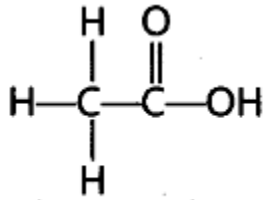
CARBON AND ITS COMPOUNDS

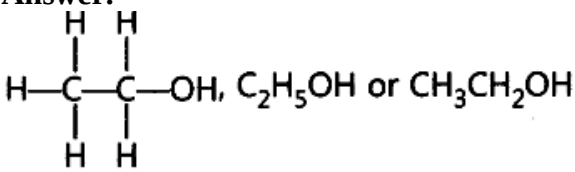
VERY SHORT ANSWER TYPE QUESTION [1 Mark]

1. **Give the names of the following functional groups:**
   (i) —OH (ii) —COOH
   Answer. (i) Alcohol group (ii) Carboxylic acid group
2. **What is the difference in the molecular formula of any two consecutive members of a homologous series of organic compounds?**
   Answer. —CH_2— is the difference in the molecular formula of any two consecutive members of a homologous series of organic compounds.
3. **Name the carbon compound which on heating with excess of concentrated sulphuric acid at 443 K gives ethene.**
   Answer.
   CH_3CH_2OH, ethanol

   $$\underset{\text{Ethanol}}{CH_3CH_2OH} \xrightarrow[443\,K]{\text{conc. } H_2SO_4} \underset{\text{Ethene}}{CH_2=CH_2} + H_2O$$
4. **What is meant by a saturated hydrocarbon?**
   Answer. Those hydrocarbons in which valency of carbon is satisfied by single bonds only are called saturated hydrocarbons.
5. **Name the compound formed when ethanol is warmed with ethanoic acid in the presence of a few drops of cone.H_2S_{04}**
   Answer.
   Ethyl ethanoate is formed.

   $$\underset{\text{Ethanoic acid}}{CH_3COOH} + \underset{\text{Ethanol}}{C_2H_5OH} \xrightarrow{\text{conc. } H_2SO_4} \underset{\text{Ethyl ethanoate}}{CH_3COOC_2H_5} + \underset{\text{Water}}{H_2O}$$
6. **Draw the structure of CH_3COOH molecule.**
   Answer.

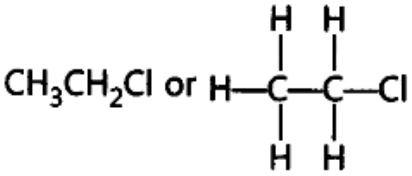
   
   Ethanoic acid
7. **Draw the structure of ethanol molecule.**
   Answer.

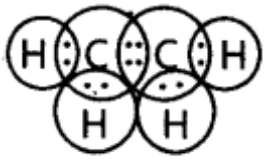
   Ethanol
8. **What happens when a small piece of sodium is dropped into ethanol?**
   Answer.
   Hydrogen gas will be evolved.

   $$2C_2H_5OH(l) + 2Na(s) \longrightarrow 2C_2H_5ONa(l) + H_2(g)$$
9. **Carbon has four electrons in its valence shell. How does carbon attain stable electronic configuration.**
   Answers. By sharing four electrons with other atoms.

10. **State two characteristic features of carbon which when put together give rise to large number of carbon compounds.**
    Answer. (i) Catenation (ii) Tetravalency of carbon
11. **Write the structural formula of chloroethane.**
    Answer.

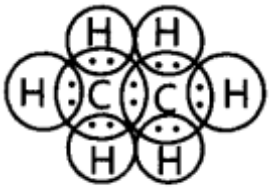


12. **How many covalent bonds are there in a molecule of ethane (C_2H_6)?**
    Answer. There are 7 covalent bonds in a molecule of ethane.
13. **Write the electron dot structure of ethene molecule (C_2H_4).**
    Answer.



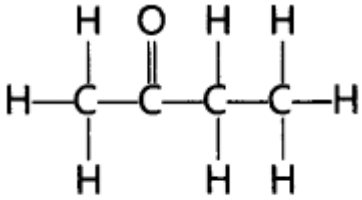
Ethene

14. **Write the electron dot structure of ethane molecule (C_2H_6).**
    Answer.



