

Carbon and Its Compounds

ONE MARK QUESTIONS

1. Write the molecular formula of first two members of homologous series having functional group —Cl.

Ans : [CBSE 2017]

- (1) CH_3Cl Chloromethane
(2) $\text{CH}_3\text{CH}_2\text{Cl}$ Chloroethane

2. Write the molecular formula of first two members of homologous series having functional group —Br.

Ans : [CBSE 2017]

- (1) CH_3Br Bromomethane
(2) $\text{C}_2\text{H}_5\text{Br}$ Bromoethane

3. Write the molecular formula of first two members of homologous series having functional group —OH.

Ans : [CBSE 2017]

- (1) CH_3OH Methanol
(2) $\text{C}_2\text{H}_5\text{OH}$ Ethanol

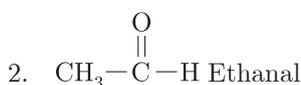
4. Write the molecular formula of 2nd and the 3rd member of homologous series whose first member is methane.

Ans : [CBSE 2017]

- (1) $\text{CH}_3\text{—CH}_3$ Ethane
(2) $\text{CH}_3\text{—CH}_2\text{—CH}_3$ Propane

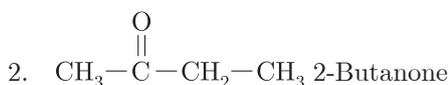
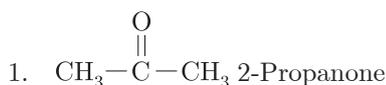
5. Write the formula of first two members of homologous series whose functional group is —CHO.

Ans : [CBSE 2017]



6. Write the formula of first two members of homologous series whose functional group is >C=O .

Ans : [CBSE 2017]



7. Write the molecular formula of the first two members of the homologous series having functional group —COOH.

Ans : [CBSE 2017]

- (1) HCOOH Methanoic acid
(2) CH_3COOH Ethanoic acid

8. Write the molecular formula of 2nd and 3rd member of the homologous series whose first member is ethyne.

Ans : [CBSE 2017]

- (1) $\text{HC}\equiv\text{C—CH}_3$ Propyne
(2) $\text{HC}\equiv\text{C—CH}_2\text{—CH}_3$ 1-Butyne

9. Write the molecular formula of 2nd and 3rd member of the homologous series whose first member is ethene.

Ans : [CBSE 2017]

- (1) $\text{CH}_2=\text{CH—CH}_3$ Propene
(2) $\text{CH}_2=\text{CH—CH}_2\text{—CH}_3$ 1-Butene

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10. Write the next homologue of each of the following:

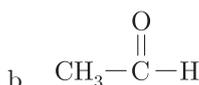
- a. C_2H_4
b. C_4H_6

Ans : [CBSE 2016]

- (1) C_3H_6 , $\text{CH}_2=\text{CH—CH}_3$
(2) C_5H_8 , $\text{HC}\equiv\text{C—CH}_2\text{—CH}_2\text{—CH}_3$

11. Name the following compounds:

- a. $\text{CH}_3\text{CH}_2\text{OH}$



Ans : [CBSE 2016]

- a. Ethanol
b. Ethanal

12. Select the saturated hydrocarbons from the following:
 C_3H_6 , C_5H_{10} , C_4H_{10} , C_6H_{14} , C_2H_4

Ans : [CBSE 2016]

C_4H_{10} , C_6H_{14} are saturated hydrocarbons

13. Write the name and structure of an alcohol with three

carbon atoms in its molecules.

Ans : [CBSE 2016]

$\text{CH}_3\text{CH}_2\text{CH}_2\text{OH}$, 1-Propanol

14. Write the name and structure of an alcohol with four carbon atoms in its molecule.

Ans : [CBSE 2016]

$\text{CH}_3\text{CH}_2\text{CH}_2\text{CH}_2\text{OH}$, 1-Butanol

15. Write the name and structure of an aldehyde with four carbon atoms in its molecule.

Ans : [CBSE 2016]



16. Which element exhibits the property of catenation to maximum extent and why?

Ans : [CBSE 2016]

Carbon because it can form strong covalent bond with other carbon atoms due to smaller size.

17. Write the name and formula of fourth member of alkane series.

Ans : [CBSE 2016]

$\text{CH}_3-\text{CH}_2-\text{CH}_2-\text{CH}_3$, Butane

18. What is a homologous series of carbon compounds?

Ans : [CBSE 2016]

Homologous series is series of organic compounds which have same functional group and similar chemical properties and each successive member has more $-\text{CH}_2-$ unit than the previous one.

19. A colourless gas X has a formula C_3H_6 . It decolourises bromine water. Write the chemical formula of 'X'.

Ans : [CBSE 2016]

$\text{CH}_2=\text{CH}-\text{CH}_3$, Propene

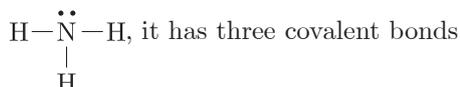
20. Draw the structural formula of methanoic acid.

Ans : [CBSE 2016]



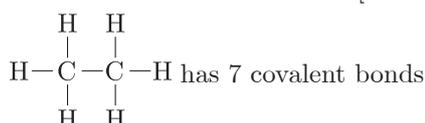
21. A molecule of ammonia has the formula NH_3 . Predict the total number of bonds present around nitrogen atom.

Ans : [CBSE 2016]



22. Write the number of covalent bonds in the molecule of ethane.

Ans : [CBSE 2016,2015,2011]



23. Write the next homologue of propanol $\text{CH}_3\text{CH}_2\text{CH}_2\text{OH}$ and butanal $\text{CH}_3\text{CH}_2\text{CH}_2\text{CHO}$.

Ans : [CBSE 2016,2011]

- a. $\text{CH}_3\text{CH}_2\text{CH}_2\text{CH}_2\text{OH}$, Butanol
b. $\text{CH}_3\text{CH}_2\text{CH}_2\text{CH}_2\text{CHO}$, Pentanal

24. Unsaturated hydrocarbon gives a yellow flame with lot of black smoke when burnt in oxygen. Give reason.

Ans : [CBSE 2015]

Unsaturated hydrocarbons have more amount of carbon, therefore burns with smoky flame due to incomplete combustion.

25. Write molecular formula of alcohol which can be derived from butane.

Ans : [CBSE 2015]

$\text{CH}_3\text{CH}_2\text{CH}_2\text{CH}_2\text{OH}$, 1-Butanol

26. Carbon has four electrons in its valence shell. How does carbon attain stable electronic configuration?

Ans : [CBSE 2015]

Carbon can share four electrons to acquire stable electronic configuration.

27. Write the name and formula of 2nd member of homologous series having general formula C_nH_{2n} .

Ans : [CBSE 2015]

$\text{CH}_2=\text{CH}-\text{CH}_3$ is second member of alkene.

28. Write the name and formula of 2nd member of homologous series having general formula $\text{C}_n\text{H}_{2n+2}$.

Ans : [CBSE 2015]

CH_3-CH_3 , Ethane

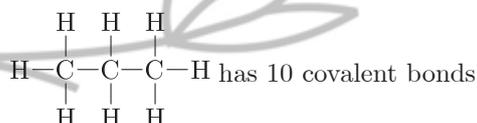
29. Write the name and formula of 2nd member of homologous series having general formula $\text{C}_n\text{H}_{2n-2}$.

Ans : [CBSE 2015]

$\text{HC}\equiv\text{C}-\text{CH}_3$, Propyne

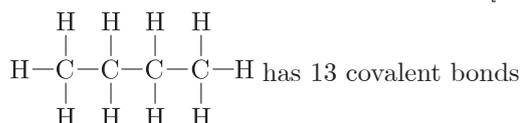
30. Write the number of covalent bonds in the molecule of propane, C_3H_6 .

