

Chapter – 4 Carbon and its Compounds

Multiple Choice Questions

Q1. Carbon exists in the atmosphere in the form of

- a) Only carbon monoxide
- b) Carbon monoxide in traces and carbon dioxide
- c) Only carbon dioxide
- d) Coal

Answer: Option c)

Carbon generally exists in the atmosphere in the form of carbon dioxide (CO_2) in air with 0.03%. Carbon is also found in the earth's crust in the form of minerals like carbonates. It occurs in the form of fossil fuels, wood, wool, cotton and organic compounds etc.

Q2. 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 force of attraction between their molecules
- iv) Do not have strong forces of attraction between their molecules

Answer: Option d)

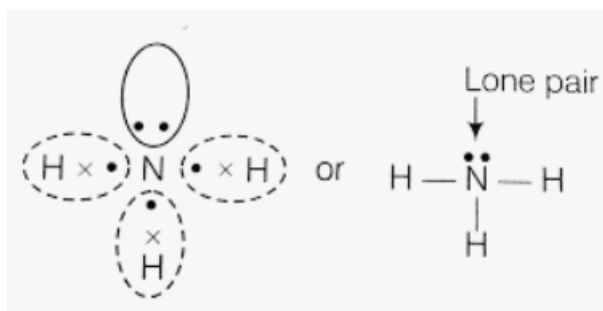
Carbon forms covalent compounds, because of the absence of free ions, which are poor conductor of electricity. The force of attraction is also weak in between their molecules.

Q3. 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

Answer: Option a)

A molecule of ammonia has single bond and these are covalent bonds.



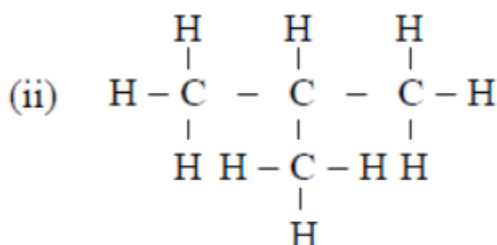
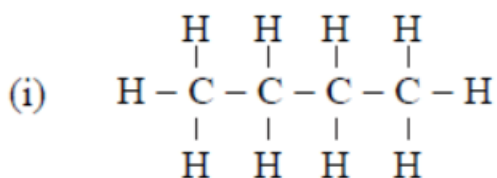
Q4. Buckminsterfullerene is an allotropic form of

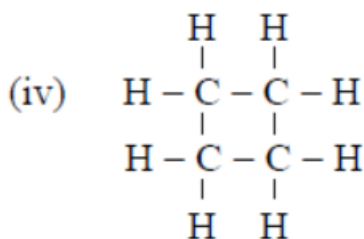
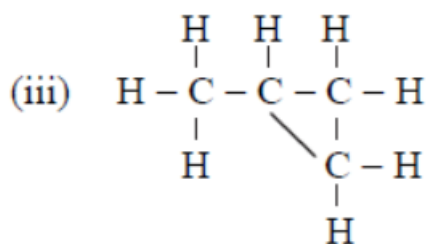
- a) Phosphorus
- b) Sulphur
- c) Carbon
- d) Tin

Answer: Option c)

Buckminsterfullerene is an allotrope of carbon containing clusters of 60 carbon atoms joined together to form spherical molecules. The formula is given as C_{60} (C-sixty). At room temperature it is dark solid compared to other allotropes of carbon like diamond and graphite.

Q5. Which of the following are correct structural isomers of butane?





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

Answer: Option a)

Figure (i) is n – butane

Figure (ii) is iso – butane

We can see the molecular formula to be same, but the structures are different. Hence, Figure (i) and (ii) are isomers whereas Figure (ii) and (iv) have molecular formula C_4H_8 .

Q6. In the given reaction, alkaline $KMnO_4$ acts as



- a) Reducing agent
- b) Oxidising agent
- c) Catalyst
- d) Dehydrating agent

Answer: Option b)

$KMnO_4$ acts as oxidising agent since it removes hydrogen from CH_3CH_2OH and adds one oxygen to it.