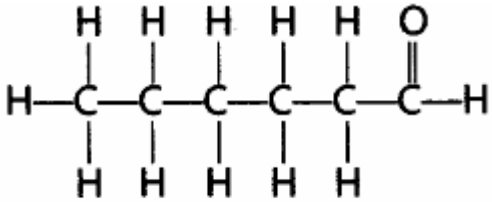
Ethane

15. **Draw the structure of butanone molecule, $CH_3COC_2H_5$.**
    Answer.



Butanone

16. **Draw the structure of the hexanal molecule, $C_5H_{11}CHO$.**
    Answer.



Hexanal ($C_5H_{11}CHO$)

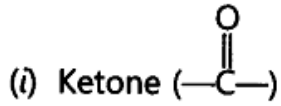
17. **Butanone is a four carbon per molecule compound. Name the functional group present in it.**
    Answer. Ketone
18. **Name the functional group present in each of the following organic compounds:**
    (i) C_2H_5CI

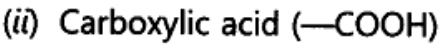
(ii) C_2H_5OH

Answer. (i) (—Cl) Halogen (Chloro) (ii) (—OH) Alcohol

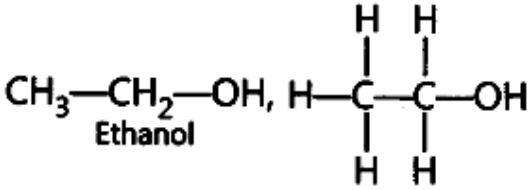
19. **Name the functional group present in each of the following compounds:**
(i) HCOOH
(ii) C_2H_5CHO
Answer.
(i) —COOH (Carboxylic acid)
(ii) —CHO (Aldehyde)

20. **Name the functional group present in each of the following organic compounds:**
(i)CH_3COCH_3
(ii) C_2H_5COOH
Answer.

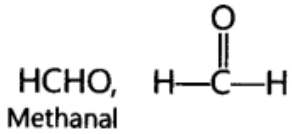




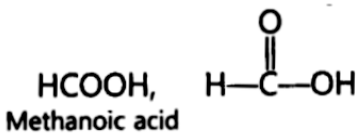
21. **Write the name and formula of the second member of the carbon compounds having functional group —OH.**
Answer.



22. **Write the name and formula of the first member of the carbon compounds having functional group —CHO.**
Answer.



23. **Write the name and formula of the first member of the carbon compounds having functional group —COOH.**
Answer.



24. **Write the name and formula of the 2nd member of the series of carbon compounds whose general formula is $C_nH_{2n+1}OH$**
Answer. Ethanol, C_2H_5OH or CH_3CH_2OH

25. **Write the name and formula of the 2nd member of the series of carbon compounds whose general formula is CnH_{2n}.**
Answer.
C_3H_6, $H_2C{=}CH{—}CH_3$
Propene is second member of series whose general formula is C_nH_{2n}.

SHORT ANSWER TYPE QUESTIONS[I] [2 Marks]

26. **(a) Give a chemical test to distinguish between saturated and unsaturated hydrocarbons.**
(b) (i) Name the products formed when ethanol burns in air. ‘

(ii) What two forms of energy are liberated on burning alcohol?
(c) Why is the reaction between methane and chlorine considered a substitution reaction?
Answer.

(*a*) Add bromine water. Saturated hydrocarbons do not react whereas unsaturated hydrocarbon will decolourise bromine water.

(*b*) (*i*) CO_2 and H_2O are formed.