Ans : [CBSE 2015]



31. Write the number of covalent bonds in the molecular formula of butane, C_4H_{10} .

Ans : [CBSE 2015]



32. Name the process by which unsaturated fats are changed into saturated fats.

Ans : [CBSE 2015]

Hydrogenation

33. Write the name of each of the following functional

groups:



Ans : [CBSE2015]

- a. Alcohol
b. Ketone

34. Write the name and molecular formula of the first member of homologous series of alkynes.

Ans : [CBSE2015]

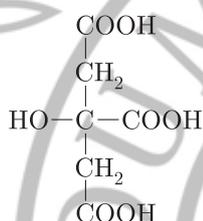
HC=CH, Ethyne

35. Mention the functional group which always occurs at the terminal position of a carbon chain of an organic compound.

Ans : [CBSE 2015]

- a. Aldehyde
b. Carboxylic acid

36. The formula of citric acid is shown below:



State the name of —COOH functional group in citric acid.

Ans : [CBSE 2014]

Carboxylic acid

37. Name the functional group in the following compounds:

- a. $\text{CH}_3-\text{CH}_2-\text{CH}_2-\text{COOH}$
b. $\text{CH}_3-\text{CO}-\text{CH}_2-\text{CH}_3$

Ans : [CBSE 2014]

- a. Carboxylic acid
b. Ketone

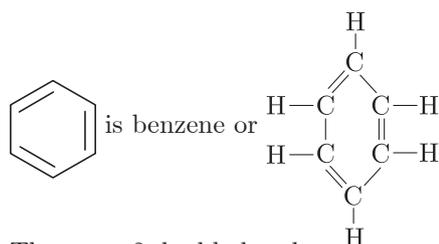
38. State the valency of each carbon atom in (i) an alkane and (ii) an alkyne.

Ans : [CBSE 2014]

- i. The valency of 'C' in alkane is 4.
ii. The valency of 'C' in alkyne is also 4.

39. Write the molecular formula of benzene and state the number of double bonds in its structure.

Ans : [CBSE 2014]



These are 3 double bonds.

40. List two characteristic features of carbon which when put together given rise to a number of carbon

compounds.

Ans : [CBSE 2014,2010]

(a) Tetravalency (b) Catenation

41. The molecular formula of A is $\text{C}_{10}\text{H}_{18}$ and B is $\text{C}_{18}\text{H}_{36}$. Name the homologous series to which they belong.

Ans : [CBSE 2014]

$\text{C}_{10}\text{H}_{18}$ belongs to alkyne, $\text{C}_{18}\text{H}_{36}$ belongs to alkene.

42. Write the names of next homologue of $\text{CH}_3\text{CH}_2\text{OH}$ and HCOOH .

Ans : [CBSE 2014]

- (i) $\text{CH}_3\text{CH}_2\text{CH}_2\text{OH}$, Propanol
(ii) CH_3COOH , Ethanoic acid

43. Will micelle formation take place when soap is dissolved in organic solvent?

Ans : [CBSE 2014]

No, micelles will not be formed in organic solvent.

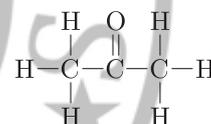
44. Explain why washing clothes with hard water is not effective.

Ans : [CBSE 2014]

Soap reacts with Ca^{2+} and Mg^{2+} ions present in hard water to form scum.

45. Draw the structure of simplest ketone.

Ans : [CBSE 2014,2011]



46. Why do alkanes burn with blue flame?

Ans : [CBSE 2013]

It is because they have less carbon and more hydrogen, therefore, undergo complete combustion and produce blue flame.

47. What happens when a small piece of sodium is dropped into ethanol?

Ans : [CBSE 2013,2011]

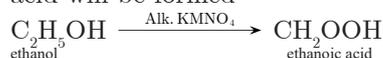
Sodium ethoxide and H_2 gas is formed



48. What will you observe on adding a 5% alkaline KMnO_4 solution drop by drop to some warm ethanol taken in a test tube? Write the name of the compound formed during the above chemical reaction.

Ans : [CBSE 2013,2011]

The purple colour of KMnO_4 decolourises and ethanoic acid will be formed



49. How is scum formed?

Ans : [CBSE 2012]

Ca^{2+} and Mg^{2+} ions react with soap (sodium stearate)

to form calcium and magnesium stearate which is insoluble in water and called scum.

50. Name the functional group present in each of the following organic compounds:

- C_2H_5-Cl
- C_2H_5OH

Ans : [CBSE 2012]

- Halogen
- Alcohol

51. Name the functional group present in each of the following compounds:

- $HCOOH$
- C_2H_5CHO

Ans : [CBSE 2012]

- Carboxylic acid
- Aldehyde

52. Name the functional group present in each of the following compounds:

- CH_3COCH_3
- C_2H_5COOH

Ans : [CBSE 2012]

- Ketone
- Carboxylic acid

53. Write the name and formula of the second member of carbon compounds having functional group $-OH$.

Ans : [CBSE 2012]

CH_3CH_2OH , Ethanol

54. Write the name and formula of the first member of series of carbon compound having functional group $-CHO$.

Ans : [CBSE 2012]

$\begin{array}{c} O \\ || \\ H-C-H \end{array}$ Methanal

55. Write the name and formula of the first member of carbon compounds having functional group $-COOH$.

Ans : [CBSE 2012]

$\begin{array}{c} O \\ || \\ H-C-OH \end{array}$ Methanoic acid

56. Write the name and formula of the 2nd member of the series of carbon compounds whose general formula is $C_nH_{2n+1}-OH$.

Ans : [CBSE 2012]

C_2H_5OH , Ethanol

57. Write the name and formula of 2nd member of the series of carbon compounds whose general formula is C_nH_{2n} .

Ans : [CBSE 2012]

$CH_2=CH-CH_3$, Propene

58. State the difference between oils and fats.

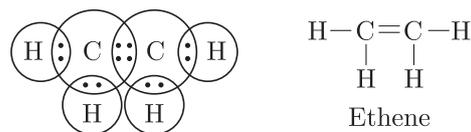
Ans : [CBSE Sample Paper 2012]

Oils are unsaturated whereas fats are saturated

compounds.

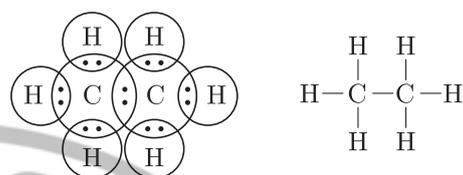
59. Write the electron dot structure of ethene molecule (C_2H_4).

Ans : [CBSE 2011]



60. Write the electron dot structure of ethane molecule C_2H_6 .

Ans : [CBSE 2011]



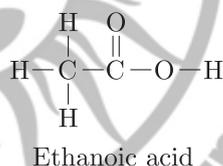
61. Draw the structure of butanone molecule, $CH_3COC_2H_5$.

Ans : [CBSE 2011]



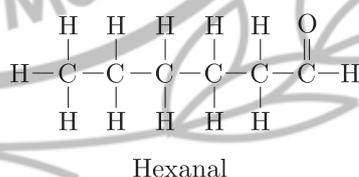
62. Draw the structure of ethanoic acid molecule, CH_3COOH .

Ans : [CBSE2011]



63. Draw the structure of the hexanal molecule $C_5H_{11}CHO$.

Ans : [CBSE2011]

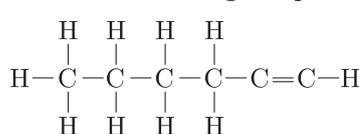


64. Butanone has four carbon per molecule of a compound. Name the functional group present in it.

Ans : [CBSE 2011]

Ketone

65. Name the following compound:

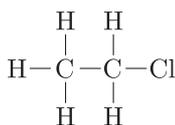


Ans : [CBSE 2011]

1-Hexyne

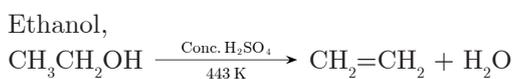
66. Write the structural formula of chloroethane.

