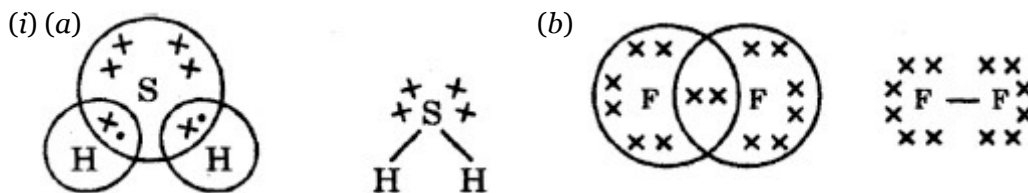


Carbon and its Compounds

23. (i) Draw the electron dot structure for: (a) H_2S , (b) F_2 .
 (ii) What type of bond is present in F_2 ?

2104/2015/2016 [3 Marks]



- (ii) The bond in F_2 molecule is covalent in nature.

24. State the reason why carbon can neither form C^{4+} cations nor C^{4-} anions, but forms covalent compounds. Also state reasons to explain why covalent compounds

- (i) are bad conductors of electricity?
 (ii) have low melting and boiling points?

2012/2014/2016 [5 Marks]

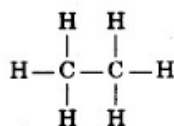
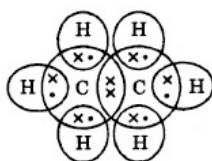
- Carbon can neither form C^{4+} cations nor C^{4-} anions, because
 - (a) to form C^{4-} anion, carbon must gain four electrons, but it would be difficult for the nucleus having six protons to hold on to ten electrons i.e., four extra electrons.
 - (b) to form C^{4+} cation, carbon must lose four electrons, but it would require a large amount of energy to remove four electrons leaving behind a carbon cation with six protons in its nucleus holding on to just two electrons.
 So, it forms covalent compounds.
- (i) Covalent compounds are bad conductors of electricity, because the bonding in these compounds does not give rise to any ions.
- (ii) Covalently bonded molecules have strong bonds within the molecule, but intermolecular forces are small, so they have low melting and boiling points.

25. Explain the following statements:

- (i) Ethane is a covalent compound.
 (ii) Carbon atoms form a strong bond.
 (iii) Carbon shows catenation property.
 (iv) Pentane has high boiling point than methane.
 (v) Double bonds are present in alkene.

2014/2015/2016 [5 Marks]

- (i) In ethane, carbon and hydrogen atoms complete their octet by sharing the valence electrons with other atoms of carbon or with hydrogen atoms, so the nature of bonding in the molecule is covalent.

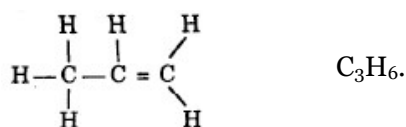


(ii) The bonds which are formed by the sharing of electron pair between two carbon atoms are called covalent bonds which are seen to have strong bonds within the molecules due to its small size.

(iii) Carbon atoms form compounds by forming covalent bonds in a long chain of other carbon atoms, branched chains or even carbon atoms arranged in rings. In addition, carbon atoms may be linked by single, double or triple bonds by other carbon atoms. Since it can form large molecules through covalent bonding with other carbon atoms, carbon exhibits the property of catenation.

(iv) Because molecular mass of pentane C_5H_{12} is higher than methane (CH_4).

(v) In alkenes, one valency per carbon atom remains unsatisfied. This can be satisfied only if there is a double bond between the two carbon atoms. For example,



26. Write the names of the following carbon compounds and draw their structures:

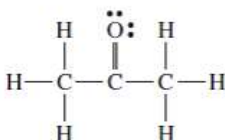
(i) CH_3COCH_3

(ii) CH_3CH_2Br

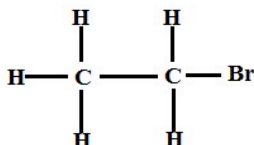
(iii) C_6H_6

2014/2015 [3 Marks]

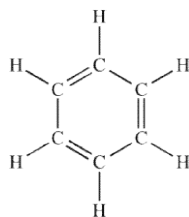
(i) Propan -2 - one Acetone



(ii) Bromo Ethane



(iii) Benzene



27. A colourless gas 'X' has a formula C_3H_6 . It decolorises bromine water. Write the chemical name of 'X'.

2014/2015 [1 Mark]

X is propene ($H_3C-HC=CH_2$)

28. An organic compound 'X' of molecular formula C_2H_4 on addition of H_2 gives another compound 'Y' of molecular formula C_2H_6 . 'Y' on reaction with bromine in presence of sunlight gives 'Z' of molecular formula C_2H_5Br .