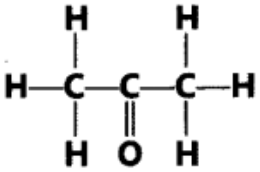
$$C_2H_5OH\ (l) + 3O_2(g) \longrightarrow 2CO_2\ (g) + 3H_2O\ (l) + \text{Heat} + \text{Light}$$

(*ii*) Heat energy and light energy

(*c*) It is because 'Cl' atom substitutes 'H' atom of methane to form chloromethane and hydrogen chloride.

$$\underset{\text{Methane}}{CH_4(g)} + \underset{\text{Chlorine}}{Cl_2(g)} \xrightarrow{\text{Sunlight}} \underset{\text{Chloromethane}}{CH_3Cl(g)} + HCl(g)$$

27. **(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 would you prove the presence of this gas?
Answer.

(*a*) It is because they do not form ions.

(*b*) Propanone

(*c*) Carbon dioxide gas. It turns lime water milky.

$$2CH_3COOH(l) + Na_2CO_3(aq) \longrightarrow 2CH_3COONa(aq) + H_2O(l) + CO_2(g)$$

$$\underset{\text{Calcium hydroxide}}{Ca(OH)_2(aq)} + \underset{\text{Carbon dioxide}}{CO_2(g)} \longrightarrow \underset{\text{Calcium carbonate}}{CaCO_3(s)} + H_2O(l)$$

28. **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 r cone.H_2S_{04}.**
Answer.

It is ethanol, its molecular formula is C_2H_6O.

Ethanol forms ethene, when heated with conc. H_2SO_4.

$$\underset{\text{Ethanol}}{CH_3CH_2OH} \xrightarrow[\text{heat}]{\text{Conc. } H_2SO_4} \underset{\text{Ethene}}{CH_2{=}CH_2} + H_2O$$

29. **Explain why carbon generally forms compounds by covalent bonds.**
Answer. Carbon cannot lose four electrons easily because very high energy is required. It cannot gain four electrons easily because six protons cannot hold 10 electrons. It can easily share four electrons forming covalent bonds.

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

Answer.

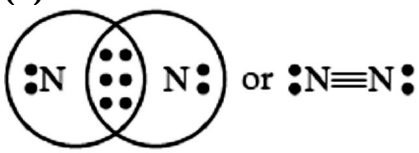
Methanoic acid, its molecular formula is CH_2O_2.

Ethanoic acid, its molecular formula is $C_2H_4O_2$.

When acid reacts with sodium hydroxide, its sodium salt and water is formed.

$$\underset{\text{Ethanoic acid}}{CH_3COOH} + NaOH \longrightarrow \underset{\text{Sodium ethanoate}}{CH_3COONa} + \underset{\text{Water}}{H_2O}$$

31. **Atom of an element contains five electrons in its valence shell. This element is major component of air. It exists as a diatomic molecule.**
(i) Identify the element.
(ii) Show the bond formed between two atoms of this element.
(iii) Write the nature of the bond between the two atoms.
Answer.
(i) Nitrogen.
(ii)



(iii) Covalent bond.

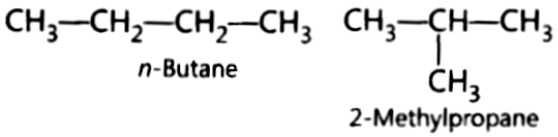
32. **What is a homologous series? Which two of the following organic compounds belong to the same homologous?**
CH_3 ,C_2H_6, C_2H_6O, $C_2H_6O_2$,CH_4O
Answer. Homologous series is a series of organic compounds which have same functional group and similar chemical properties. Each member of this series is differ by —CH_2— in its molecular formula and 14 u in its molecular mass.
C_2H_6O (C_2H_5OH) and CH_4O (CH_3OH) belong to same homologous series.