Ans : [CBSE 2010]



67. Name the carbon compound which on heating with excess of cone. H_2SO_4 at 443 K gives ethene.

Ans : [CBSE 2009 (C)]



68. What is meant by saturated hydrocarbon?

Ans : [CBSE 2009 (C)]

Those hydrocarbons in which valency of carbon is satisfied by single bonds only are called saturated hydrocarbons.

69. Name the compound formed when ethanol is warmed with ethanoic acid in the presence of few drops of cone. H_2SO_4 .

Ans : [CBSE 2009 (C)]



70. What is the difference in the molecular formula of any two consecutive members of homologous series of organic compounds?

Ans : [CBSE 2008 (C)]

The difference between successive members of homologous series is of $-\text{CH}_2$ unit.

TWO MARKS QUESTIONS

71. Draw the structural formulae of the possible isomers for the compound with molecular formula $\text{C}_3\text{H}_6\text{O}$.

Ans : [CBSE Sample Paper 2017]



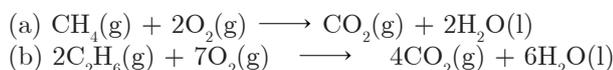
72. Explain why cannot we have isomers of first three members of alkane family.

Ans : [CBSE Sample Paper 2017, CBSE 2015]

It is because branching is not possible with carbon atoms, that is why, there are no isomers till propane.

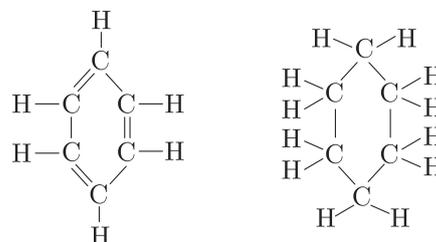
73. Write balanced equations for the burning of (a) methane (b) ethane in air.

Ans : [CBSE 2017]

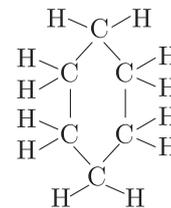


74. Compare the structures of benzene and cyclohexane by drawing them.

Ans : [CBSE 2017]



Benzene



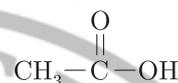
Cyclohexane

Benzene has 3 double bonds whereas cyclohexane has all single bonds.

75. a. Write chemical name and formula of vinegar?
 b. Describe with a chemical equation what happens when sodium reacts with ethanol.

Ans : [CBSE 2017,2012]

a. Vinegar contains ethanoic acid,



b. Sodium ethoxide and hydrogen gas is formed.



76. State reasons to explain why covalent compounds:

- are bad conductors of electricity?
- have low melting and boiling points?

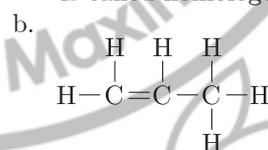
Ans : [CBSE 2016]

- Covalent compounds do not form ions, hence they are bad conductor of electricity.
- Covalent compounds have weak intermolecular forces of attraction, therefore, have low melting and boiling points.

77. What is homologous series? Write the name and draw the structure of the second member of alkene series.

Ans : [CBSE 2016]

a. The series of organic compounds having same functional group and similar chemical properties is called homologous series.



Propene

78. List two characteristics of covalent compounds.

Ans : [CBSE 2015]

- They have low melting and boiling point.
- They do not conduct electricity.

79. Name an element, other than carbon, which exhibits property of catenation up to seven or eight atoms. Are these compounds stable?

Ans : [CBSE 2015]

Si and Sulphur (S_8).

No, these compounds are not stable, rather they are reactive.

80. Select alkenes and alkynes from the following:



Ans : [CBSE 2015,2014]

Alkenes C_2H_4 , C_4H_8 Alkynes C_3H_4 , C_2H_2

81. Why are detergents preferred over soaps for washing clothes in hard water? Explain.

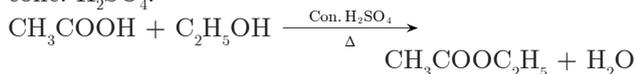
Ans : [CBSE 2015,2014]

Detergents work well even with hard water because their calcium and magnesium salts are soluble in water. They do not form scum.

82. What happens when ethyl alcohol and acetic acid react with each other in presence of cone. H_2SO_4 ?

Ans : [CBSE 2015,2013,2011]

Pleasant fruity smelling compound ester is formed cone. H_2SO_4 .



83. Name the functional groups of the following compounds:



Ans : [CBSE 2013]

- a. Carboxylic acid
b. Ester
c. Alcohol
d. Halogen

84. Why is hydrogenation? What is its industrial application?

Ans : [CBSE 2015,2014]

Hydrogenation is a process of adding hydrogen to unsaturated compounds in presence of catalyst like nickel to form saturated hydrocarbons. Industrially, it is used to convert vegetable oils to vegetable ghee.

85. List four characteristics of homologous series.

Ans : [CBSE 2014]

- a. All members are derived from same general formula.
b. All members have same functional group.
c. Each successive member differ by $-CH_2$ unit.
d. All members can be prepared by same methods of preparation.

86. Carbon does not form ionic compounds, why?

Ans : [CBSE 2015,2013]

Carbon cannot lose four electrons because high energy is needed to remove four electrons. It cannot gain 4 electrons because 6 protons cannot hold 10 electrons. That is why carbon cannot form ionic compounds.

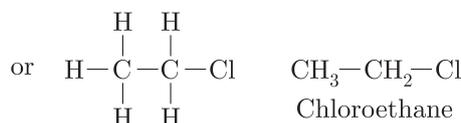
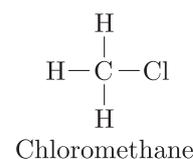
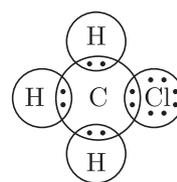
87. What are soaps? Why do they form scum with hard water?

Ans : [CBSE 2013]

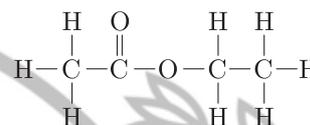
Soaps are sodium or potassium salts of fatty acids e.g. sodium stearate. They react with Ca^{2+} and Mg^{2+} ions in hard water to form calcium and magnesium salt of fatty acids which are insoluble in water and called scum.

88. Give the electron dot structure of chloro-methane. Also write the formula and the name of next homologue of it.

Ans : [CBSE 2015]

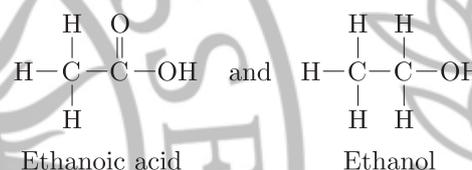


89. The structural formula of an ester is



Write the structural formula of the corresponding alcohol and acid.

Ans : [CBSE 2015]



90. How do the melting and boiling points of the hydrocarbons change with increase in molecular mass?

Ans : [CBSE 2012]

Melting and boiling point of the hydrocarbons increases with increase in molecular mass because surface area increases which results an increase in vander Waal's forces of attraction between molecules.

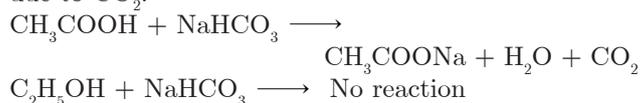
91. Write a chemical test to distinguish between ethanol and ethanoic acid.

or

How would you distinguish experimentally between ethanol and ethanoic acid with the help of sodium hydrogen carbonate? Write the chemical equation for the reaction involved.

Ans : [CBSE 2012]

Add $NaHCO_3$ to each of them separately. Ethanol will not react. Ethanoic acid will give brisk effervescence due to CO_2 .



92. Explain the action of soap in removing an oily spot from a piece of cloth.

Ans : [CBSE 2011]

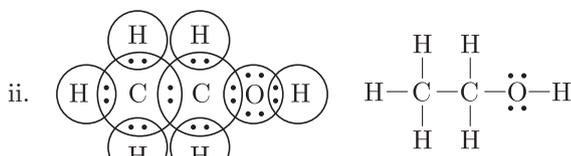
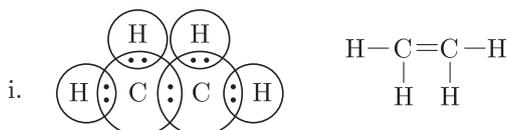
Cleansing action of soap: Soap has ionic end which is hydrophilic, interacts with water while carbon chain is hydrophobic interacts with oil, grease. The soap molecules orient themselves in a cluster in which hydrophobic tails are inside the cluster and ionic ends

face outside.