Q7. 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

Answer: Option a)

Oil are unsaturated compounds containing double bonds. Addition reaction are characteristic property of unsaturated hydrocarbons. This is an addition reaction.

Q8. In which of the following compounds – OH is the functional group?

- a) Butanone
- b) Butanol
- c) Butanoic
- d) Butanal

Answer: Option b)

Butanol, $CH_3 - CH_2 - CH_2 - CH_2 - OH$

$C_nH_{2n+1} - OH$ (general formula of alcohols)

For butanol, $n = 4$. Hence, the formula is

$C_4H_9 - OH$ or $CH_3 - CH_2 - CH_2 - CH_2 - OH$

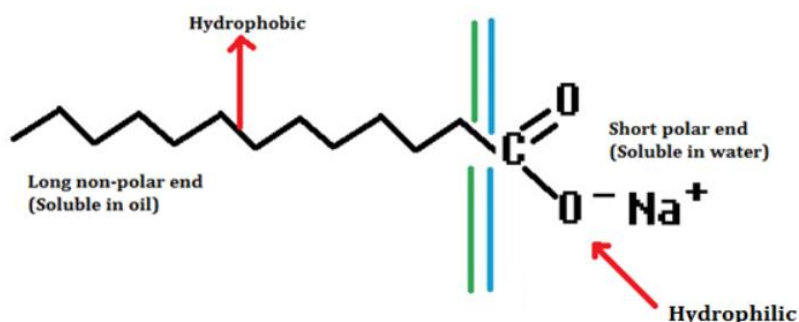
Q9. The soap molecule has a

- a) Hydrophilic head and a hydrophobic tail
- b) Hydrophobic head and a hydrophilic tail
- c) Hydrophobic head and a hydrophobic tail
- d) Hydrophilic head and a hydrophilic tail

Answer: Option a)

A soap molecule is made up of two parts: a long hydrocarbon part and a short ionic part $-COO^-Na^+$ group.

The long hydrocarbon chain is water repelling (hydrophobic) and ionic portion is water attracting (hydrophilic).



Q10. Which of the following is the correct representation of electron dot structure of nitrogen?

- (a) $\cdot\ddot{\text{N}} : \ddot{\text{N}}\cdot$
- (b) $\cdot\ddot{\text{N}} :: \ddot{\text{N}}\cdot$
- (c) $\cdot\ddot{\text{N}} : \ddot{\text{N}}:$
- (d) $:\text{N}::\text{N}:$

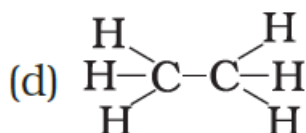
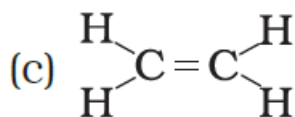
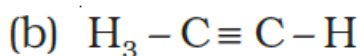
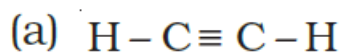
Answer: Option d)

We know, the electronic configuration of N (atomic number 7) is 2, 5.

So, it will need more three electrons to complete its octet. Each and every nitrogen will share three electrons so it forms a molecule of N_2 as



Q11. Structural formula of ethyne is



Answer: Option a)

'eth' represents the presence of two carbon atoms.

'yne' represents the presence of a triple bond.

Hence, ethyne has the structure, $\text{H} - \text{C} \equiv \text{C} - \text{H}$. It is called as acetylene.

Q12. Identify the unsaturated compounds from the following.

- (i) Propane
- (ii) Propene
- (iii) Propyne
- (iv) Chloropropane

Answer: Option d)

Unsaturated compounds have double or triple bonds between the carbon atoms.

Propane and propyne both have double and triple bonds, respectively, hence they are unsaturated compounds.