SHORT ANSWER TYPE QUESTIONS[II] [3 Marks]

33. **What is meant by a functional group in an organic compound? Name the functional group present in**
(i) CH_3CH_2OH
(ii) CH_3COOH
Answer.
Functional group is an atom or group of atoms or reactive part of compound, which determines chemical properties of compounds.
(i) —OH (Alcohol)
(ii) —COOH (Carboxylic acid)

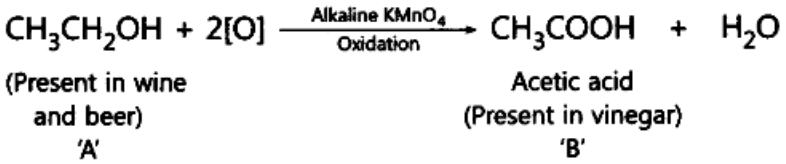
34. **Give reasons for the following observations:**
(a) The element carbon forms a very large number of compounds.
(b) Air holes of a gas burner have to be adjusted when the heated vessels get blackened by the flame.
Answer.
(a) Carbon forms large number of compounds since carbon is small in size and can form stable covalent bonds (catenation) and it shows tetravalency.
(b) Air holes of gas burner are made open (adjusted) so that air can pass through, which is needed for complete combustion, so that heated vessels do not get blackened.

35. **What are isomers? Draw the structures of two isomers of butane, C_4H_{10}. Why can't we have isomers of first three members of alkane series?**
Answer. Those compounds, which have same molecular formula but different structural formulae are called isomers.

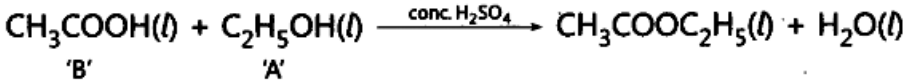


In first three members of alkane series, branching is not possible. Therefore, we cannot have isomers.

36. **An organic compound 'A' is an essential constituent of wine and beer. Oxidation of 'A' yields an organic acid 'B' which is present in vinegar. Name the compounds 'A' and 'B' and write their structural formula. What happens when 'A' and 'B' react in the presence of an acid catalyst? Write the chemical equation for the reaction.**
Answer.
'A' is ethanol (C_2H_5OH) which is essential constituent of wine and beer and 'B' is acetic acid (CH_3COOH) which is present in vinegar.



When 'A' and 'B' react in the presence of an acid catalyst, ethyl ethanoate is formed.



37. **Define homologous series of organic compounds. List its two characteristics. Write the name and formula of the first member of the series of alkenes.**
Answer. The series of organic compounds having same functional group and similar chemical properties is called homologous series.
Each member differs from successive member by —CH_2— group. The difference in molecular weight between two successive members is 14 u.
Characteristics:
(i) It has same general formula, from which, all members can be derived.
(ii) They have similar chemical properties.
C_2H_4, CH_2=CH_2, Ethene is first member of alkene series.

38. **Why homologous series of carbon compounds are so called? Write chemical formula of two consecutive members of a homologous series and state the part of these compounds that determines their**
(i) physical properties, and (ii) chemical properties.
Answer. The series consists of members of same family with similar physical and chemical properties, therefore, called homologous series
(i) CH_3OH, and (ii) CH_3CH_2OH are two consecutive members of homologous series.
Alkyl group —CH_3 and —CH_3CH_2 part determines physical properties. Functional group —OH determines chemical properties of the compounds.

LONG ANSWER TYPE QUESTIONS [5 Marks]

39. **(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?

Answer.

(a) (i)-Catenation (ii) Tetravalency

(b) It is because large number 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 gets attracted towards ethanol and ionic end will not dissolve in alcohol.

40. **Explain isomerism. State any four characteristics of isomers. Draw the structures of possible isomers of butane, C_4H_{10}**

Answer. 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.

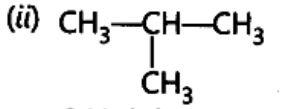
(iv) They differ in solubility in same solvent.

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

(*i*) $CH_3—CH_2—CH_2—CH_3$

n-Butane

(*ii*)



2-Methylpropane

41. **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 bums with a sooty flame.

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

Answer.

(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.

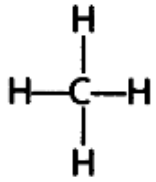
(iv) It is due to high percentage of carbon, it burns with sooty or smoky flame.