These cluster are called micelles. These attract oil which is washed away by water.

93. Draw electron dot structures of (i) C_2H_4 (ii) C_2H_5OH .

Ans : [CBSE 2011]



94. Give reasons for the following:

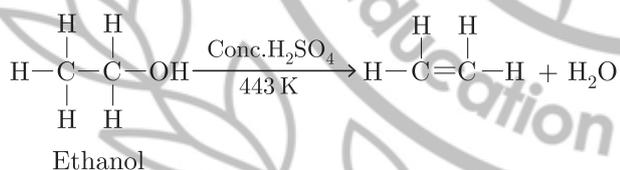
- Unsaturated hydrocarbons show addition reactions but not saturated hydrocarbons.
- Carbon forms only covalent bonds.

Ans : [CBSE 2011]

- Unsaturated hydrocarbons have double or triple bonds to which a molecule can be added whereas saturated hydrocarbons have single bonds addition reaction cannot take place.
- It cannot lose four electrons because high energy is required. It cannot gain four electrons because 6 protons cannot hold 10 electrons. Thus it shares four electrons to form covalent bonds and become stable.

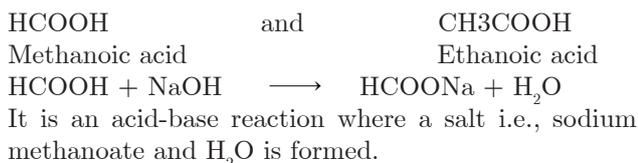
95. Write the name and molecular formula of an organic compound having its name suffixed with '—ol' and having two carbon atoms in the molecule. With the help of a balanced chemical equation indicate what happens when it is heated with excess of conc. H_2SO_4 .

Ans : [CBSE 2010]

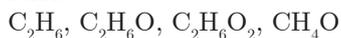


96. Write the names and molecular formulae of two organic compounds having functional group suffixed as '—oic acid'. With the help of a balanced chemical equation explain what happens when any one of them reacts with sodium hydroxide.

Ans : [CBSE 2010]



97. What is homologous series? Which of the following organic compounds belong to the same homologous series?



Ans : [CBSE 2010]

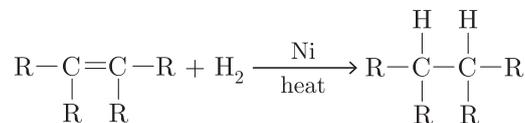
The series of organic compounds having same functional group and similar chemical properties is

called homologous series.

C_2H_6O (C_2H_5OH) and CH_4O (CH_3OH) belong to same homologous series.

98. With the help of a suitable example explain in brief the process of hydrogenation mentioning the conditions of the reaction and also state any one physical property of substances changes due to hydrogenation.

Ans : [CBSE 2010]

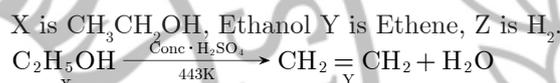


Liquid oil changes to solid ghee

THREE MARKS QUESTIONS

99. A compound X on heating with excess of conc. H_2SO_4 at 443 K gives an unsaturated compound Y. X also reacts with sodium metal to evolve a colourless gas Z. Identify X, Y and Z. Write the equations of the chemical reaction of formation of Y and also write the role of conc. sulphuric acid in the reaction.

Ans : [CBSE 2016]

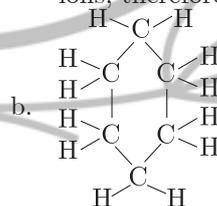


Conc. H_2SO_4 acts as dehydrating agent.

100. a. Why are most carbon compounds poor conductors of electricity?
b. Write the name and structure of a saturated compound in which carbon atoms are arranged in a ring. Give the number of single bonds present in this compound.

Ans : [CBSE 2018]

- a. It is because covalent compounds do not form ions, therefore, do not conduct electricity.

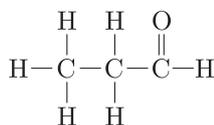


Cyclohexane

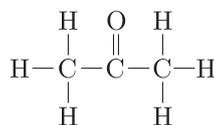
It has 18 single bonds.

101. Draw the structural formula of all the possible isomers of the compound with the molecular formula C_3H_6O and also give electron dot structures.

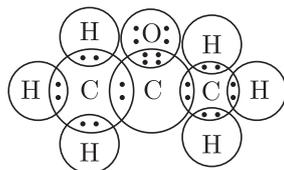
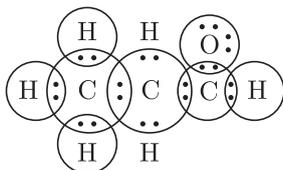
Ans : [CBSE Sample Paper 2018] [CBSE 2013]



Propanal

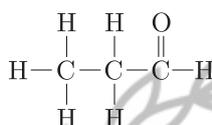
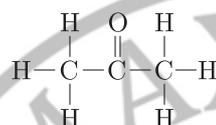


Propanone



102. An aldehyde as well as ketone can be represented by the same molecular formula say $\text{C}_3\text{H}_6\text{O}$. Write their structures and name them. State the relationship between two in language of science.

Ans : [CBSE Sample Paper 2017-2018, CBSE 2016]

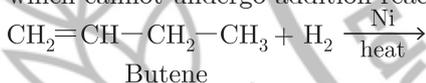
Propanal
(Aldehyde)Propanone
(Ketone)

These are functional isomers.

103. The carbon compounds X and Y have the molecular formula C_4H_8 and C_5H_{12} respectively. Which one of these is most likely to show addition reaction? Justify your answer. Also give chemical equations to explain the process of addition reaction in this case.

Ans : [CBSE 2017]

C_4H_8 will undergo addition reaction. It is because it has double bond while C_5H_{12} is a saturated hydrocarbon which cannot undergo addition reaction.

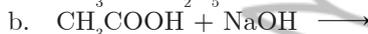


Butene

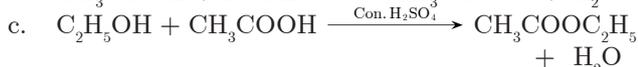
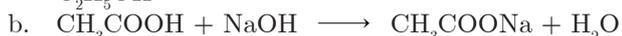


Butane

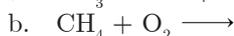
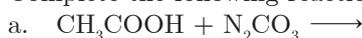
104. Complete the following equations:



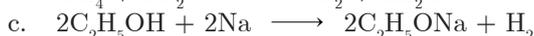
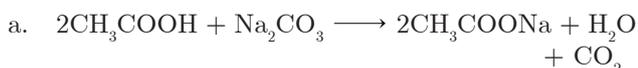
Ans : [CBSE 2017]



105. Complete the following reactions:



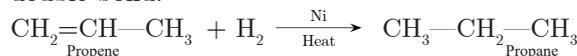
Ans : [CBSE 2017]



106. Two carbon compounds 'X' and 'Y' have the molecular formula C_3H_6 and C_4H_{10} respectively. Which one of the two is most likely to show addition reaction? Justify your answer. Also give chemical equation to explain the process of addition in this case.

Ans : [CBSE 2017]

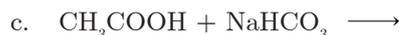
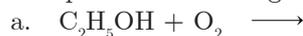
C_3H_6 will undergo addition reaction because it has double bond.



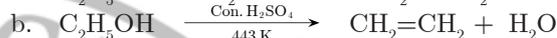
Propene

Propane

107. Complete the following chemical reactions:



Ans : [CBSE 2017]



108. The molecular formula of two carbon compounds are C_4H_8 and C_5H_{12} . Which one is most likely to show addition reaction? Justify your answer. Also give the chemical equation to explain the process of addition reaction in this case.

