SCIENCE

Carbon and its Compounds

51. (a) In tabular form, differentiate between ethanol and ethanoic acid under the following heads:

(i) Physical state (ii) Taste

(iii) $NaHCO_3$ test (iv) Ester test

(b) Write a chemical reaction to show the dehydration of ethanol.

Ans: (a)

Properties	Ethanol	Ethanoic acid
(i) Physical state	It is liquid with specific smell.	It is also liquid with vinegar like smell.
(ii) Taste	It has burning taste.	It has sour taste.
(iii) $NaHCO_3$ test	It does not react.	It gives brisk effervescence due to CO_2.
(iv) Ester test	Add acetic acid and conc. H_2SO_4, pleasant fruity smelling compound, ester is formed.	Add ethyl alcohol and conc. H_2SO_4, pleasant fruity smelling compound, ester is formed.

(b) $\underset{\text{Ethanol}}{CH_3CH_2OH} \xrightarrow[443\,K]{\text{conc. } H_2SO_4} \underset{\text{Ethene}}{CH_2=CH_2} + H_2O$

52. (a) State two properties of carbon which lead to a very large number of carbon compounds

(b) Why does micelle formation take place when soap is added to water? Why are micelles not formed when soap is added to ethanol?

Ans: (a) (i) Catenation (ii) Tetravalency

(b) It is because large numbers of molecular ions of soaps get aggregated and form colloidal solution. Soap has hydrophobic tail (hydrocarbon) which dissolves in hydrocarbon part and hydrophilic part dissolves in water. Ethanol is non-polar solvent therefore micelles are not formed because hydrocarbon part get attracted towards ethanol and ionic end will not dissolve in alcohol.

53. Explain isomerism, state any four characteristics of isomers. Draw the structures of possible isomers of butane, C_4H_{10}

Ans: Isomerism is a phenomenon due to which some compounds have same molecular formula but different structural formulae.

Characteristics:

(i) They differ in structural formula.

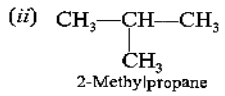
(ii) They differ in melting point.

(iii) They differ in boiling point.

(iv) They differ in solubility in same solvent.

There are two isomers of butane, C_4H_{10}.

(i) $\underset{\text{n-Butane}}{CH_3-CH_2-CH_2-CH_3}$

(ii) 

2-Methylpropane

54. Give reasons for the following:

(i) Element carbon forms compounds mainly by covalent bonding.

(ii) Diamond has a high melting point.

(iii) Graphite is a good conductor of electricity.

(iv) Acetylene burns with a sooty flame.

(v) Kerosene does not decolourise bromine water while cooking oils do.

Ans: (i) It is because carbon has four valence electrons; it cannot gain or lose four electrons because high energy is needed. It can only share four electrons.

(ii) It is due to strong covalent bonds and compact structure of diamond.

(iii) It is due to presence of free electrons in graphite because each carbon is linked to three more carbon atoms.

(iv) It is due to high percentage of carbon, it burns with sooty or smoky flame.

(v) Kerosene oil is mixture of saturated hydrocarbons therefore does not decolourise bromine water.

55. An organic compound 'A' is widely used as a preservative in pickles and has a molecular formula $C_2H_4O_2$. This compound reacts with ethanol to form a sweet smelling compound 'B'.

(i) Identify the compound 'A'

(ii) Write the chemical equation for its reaction with ethanol to form compound 'B'

(iii) How can we get compound 'A' back from 'B'?

(iv) Name the process and write corresponding chemical equation.

(v) Which gas is produced when compound 'A' reacts with washing soda? Write the chemical equation.

Ans: (i) 'A' is Ethanoic acid / Acetic acid.

(ii) $\underset{\text{'A'}}{CH_3COOH} + C_2H_5OH \rightarrow \underset{\text{'B'}}{CH_3COOC_2H_5} + H_2O$

(iii) When 'A' reacts with dilute solution of NaOH, as ester converts into acid and alocohol.

(iv) It is a saponification process.

$\underset{\text{'B'}}{CH_3COOC_2H_5} + H_2O \xrightarrow{NaOH} \underset{\text{'A'}}{CH_3COOH} + C_2H_5OH$

(v) CO_2 gas is produced when 'A' CH_3COOH reacts with Na_2CO_3 (washing soda).

56. A compound 'X' is formed by the reaction of carboxylic acid $C_2H_2O_4$ and an alcohol in the presence of Conc. H_2SO_4. This alcohol on treating with alkaline $KMnO_4$ gives the same carboxylic acid used in the reaction. Give the name and structure of carboxylic acid, alcohol. Write the reaction involving formation of 'X'.

Ans:

$CH_3COOH\,(l) + C_2H_5OH\,(l) \xrightarrow{\text{conc. } H_2SO_4} CH_3COOC_2H_5\ \text{'X'} + H_2O$

$CH_3CH_2OH + 2[O] \xrightarrow[KMnO_4]{\text{Alkaline}} \underset{\text{Ethanoic acid}}{CH_3COOH}$