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

42. **What are the hydrocarbons? Write the name and general formula of (i) saturated hydrocarbons, (ii) unsaturated hydrocarbons, and draw the structure of one hydrocarbon of each type. How can an unsaturated hydrocarbon be made saturated?**

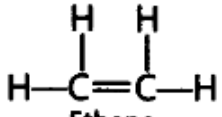
Answer.

(*i*) Alkanes, C_nH_{2n+2} are saturated hydrocarbons.

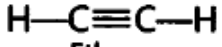


Methane
(Saturated hydrocarbon)

(*ii*) Alkenes, C_nH_{2n} and Alkynes, C_nH_{2n-2} are unsaturated hydrocarbons.

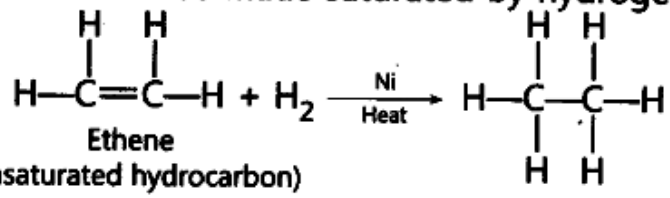


Ethene
(Unsaturated hydrocarbon)



Ethyne
(Unsaturated hydrocarbon)

Unsaturated hydrocarbons can be made saturated by hydrogenation.



Ethene
(Unsaturated hydrocarbon)

Ethane
(Saturated hydrocarbon)

MULTIPLE CHOICE QUESTIONS [1 Mark]

1. Which of the following is not a saturated hydrocarbon ?
i) Cyclohexane.
ii) Benzene.
iii) Butane
iv) isobutene

2. The bond between two identical non metallic atom has a pair of electron ?
i) un equally shared between two atoms.
ii) Transferred completely from one atom to another.
iii) With identical spins
iv) Unequally shared between them.

3. Covalent compounds are generally
i) Soluble in water
ii) Insoluble in water
iii) Ionize in water
iv) Hydrolyse in water

4. Propane with the molecular formula C_3H_8 has

i) 7covalent bonds
ii) 8 covalent bonds
iii) 9 covalent bonds
iv) 10 Covalent bonds.

5. Which of the following is not an allotropic form of carbon
i)fluorine ii)fullerene
iii)diamond iv)graphite

6. Which of the following represents the correct decreasing order of hydrogen atoms ?
i)alkanes , alkenes , alkynes
ii)alkanes , alkaynes , alkenes
iii)alkenes , alkynes , alkanes
iv)alkynes , alkanes , alkenes

7. Which of the following represents the structure of N_2 Mmolecule ?
i) N≡ N
ii) N = N
iii) N - N
iv) None of the above

8. In double covalent bond there is sharing of
i) 2 electrons
ii) 4 electrons
iii) 6 electrons
iv) 3 electrons

9. Cation is formed when
i) atom gains electrons
ii) atom loses electrons
iii) proton is lost by the atom
iv) atom shared by electrons

10. The total no. of electrons that take part in forming a bond in N_2 is
i) 2
ii) 4
iii) 6
iv) 10

11. Which of the following has the weakest carbon-carbon strength?
i)C_2H_2
ii)C_2H_4
iii)C_2H_6
iv)all have the same bond strength

12. Which of the following salt when dissolved in water produce hard water.
i) calcium sulphate
ii) magnesium bicarbonate
iii) calcium chloride
iv) any of the above

13. Which of the following is not a saturated hydrocarbon ?

i) cyclohexane
ii) benzene
iii) butane
iv) isobutene

14. The bond between two identical nonmetallic atom has a pair of electron ?
i) unequally shared between two atoms
ii) transferred completely from one atom to another
iii) With identical spins
iv) Equally shared between them

15. Covalent compounds are generally –
i) Soluble in water
ii) insoluble in water
iii) Ionize in water
iv) hydrolyse in water

16. Propane with molecular formula C3H8 has –
i) 7 covalent bonds
ii) 8 covalent bonds
iii) 9 covalent bonds
iv) 10 covalent bonds