(i) Name the compound 'X', 'Y', and 'Z'.

(ii) Write the equation for the conversion of 'X' to 'Z' and name the type of reaction.

2015/2016 [3 Marks]

$$(ii) \quad \begin{array}{c} \text{H} & & \text{H} \\ & \backslash & / \\ & \text{C} = \text{C} \\ & / & \backslash \\ \text{H} & & \text{H} \end{array} \xrightarrow[\text{Addition reaction}]{\text{H}_2/\text{Pd or H}_2/\text{Ni}} \begin{array}{c} \text{H} & \text{H} \\ | & | \\ \text{H}-\text{C}- & \text{C}-\text{H} \\ | & | \\ \text{H} & \text{H} \end{array} \xrightarrow[\text{Substitution reaction}]{\text{Br}_2, \text{Light}} \begin{array}{c} \text{H} & \text{H} \\ | & | \\ \text{H}-\text{C}- & \text{C}-\text{Br} \\ | & | \\ \text{H} & \text{H} \\ & | \\ & \text{H} \end{array}$$

(i) Write the chemical equation for the reaction between propene and hydrogen.

(ii) Write the significance of this reaction in our daily life. Mention the function of Ni in this reaction.

$$(i) \quad \begin{array}{c} \text{H} \quad \text{H} \quad \text{H} \\ | \quad | \quad / \\ \text{H}-\text{C}-\text{C}=\text{C} + \text{H}_2 \\ | \quad \quad \backslash \\ \text{H} \quad \quad \text{H} \end{array} \xrightarrow{\text{Ni or Pd}} \begin{array}{c} \text{H} \quad \text{H} \quad \text{H} \\ | \quad | \quad | \\ \text{H}-\text{C}-\text{C}-\text{C}-\text{H} \\ | \quad | \quad | \\ \text{H} \quad \text{H} \quad \text{H} \end{array}$$

(Propene) (Propane)

2014/2015 [3 Marks]

| S. No. | Test | Ethanol | Ethanoic acid |
|--------|---|-------------------------------|--|
| 1. | Litmus test | Does not affect litmus paper. | It turns blue litmus red. |
| 2. | Reaction with NaHCO_3 | It does not react. | Effervescence is observed due to the evolution of CO_2 gas. |
| 3. | Added $\text{C}_2\text{H}_5\text{OH}$ in presence of few drops of conc. H_2SO_4 and heated. | | Fruity smell is observed due to the formation of ester. |

(i) Ethanol to ethene (ii) Ethanoic acid to ester (iii) Ester to ethanol

$$\text{CH}_3\text{CH}_2\text{OH} \xrightarrow[443\text{ K}]{\text{Conc. H}_2\text{SO}_4} \text{CH}_2=\text{CH}_2 + \text{H}_2\text{O}$$

(Ethanol) (Ethene)