Ans : [CBSE 2017]

C_4H_8 will undergo addition reaction. It is because it is unsaturated compound.



109. Write the structural formula of ethanol. What happens when it is heated with excess of conc. H_2SO_4 at 443 K? Write the chemical equation for the reaction stating the role of conc. H_2SO_4 in this reaction.

Ans : [CBSE 2017]

$\text{CH}_3\text{CH}_2\text{OH}$, Ethanol

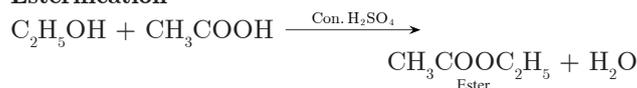


Concentrated H_2SO_4 is dehydrating agent.

110. Distinguish between esterification and saponification reaction with the help of equations for each. State one use of each (i) esters and (ii) saponification process.

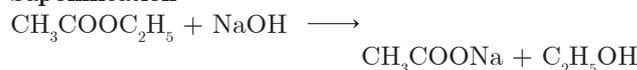
Ans : [CBSE 2017]

Esterification



Ester

Saponification



Esters are used in synthetic flavours, perfumes, etc.

Saponification process is used for manufacture of soaps.

111. What happens when:
(Write chemical equation in each case)

- Ethanol is burnt in air?
- Ethanol is heated with excess conc. H_2SO_4 at 443 K?
- A piece of sodium is dropped in ethanol.

Ans : [CBSE 2017]

- CO_2 and H_2O are formed.
 $C_2H_5-OH + 3O_2 \longrightarrow 2CO_2 + 3H_2O$
- Ethene is formed
 $CH_3CH_2OH \xrightarrow[443\text{K}]{\text{Con. } H_2SO_4} CH_2=CH_2 + H_2O$
- Hydrogen gas evolves out
 $2CH_3CH_2OH + 2Na \longrightarrow 2CH_3CH_2ONa + H_2$

- 112.** Explain esterification reaction with the help of a chemical equation. Describe an activity to show esterification.

Ans : [CBSE 2017]

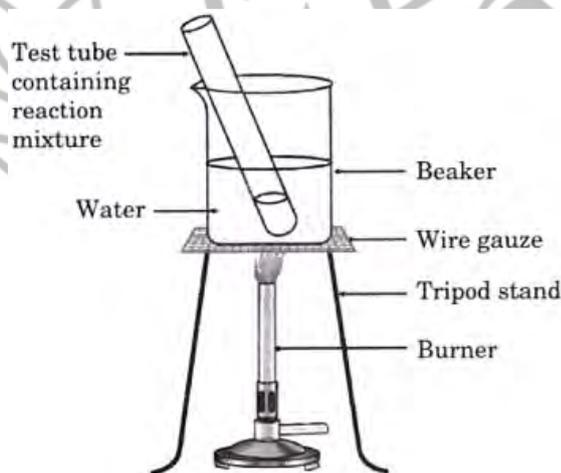
Esterification is the process in which carboxylic acid reacts with alcohol in presence of conc. H_2SO_4 to form pleasant fruity smelling compound ester.



Activity:

To carry out esterification reaction.

- Take 2 mL of ethanol (100% alcohol) in a test tube.
- Add 2 mL of glacial acetic acid.
- Add few drops of conc. H_2SO_4 .
- Set the apparatus as shown in diagram.
- Heat the mixture in test tube in water bath for 5 to 10 minutes observe what happens.
- Observation:** Pleasant fruity smell is observed.
- Conclusion:** Ester is formed.



- 113.** Name two oxidising agents that are used to convert alcohols to acids. Distinguish between ethanol and ethanoic acid on the basis of (a) litmus test (b) reaction with $NaHCO_3$.

Ans : [CBSE 2017]

These two oxidising agents will convert alcohols to acids (i) Alkaline $KMnO_4$ (ii) Acidified $K_2Cr_2O_7$

- Litmus test:** Acetic acid turns blue litmus red but ethanol does not.
- $NaHCO_3$ test:** Acetic acid will give brisk effervescence due to evolution of CO_2 whereas ethanol will not react.

- 114.** Explain giving reasons, why carbon can neither form C^{4+} cation nor C^{4-} anion but forms covalent compounds which are bad conductors of electricity and have low melting and boiling points.

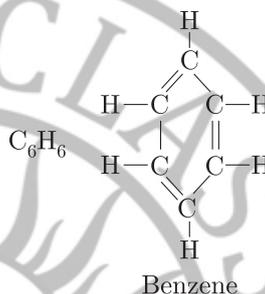
Ans : [CBSE 2017]

Carbon cannot lose four electrons because high energy is needed to remove four electrons. It cannot gain 4 electrons because 6 protons cannot hold 10 electrons.

It can share 4 electrons to form covalent bonds. Covalent compounds do not conduct electricity because these do not form ions. They have low melting and boiling points due to weak force of attraction between molecules.

- 115.** Write the molecular formula of benzene and draw its structure. List in tabular form how covalent compounds differ from ionic compounds.

Ans : [CBSE 2017]



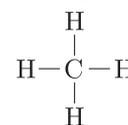
	Covalent compounds	Ionic compounds
1.	They are bad conductor of electricity.	They are good conductor of electricity.
2.	They have low melting and boiling points.	They have high melting and boiling points.

- 116.** What are hydrocarbons? Write the general formula of (a) saturated hydrocarbons (b) unsaturated hydrocarbons and draw the structure of one hydrocarbon of each type.

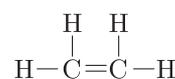
Ans : [CBSE 2017]

Hydrocarbons are compounds of carbon and hydrogen only

- C_nH_{2n+2} is general formula of saturated hydrocarbon. For example, CH_4



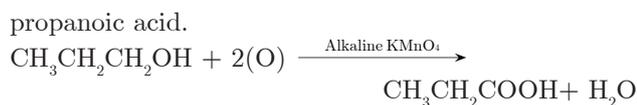
- C_nH_{2n} (alkenes) and C_nH_{2n-2} (alkynes) are general formulae of unsaturated hydrocarbons. For example,



- 117.** What is an oxidising agent? What happens when oxidising agent is added to propanol? Explain with the help of a chemical equation.

Ans : [CBSE 2016]

Oxidising agent is a substance which adds oxygen or remove hydrogen. Propanol will get oxidised to



118. What are covalent compounds? Why are they different from ionic compounds? List three characteristic properties.

Ans : [CBSE 2016]

Those compounds in which bonds are formed by sharing of electrons are covalent compounds.

While ionic compounds are formed by complete transfer of electrons.

	Covalent compounds	Ionic compounds
1.	They have weak intermolecular forces of attraction.	They have strong intermolecular forces of attraction.
2.	They have low melting and boiling points.	They have high melting and boiling points.
3.	They do not conduct electricity.	They conduct electricity in molten state or in aqueous solution.

119. When ethanol reacts with ethanoic acid in presence of cone. H_2SO_4 , a substance with fruity smell is produced. Answer the following questions:

- State the class of compounds to which fruity smelling compounds belong. Write the chemical equation and write the chemical name of the product formed.
- State the role of cone. H_2SO_4 in this reaction.

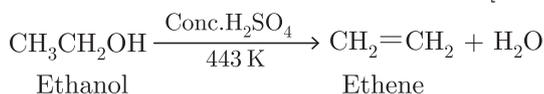
Ans : [CBSE 2016]

- The fruity smelling compounds are esters

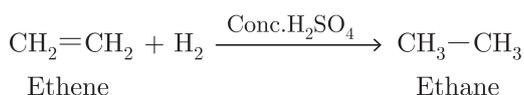
$$\underset{\text{Ethanoic acid}}{\text{CH}_3\text{COOH}} + \underset{\text{Ethanol}}{\text{C}_2\text{H}_5\text{OH}} \xrightarrow{\text{Con. H}_2\text{SO}_4} \underset{\text{Ethyl Ethanoate}}{\text{CH}_3\text{COOC}_2\text{H}_5} + \underset{\text{Water}}{\text{H}_2\text{O}}$$
- Cone. H_2SO_4 acts as dehydrating agent.