17. A hydrocarbon reacts with ammonical cuprous chloride solution to form a red precipitate, the hydrocarbon is –
i) Ethane
ii) ethane
iii) butane
iv) 1-propyne

18. Which of the following substance is added to denature Ethanol?
i) Methanol ii) pyridine
iii) copper sulphate iv) all of these

19. Which of the following is not an allotropic form of carbon ?
i) fluorine
ii) fullerene
iii) diamond
iv) graphite

20. Which of the following represents the correct deceasing order of hydrogen atoms ?
i) alkanes, alkenes, alkynes
ii) alkanes, alkynes, alkenes
iii) alkenes, alkynes, alkanes
iv) alkynes, alkanes, alkenes

21. Detergents are sodium or potassium salts of long chain of :
i) aldehydes
ii) ketones
iii) carboxylic acid
iv) sulphonic acid

22. In double covalent bond there is a sharing of
i) 2 electrons
ii) 4 electrons
iii) 6 electrons
iv) 3 electrons

23. Cation is formed when
i) atom gains electrons
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24. The total number of electrons that take part in forming a bond in N_2 is
i) 2
ii) 4
iii) 6
iv) 10

25. Which of the following has the weakest carbon-carbon strength ?
i) C_2H_2
ii) C_2H_4
iii) C_2H_6
iv) all have the same bond strength

26. Synthetic flavours contain:-
i) unsaturated acids
ii) esters
iii) dilute carboxylic acids
iv) hydroxyl acids

27. Out of the following which one is used as preservative for pickle and sauces:-
i) esters ii) acetone
iii) aldehyde iv) acetic acid

28. Carbon exists in the atmosphere in the form of
(a) carbon monoxide only
(b) carbon monoxide in traces and carbon dioxide
(c) carbon dioxide only
(d) coal

29. Which of the following statements are usually correct for carbon compounds? These
(i) are good conductors of electricity
(ii) are poor conductors of electricity
(iii) have strong forces of attraction between their molecules
(iv) do not have strong forces of attraction between their molecules
(a) (i) and (iii) (b) (ii) and (iii)
(c) (i) and (iv) (d) (ii) and (iv)

30. A molecule of ammonia (NH_3) has
(a) only single bonds
(b) only double bonds
(c) only triple bonds

(d) two double bonds and one single bond

31. Buckminsterfullerene is an allotropic form of
(a) phosphorus
(b) sulphur
(c) carbon
(d) tin

32. Which of the following is the correct representation of electron dot structure of nitrogen?

(a) :N⋮⋮N:

(b) :N⋮⋮N:

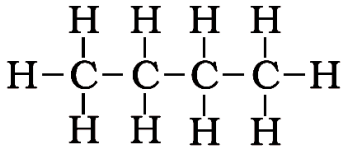
(c) :N⋮⋮N:

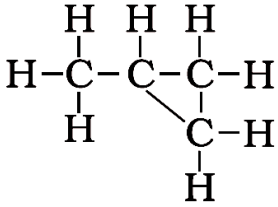
(d) :N⋮⋮N:

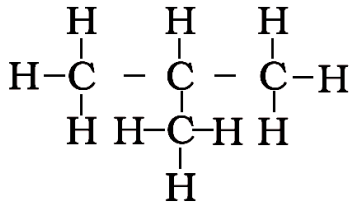
33. Oils on treating with hydrogen in the presence of palladium or nickel catalyst form fats. This is an example of
(a) Addition reaction
(b) Substitution reaction
(c) Displacement reaction
(d) Oxidation reaction

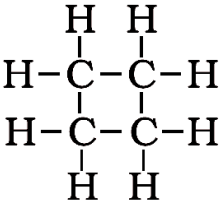
34. In which of the following compounds, — OH is the functional group?
(a) Butanone (b) Butanol
(c) Butanoic acid (d) Butanal

35. Which of the following are correct structural isomers of butane?

(i)


(iii)


(ii)


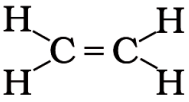
(iv)