Q13. 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

Answer: Option b)

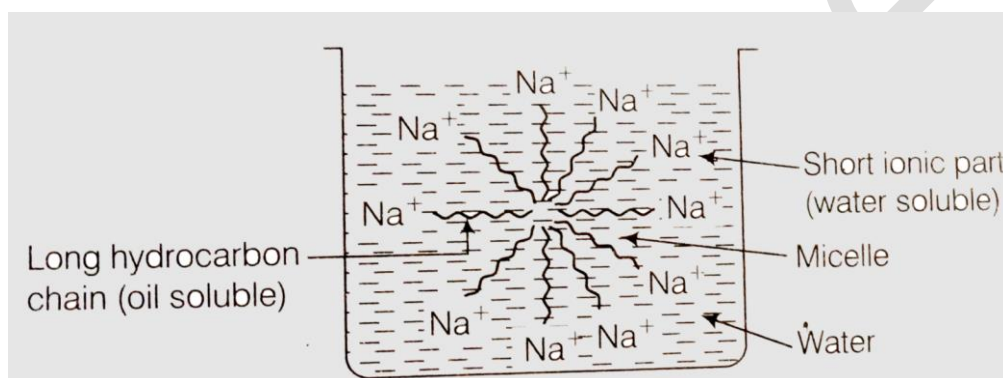
In the presence of sunlight chlorine reacts with saturated hydrocarbons at room temperature.

Q14. In the soap micelles

- a) The ionic end of soap is on the surface of the cluster while the carbon chain is in the interior of the cluster
- b) Ionic end of soap is in the interior of the cluster and the carbon chain is out of the cluster
- c) Both ionic end and carbon chain are in the interior of the cluster.
- d) Both ionic end and carbon chain are on the exterior of the cluster.

Answer: Option a)

The soap molecules are arranged already with hydrocarbon ends directed to the centre and the ionic ends directed outwards.

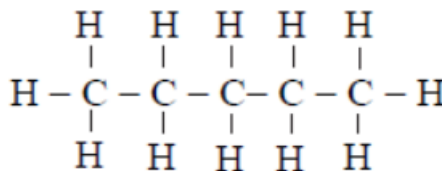


Q15. Pentane has the molecular formula C_5H_{12} . It has

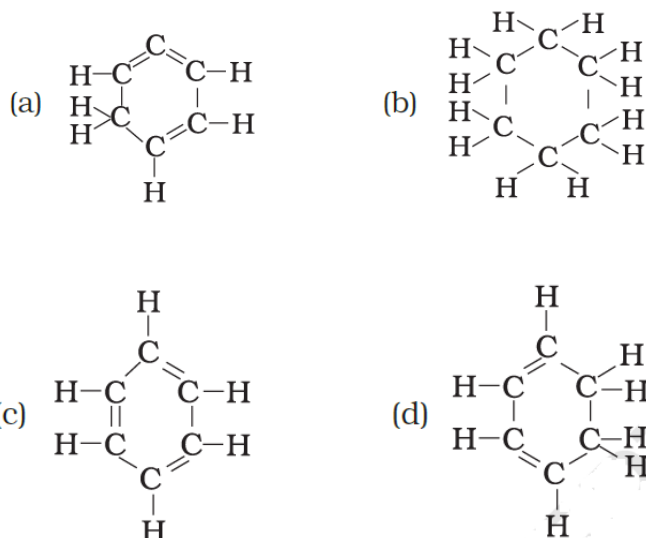
- a) 5 covalent bonds
- b) 12 covalent bonds
- c) 16 covalent bonds
- d) 17 covalent bonds

Answer: Option c)

The structural formula of pentane contains 16 covalent bonds.



Q16. Structural formula of benzene is



Answer: Option c)

Benzene molecule will contain alternate single and double bonds.

Figure (b) will have the formula representation as C_6H_6

Figure (c) does not have double bond at alternate position. Hence Option (c) is correct.