120. Name the compound formed when ethanol is heated with excess of cone. H_2SO_4 at 443 K. Also write the chemical equation of the reaction stating the role of cone. H_2SO_4 in it. What would happen if hydrogen is added to the product in presence of catalyst such as Pd or Ni?

Ans : [CBSE 2016]



Cone. H_2SO_4 acts as dehydrating agent.



121. Write the chemical equation of the reaction of ethanoic acid with the following:

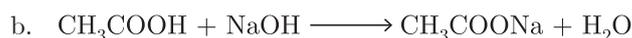
- Sodium
- Sodium hydroxide,
- Ethanol.

Write the name of one main product of each reaction.

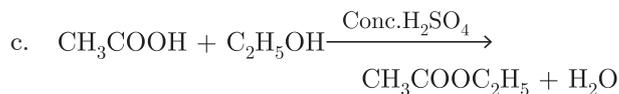
Ans : [CBSE 2016]



Sodium ethanoate



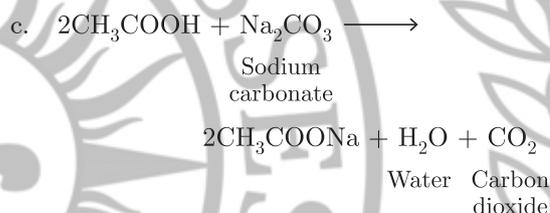
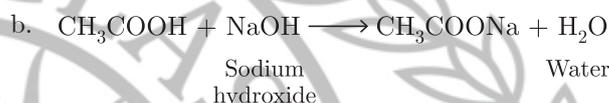
Sodium ethanoate



Ethyl ethanoate

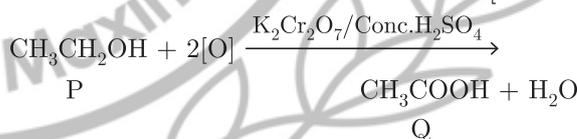
122. Write three different chemical reactions showing the conversion of ethanoic acid to sodium ethanoate. Write balanced chemical equation in each case. Write the name of the reactants and products other than ethanoic acid and sodium ethanoate in each case.

Ans : [CBSE 2016]

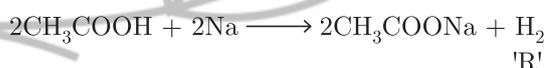


123. An organic compound 'P' is a constituent of wine. 'P' on reacting with acidified $\text{K}_2\text{Cr}_2\text{O}_7$ forms another compound 'Q'. When a piece of sodium is added to 'Q' a gas 'R' evolves which burns with a pop sound. Identify P, Q and R and write the chemical equations of the reactions involved.

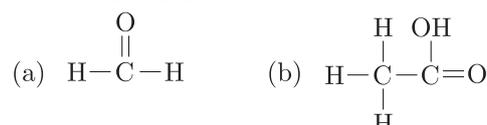
Ans : [CBSE 2016]



Q is ethanoic acid,



124. a. Define the term functional group. Identify the functional group present in

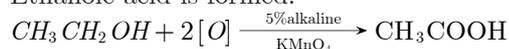


b. What happens when 5% alkaline KMnO_4 solution is added drop by drop to warm ethanol taken in a test tube? State the role of alkaline KMnO_4 solution in this reaction.

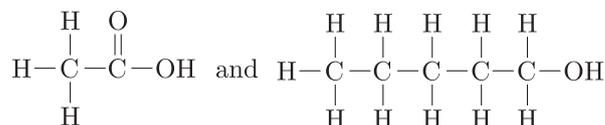
Ans : [CBSE 2016]

a. Functional group is an atom or group of atoms which determine chemical properties of organic compounds. (a) Aldehyde, (b) Carboxylic acid.

b. Ethanoic acid is formed.



KMnO_4 acts as oxidising agent.



Ethanoic acid

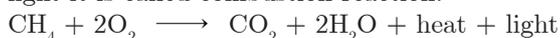
Pentanol

Esterification is the process of forming ester

125. Under which condition an oxidation reaction can be called as combustion reaction. Illustrate your answer with example.

Ans : [CBSE 2016]

When oxidation reaction produces heat as well as light it is called combustion reaction.



It is oxidation as well as combustion reaction.

126. a. Give chemical tests to detect the presence of (a) ethanol (b) ethanoic acid.

b. Why ethanoic acid is called glacial acetic acid?

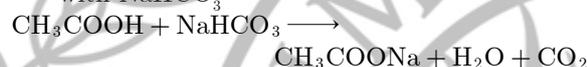
Ans : [CBSE 2016]

(i) (a) Ethanol reacts with Na to liberate

H_2 gas



(b) Ethanoic acid gives brisk effervescence of CO_2 with NaHCO_3



(ii) It is because pure acetic acid (anhydrous) solidifies into solid crystals just below the room temperature at 16.7°C and look like glacier of snow.

127. a. Chemical properties of ethanol is different from methyl ethanoate. Justify the statement with proper reason.

b. Methyl ethanoate is used in making perfume. Justify.

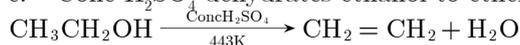
c. Ethanol is converted into ethene when excess of conc. H_2SO_4 is added. Justify with the help of reaction.

Ans : [CBSE 2016]

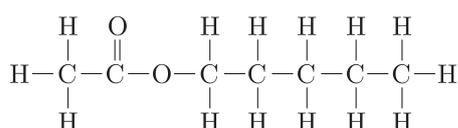
a. Chemical properties of a compound depends on its functional group. Ethanol and methyl ethanoate have different functional group thus behave differently. $\text{CH}_3\text{CH}_2\text{OH}$ has functional group — OH. It has specific smell, reacts with Na metal to liberate H_2 . $\text{CH}_3\text{COOCH}_3$ has ester (RCOOR') as functional group. It has pleasant fruity smell, undergoes saponification reaction with NaOH.

b. It is due to pleasant fruity smell.

c. Conc H_2SO_4 dehydrates ethanol to ethene.



128. The structural formula of an ester is



Write the structural formula of the acid and the alcohol from which it might be prepared. Name the process of formation of an ester.

Ans : [CBSE 2016]

129. Write any three physical properties and three uses of ethanol.

Ans : [CBSE 2016]

Properties

a. Ethanol has specific smell.

b. It is soluble in water.

c. It has burning taste.

Uses

a. It is used as solvent.

b. It is used as an antiseptic.

c. It is used in wine, beer, whisky, etc.

d. It is used for preparation of ethanoic acid, ethyl ethanoate (esters).

130. Explain the following reactions with chemical equations:

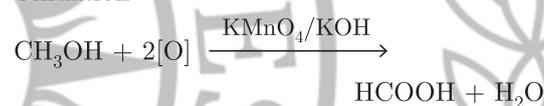
a. Oxidation

b. Hydrogenation

c. Substitution

Ans : [CBSE 2016]

a. Oxidation



b. Hydrogenation



c. Substitution



131. C_3H_6 , C_4H_8 and C_5H_{10} belong to same 1 homologous series.

a. Define homologous series.

b. Why the melting and boiling point of C_5H_{10} is higher than C_4H_8 ?

c. Arrange these hydrocarbons in order of increasing boiling points.

Ans : [CBSE 2016]

a. The series of organic compounds having same functional group and similar chemical properties is called homologous series.

b. C_5H_{10} has higher molecular mass, more surface area, more van der Waal's forces of attraction, hence higher boiling point than C_4H_8 .

c. $\text{C}_3\text{H}_6 < \text{C}_4\text{H}_8 < \text{C}_5\text{H}_{10}$

132. The general formula of three compounds A, B and C is $\text{C}_n(\text{H}_{2n})$. 'B' has highest boiling point and 'C' has lowest boiling point.

a. Mention the type of compounds A, B, C.

b. Which of these have minimum number of carbon atoms?

c. Name the homologous series to which A, B and

called? Write the chemical formula of two consecutive members of any two homologous series and state the part of these compounds that determines their (a) physical and (b) chemical properties.

