Carbon dioxide
- When soap or detergent is dissolved in water, the molecules gather together in clusters these clusters are called miscelles.

Short questions

- The organic compounds having same molecular formula but different structural formula are **Isomers**. Isomers of butane



- Functional group : An atom or a group of atoms present in the molecule which determines its chemical properties
 - $-\text{COOH}$ carboxylic acid.
 - $\begin{array}{c} \text{O} \\ || \\ \text{---C---} \end{array}$ ketonic.
- Methane
- X-Ethyl alcohol $\text{C}_2\text{H}_5\text{OH}$ Y-Ethanoic acid CH_3COOH
- Ethane and chlorine - Substitution reaction Ethene and chlorine - Addition reaction.
- Fermentation : Slow decomposition of sugars/molasses into alcohol in presence of enzymes.
Enzymes : Invertase and Zymase.

7. Hydrogenation : Addition of hydrogen to an unsaturated hydrocarbon producing saturated hydrocarbon.

Application : Hydrogenation of vanaspati oil to produce vanaspati ghée.
 8. Hydrogen gas



9. Decarboxylation : Removal of one molecule of carbondioxide from carboxylic acid.

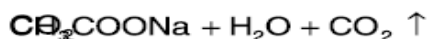
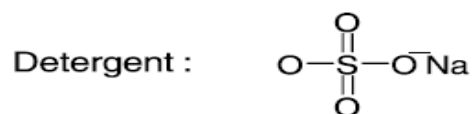
10. H atom has 1 e⁻ and needs 1 e⁻ to be stable

\ Two H atoms share 1 e⁻ each making covalent bond



2. (a) Soaps are sodium or potassium salts of higher fatty acids.

Detergents are sodium salts of long chain of hydrogen sulphates or long chain of alkyl benzene sulphonates soap – COO⁻Na⁺



3. Hard water contains Ca⁺² and Mg⁺² ions in it which react with soap to form scum (ppt of Ca or Mg salts).

- (a) Litmus test :

Ethanol does not change colour of litmus Ethanoic acid turns blue litmus to red.

- (b) Sodium hydrogen carbonate test



Ethanoic acid releases gas with NaHCO₃



Similarity : Both produce H₂ gas with sodium metal.



4. (a) $2CH_3CH_2OH + 2Na \longrightarrow 2CH_3CH_2ONa + H_2$