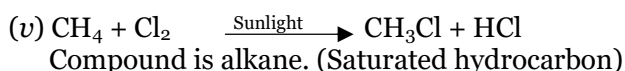
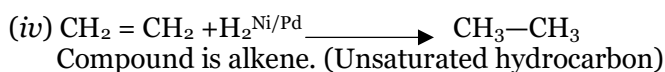
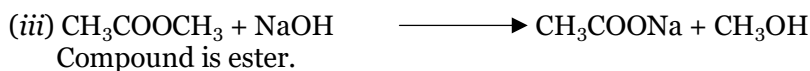
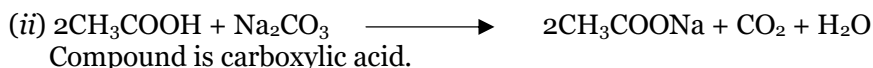
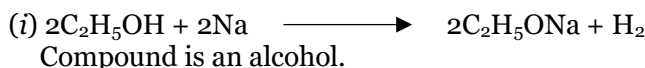
$$\begin{array}{ccccccc} \text{CH}_3\text{COOH} & + & \text{CH}_3\text{CH}_2\text{OH} & \xrightarrow{\text{H}^+} & \text{CH}_3\text{COOC}_2\text{H}_5 & + & \text{H}_2\text{O} \\ \text{(Ethanoic acid)} & & \text{(Ethanol)} & & \text{(Ethyl ethanoate)} & & \end{array}$$
$$\text{CH}_3\text{COOC}_2\text{H}_5 \xrightarrow{\text{NaOH}} \text{C}_2\text{H}_5\text{OH} + \text{CH}_3\text{COONa}$$

(Ester) (Ethanol)

32. Classify the following organic compounds on the basis of their unique chemical properties. Write the chemical equation for the one indicated in the column:

| Compounds | Reaction with |
|--|---|
| (i) C ₂ H ₅ OH | Sodium |
| (ii) CH ₃ COOH | Sodium carbonate |
| (iii) CH ₃ COOCH ₃ | Sodium hydroxide |
| (iv) CH ₂ =CH ₂ | Hydrogen |
| (v) CH ₄ | Chlorine molecule (in presence of sunlight) |

2014/2015 [5 Marks]

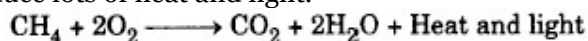


33. Explain the following terms with the help of chemical reaction:

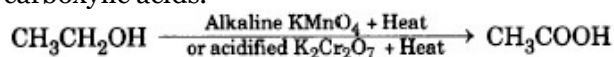
- (i) Oxidation reaction (ii) Hydrogenation reaction
(iii) Substitution reaction (iv) Esterification reaction
(v) Saponification reaction

2014/2015 [5 Marks]

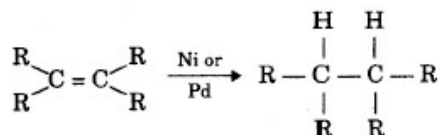
(i) Oxidation reaction: Hydrocarbons burn in excess of oxygen to form CO₂ and H₂O and produce lots of heat and light.



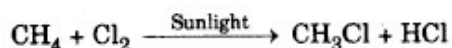
In addition of this complete oxidation, in some other reactions alcohols are converted to carboxylic acids.



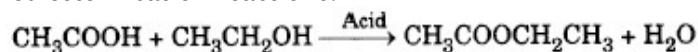
(ii) Hydrogenation reaction: Unsaturated hydrocarbons add hydrogen in the presence of catalysts such as palladium or nickel to give saturated hydrocarbons. Such reactions are called hydrogenation reactions. This reaction is commonly used in the hydrogenation of vegetable oils into saturated fats.



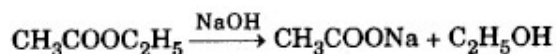
(iii) Substitution reactions: These are the reactions in which some atoms such as chlorine replace hydrogen atoms from saturated hydrocarbons one by one in the presence of sunlight. A number of products are usually formed with the higher homologues of alkanes.



(iv) Esterification reaction: The reactions in which alcohols react with carboxylic acid in presence of an acid to form sweet-smelling products, called ester are called esterification reactions.



(v) Saponification reaction: On treating with sodium hydroxide, which is an alkali, the ester is converted back to alcohol and sodium salt of carboxylic acid. This reaction is called saponification because it is used in the preparation of soap.



34. A compound 'X' has molecular formula $\text{C}_3\text{H}_8\text{O}$ which reacts with Na metal to produce H_2 gas. Identify the compound and functional group present in the compound.

(i) Write all possible isomers of the compound.

(ii) Write the reaction of the compound with Na metal.

2014/2015 [5 Marks]

Compound 'X' is propanol and the functional group is alcohol.

(i) **Isomers of propanol:**