Ans : [CBSE 2015]

Homologous means members of same family that is why series of carbon compounds having same functional group and similar properties is called homologous series.

Homologous series of alcohol.

CH₃OH Methanol

C₂H₅OH Ethanol

CH₃— and C₂H₅— groups determine physical properties and —OH group determines chemical properties. Homologous series of aldehyde.

CH₃OH Ethanol

C₂H₅OH Propanal

Here, CH₃— and C₂H₅— groups determine physical properties while —CHO group determines chemical properties.

142. What are esters? How are they prepared? List two uses of esters.

Ans : [CBSE 2014]

Esters are pleasant fruity smelling compounds with general formula R—COOR'. They are prepared by reaction of carboxylic acid and alcohol in presence of conc. H₂SO₄.



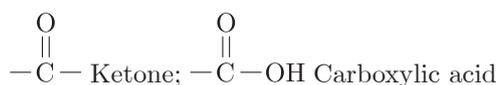
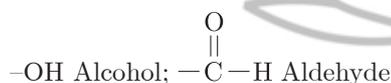
Uses

- They are used in cold drinks and ice creams as synthetic flavours.
- They are used in perfumes.

143. State the meaning of functional group in an organic compound. Write the formula of the functional group present in alcohols, aldehydes, ketones and carboxylic acids.

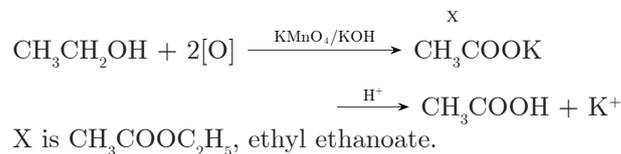
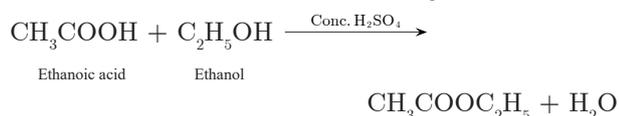
Ans : [CBSE 2014]

Functional group is an atom or group of atoms which determine chemical properties of organic compounds (a) Aldehyde, (b) Carboxylic acid.



144. A carboxylic acid (molecular formula C₂H₄O₂) reacts with an alcohol in the presence of an acid catalyst to form a compound X. The alcohol on oxidation with alkaline KMnO₄ following by acidification gives the same carboxylic acid C₂H₄O₂. Write the name and structure of (i) carboxylic acid, (ii) alcohol and (iii) the compound 'X'.

Ans : [CBSE 2014,2013]

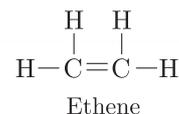


145. What is meant by homologous series of carbon compounds? Write the general formula of (i) alkenes, and (ii) alkynes. Draw the structures of the first member of each series to show the bonding between the two carbon atoms.

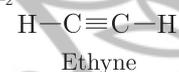
Ans : [CBSE 2014]

The series of organic compounds having same functional group and similar chemical properties is called homologous series.

- i. Alkenes C_nH_{2n}



- ii. Alkynes C_nH_{2n-2}



146. Write the chemical equations to show what happens when

- an ester reacts with a base?
- methane is treated with chlorine in the presence of sunlight?
- ethanol reacts with ethanoic acid in the presence of sulphuric acid?

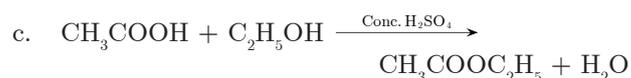
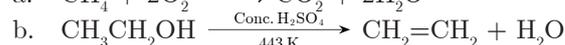
Ans : [CBSE 2014]



147. Write the respective chemical equations to show what happens when

- methane is burned in presence of oxygen?
- ethanol is heated with concentrated sulphuric acid at 443 K?
- ethanol reacts with ethanoic acid in the presence of an acid acting as a catalyst?

Ans : [CBSE 2014]



148. Write chemical equations to describe two different oxidations of ethanol. List two uses of ethanol.

Ans : [CBSE 2015]



Ethanol is used as an antiseptic and solvent

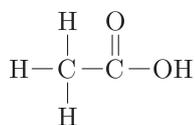
149. A carbon compound X turns blue litmus to red and

has a molecular formula $C_2H_4O_2$. Identify X and draw its structure. Write chemical equation for the reaction and name of the product formed in each case when X reacts with

- ethanol in the presence of concentrate H_2SO_4 .
- sodium carbonate.

Ans : [CBSE 2013]

X is CH_3COOH



- $CH_3CH_2OH \xrightarrow[443\text{K}]{\text{Conc. } H_2SO_4} CH_2=CH_2 + H_2O$
- $2CH_3COOH + Na_2CO_3 \longrightarrow 2CH_3COONa + H_2O + CO_2$

150. What is meant by isomers? "We cannot have isomers of first three members of alkane series." Give reason to justify this statement. Draw the structures of two isomers of pentane, C_5H_{12} .

Ans : [CBSE 2013]

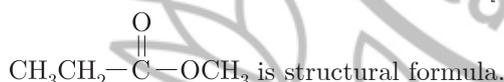
Isomers are those compounds which have same molecular formula but different structural formula.



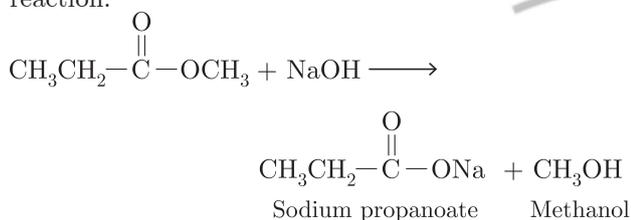
2-Methylbutane

151. An ester has the molecular formula $C_4H_8O_2$. Write its structural formula. What happens when this ester is heated in the presence of sodium hydroxide solution? Write the balanced chemical equation for the reaction and name the products. What is a saponification reaction.

Ans : [CBSE 2010]



When ester is heated with NaOH, sodium salt of acid and alcohol are formed. It is called saponification reaction.



- 152. a.** What is meant by a functional group in an organic compound? Name the functional group present in
- CH_3CH_2OH
 - CH_3COOH
- b. State one point of difference between soap and synthetic detergent.

Ans : [CBSE2009]

- a. Functional group is an atom or group of atoms which determine chemical properties of organic

compounds. (1) Alcohol, (2) Carboxylic acid.

- a. Soaps do not work well with hard water as form insoluble scum whereas detergents work well with hard water.

153. Give reasons for the following observations:

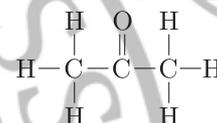
- The element carbon forms a very large number of compounds.
- Air holes of a gas burner have to be adjusted when the heated vessels get blackened by the flame.
- Use of synthetic detergents causes pollution of water.

Ans : [CBSE 2009]

- It is due to tetravalency of carbon and property of catenation shown by carbon to maximum extent.
- Air holes must be kept open fully so that complete combustion of fuel takes place producing blue flame.
- Some of detergents are not bio-degradable, they create water pollution.

154. a. Why are covalent compounds generally poor conductors of electricity?

- b. Name the following compound:



- c. Name the gas evolved when ethanoic acid is added to sodium carbonate. How will you test the presence of this gas.

Ans : [CBSE 2008]

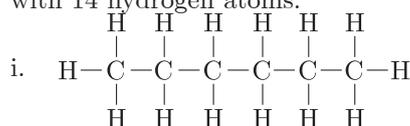
- It is because they do not form ions in their aqueous solution.
- Propanone
- Carbon dioxide gas will be liberated. Test: Pass the gas through lime water. If lime water turns milky it shows the presence of CO_2 gas.