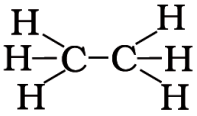
(a) (i) and (iii) (b) (ii) and (iv)
(c) (i) and (ii) (d) (iii) and (iv)

36. Structural formula of ethyne is

(a) $H-C\equiv C-H$

(b) $H_3-C\equiv C-H$

(c) 

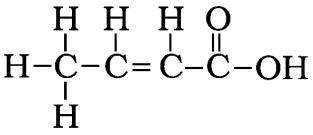
(d) 

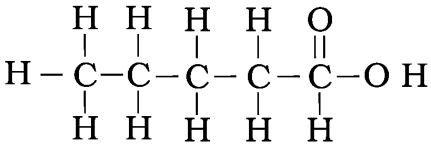
37. Identify the unsaturated compounds from the following
(i) Propane
(ii) Propene
(iii) Propyne
(iv) Chloropropane
(a) (i) and (ii) (b) (ii) and (iv)
(c) (iii) and (iv) (d) (ii) and (iii)

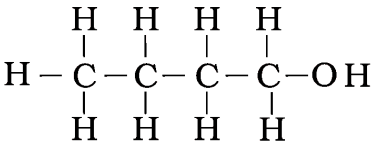
38. Chlorine reacts with saturated hydrocarbons at room temperature in the
(a) absence of sunlight
(b) presence of sunlight
(c) presence of water
(d) presence of hydrochloric acid

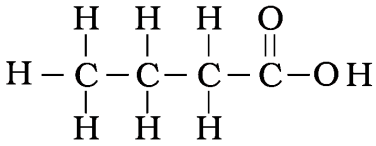
39. Pentane has the molecular formula C_5H_{12}. It has
(a) 5 covalent bonds
(b) 12 covalent bonds
(c) 16 covalent bonds
(d) 17 covalent bonds

40. The correct structural formula of butanoic acid is

(a) 

(b) 

(c) 

(d) 

41. Vinegar is a solution of
(a) 50% – 60% acetic acid in alcohol
(b) 5% – 8% acetic acid in alcohol
(c) 5% – 8% acetic acid in water
(d) 50% – 60% acetic acid in water

42. The correct electron dot structure of a water molecule is

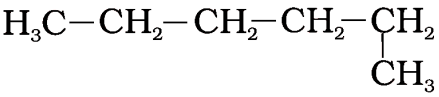
(a) 

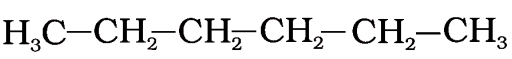
(b) 

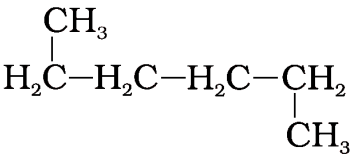
(c) 

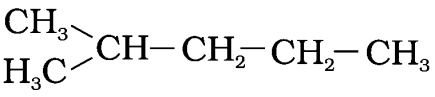
(d) 

43. Which of the following is not a straight chain hydrocarbon?

(a) 

(b) 

(c) 

(d) 

44. Carbon forms four covalent bonds by sharing its four valence electrons with four univalent atoms, e.g. hydrogen. After the formation of four bonds, carbon attains the electronic configuration of
(a) helium (b) neon (c) argon (d) krypton

45. Which of the following does not belong to the same homologous series?
(a) CH_4 (b) C_2H_6 (c) C_3H_8 (d) C_4H_8

46. The name of the compound CH_3 — CH_2 — CHO is
(a) Propanal (b) Propanone (c) Ethanol (d) Ethanal

47. The heteroatoms present in CH_3 — CH_2 — O — CH_2— CH_2Cl are
(i) oxygen
(ii) carbon
(iii) hydrogen
(iv) chlorine
(a) (i) and (ii) (b) (ii) and (iii)
(c) (iii) and (iv) (d) (i) and (iv)

48. The first member of alkyne homologous series is
(a) ethyne (b) ethane (c) propyne (d) methane