FIVE MARKS QUESTIONS

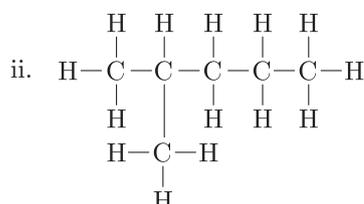
155. You are given balls and stick model of six carbon atoms and fourteen hydrogen atoms and sufficient number of sticks. In how many ways one can join the models of six carbon atoms and fourteen hydrogen atoms to form different molecules of C_6H_{14} .

Ans : [CBSE Sample Paper 2017-2018]

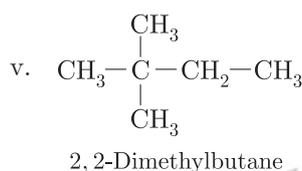
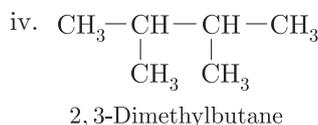
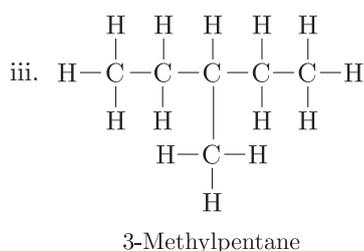
There are five ways in which six carbons can be joined with 14 hydrogen atoms.



Hexane



2-Methylpentane



Check Answer :

156. Soaps and detergents are both types of salts. State the difference between the two. Write the mechanism of the cleansing action of soaps. Why do soaps not form lather (foam) with hard water? Mention any two problems that arise due to the use of detergents instead of soaps.

Ans : [CBSE 2017]

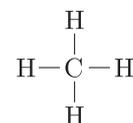
- Soaps are sodium or potassium salts of fatty acids e.g. $-\text{COONa}$. Detergents are sodium or potassium salts of sulphonic acids e.g. $-\text{SO}_3\text{Na}$ or $-\text{SO}_4\text{Na}$
- Soaps are sodium or potassium salts of fatty acids. They contain $-\text{COONa}$ group. Detergents are sodium or potassium salts of sulphonic acids. They contains $-\text{SO}_3\text{Na}$ or $-\text{SO}_4\text{Na}$ group. Soap has ionic end which is hydrophilic, interacts with water while carbon chain is hydrophobic interacts with oil, grease. The soap molecules orient themselves in a cluster in which hydrophobic tails are inside the cluster and ionic ends face outside. These cluster are called micelles. These attract oil which is washed away by water.
- Soaps react with Ca^{2+} and Mg^{2+} ions in hard water to form calcium or magnesium salts of fatty acids which are insoluble in water and thus interfere in action of soap,
- (i) Detergents are more expensive than soaps.
(ii) Some detergents are not biodegradable i.e. will create pollution.

157. Why are certain compounds called hydrocarbons? Write the general formula for homologous series of alkanes, alkenes and alkynes and also draw the structure of the first member of each series. Write the name of the reaction which converts alkene into alkane. Also write the chemical equation to show the necessary conditions for the reaction to occur.

Ans : [CBSE 2017]

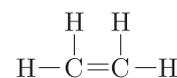
Compounds of carbon and hydrogen are called hydrocarbons.

Alkane $\text{C}_n\text{H}_{2n+2}$



Methane

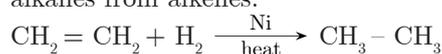
Alkene C_nH_{2n}



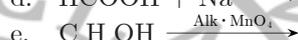
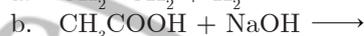
Ethene

Alkyne $\text{C}_n\text{H}_{2n-2}$ $\text{HC}\equiv\text{CH}$ Ethyne

Hydrogenation i.e. addition of H_2 leads to formation of alkanes from alkenes.



158. Complete the following chemical equations and write the chemical name of the products formed.



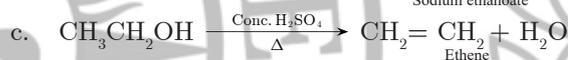
Ans : [CBSE 2018]



Ethane



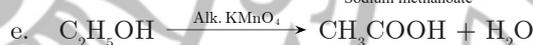
Sodium ethanoate



Ethene



Sodium methanoate



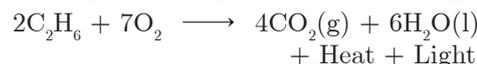
Ethanoic acid

- 159.** a. Give a chemical test to distinguish between saturated and unsaturated hydrocarbons.
b. Name the products formed when ethane burns in air. Write the balanced chemical equation for the reactions showing two types of energies liberated.
c. Why is reaction between methane and chlorine in presence of sunlight is considered a substitution reaction.

Ans : [CBSE 2016]

a. Saturated hydrocarbons will not react with bromine water whereas unsaturated hydrocarbons will decolourise it.

b. Carbon dioxide and water will be formed.



c. It is because hydrogen atom is substituted by halogen atom, that is why it is called substitution reaction.

- 160.** a. You have three unlabelled test tubes containing ethanol, ethanoic acid and soap solution. Explain the method you would use to identify the compounds in different test tubes by chemical tests using litmus paper and sodium metal.

b. Give reason of formation of scum when soaps are used with hard water.

Ans : [CBSE 2016]



'Z' on combustion gives $2CO_2$ and $3H_2O$ so hydrocarbon 'Z' must be ethane. 'Y' on addition of H_2 gives ethane so 'Y' must be ethene. 'X' in presence of conc. H_2SO_4 dehydrates to ethene i.e., 'X' is ethanol.

167. List in tabular form three physical and two chemical properties on the basis of which ethanol and ethanoic acid can be differentiated.

Ans : [CBSE 2012]

	Ethanol	Ethanoic acid
Physical Properties		
1.	It has Specific smell	It has vinegar like smell.
2.	It has burnnrg taste	It has sour taste
3.	Pure ethanol is liquid of room temperature.	Pure acetic acid is solid below 290 K.
Chemical Properties		
4.	It does not change colour of litmus	It turn-s blue litmus red.
5.	It does not react with $NaHCO_3$	It liberstes CO_2 with $NaHCO_3$.

168. What are detergents chemically? List two merits and two demerits of using detergents for cleansing. State the reason for the suitability of detergents for washing even in case of water having calcium and magnesium ions.

Ans : [CBSE 2012]

Detergents are sodium or potassium salts of sulphonic acids of benzene or sulphates of unsaturated hydrocarbons like alkenes with $-SO_3Na$ or $-SO_4Na$ group.

Merits:

They are more effective than soaps.

They work well even with hard water.

Demerits:

- They are expensive.
- Some of them create water pollution.

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

- Physical state
- Taste
- $NaHCO_3$ test
- Ester test

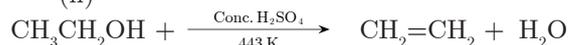
- b. Write a chemical reaction to show dehydration of ethanol.

Ans : [CBSE 2011]

-

	Ethanol	Ethanoic acid
(a)	Physical taste: It is liquid.	It is solid below 290 K
(b)	Taste: It has burning taste.	It has sour taste.
(c)	$NaHCO_3$ test It does not react.	It liberates CO_2 gas.
(d)	Ester test: It reacts with carboxylic acid to form easter	It reacts with alcohol to form pleasant to form fruity smelling esters.

(ii)



170. Give reasons for the following:

- Element carbon forms compound mainly by covalent bonding.
- Diamond has high melting point.
- Graphite is good conductor of electricity.
- Acetylene bums with sooty flame.
- Kerosene does not decolourise bromine water whereas cooking oil does.

Ans : [CBSE 2011]

- It is because carbon can neither lose 4 electrons nor gain 4 electrons. It can share four electrons to form covalent bonds.
- Diamond has strong C—C bonds and compact 3-D structure in which one carbon atom is covalently bonded to other four carbon atoms therefore, has high melting point.
- In graphite, one carbon atom is bonded to other three carbon atoms. Remaining one electron on each carbon is free to move due to which graphite conducts electricity.
- Acetylene has high carbon content, therefore, partial oxidation causes it to bum with sooty or smoky flame.
- Kerosene is a saturated compound, therefore, does not decolourise bromine water.

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