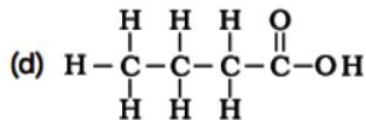
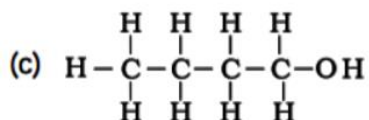
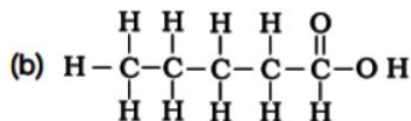
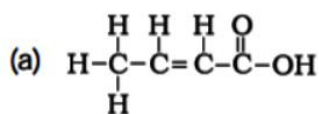
Q17. Ethanol reacts with sodium and forms two products. These are

- a) Sodium ethanoate and hydrogen
- b) Sodium ethanoate and oxygen
- c) Sodium ethoxide and hydrogen
- d) Sodium ethoxide and oxygen

Answer: Option c)

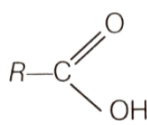
Ethanol reacts with sodium to form hydrogen gas and sodium ethoxide.

Q18. The correct structural formula of butanoic acid is

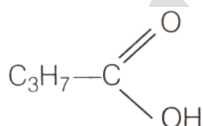


Answer: Option d)

The general formula of carboxylic acid is represented as $R - \text{COOH}$, and R is the alkali group representation;



Hence, its formula is



Since, butane shows the presence of 4 bonded carbon atoms and 'oic acid' shows presence of $\begin{array}{c} \text{O} \\ || \\ -\text{C} - \text{OH} \end{array}$ group.

Q19. 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

Answer: Option c)

A 5% - 8% solution of acetic acid in water is called as Vinegar.

Q20. Mineral acids are stronger acids than carboxylic acids because

- (i) Mineral acids are completely ionised
- (ii) Carboxylic acids are completely ionised
- (iii) Mineral acids are partially ionised
- (iv) Carboxylic acids are partially ionised.

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

Answer: Option a)

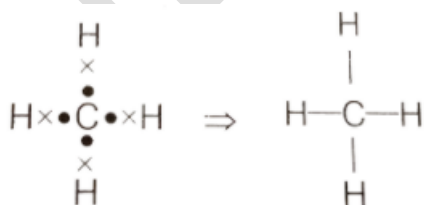
Mineral acids are strong acids which ionised completely and carboxylic acids are weak acids which ionise only partially.

Q21. 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

Answer: Option b)

Electronic configuration of carbon (C) = 2, 4 when it forms 4 covalent bonds by sharing its four valence electrons with hydrogen, it will form CH_4 molecule like;



So, electronic configuration of C in CH_4 = 2, 8

Atomic number of Neon is 10, and its electronic configuration is 2, 8.

Hence, the formation of 4 bonds, carbon attains the electronic configuration of neon.

Q22. The correct electron dot structure of a water molecule is

- (a) $\text{H} \cdot \ddot{\text{O}} \cdot \text{H}$
- (b) $\text{H} : \ddot{\text{O}} : \text{H}$
- (c) $\text{H} : \ddot{\text{O}} : \text{H}$
- (d) $\text{H} : \text{O} : \text{H}$

Answer: Option c)

Water molecule has 2 bond pairs and 2 lone pairs of electrons.

(i) $\text{H}_3\text{C}-\text{CH}_2-\text{CH}_2-\text{CH}_2-\underset{\text{CH}_3}{\overset{|}{\text{CH}}}$

(ii) $\text{H}_3\text{C}-\text{CH}_2-\text{CH}_2-\text{CH}_2-\text{CH}_2-\text{CH}_3$

(iii) $\underset{\text{CH}_3}{\overset{|}{\text{CH}_2}}-\text{H}_2\text{C}-\text{H}_2\text{C}-\underset{\text{CH}_3}{\overset{|}{\text{CH}_2}}$

(iv) $\begin{matrix} \text{CH}_3 \\ \text{H}_3\text{C} \end{matrix} \text{>CH}-\text{CH}_2-\text{CH}_2-\text{CH}_3$

(i) $\text{H}_3\text{C}-\text{CH}_2-\text{CH}_2-\text{CH}_3$
 (ii) $\text{H}_3\text{C}-\text{C}\equiv\text{C}-\text{CH}_3$
 (iii) $\begin{array}{c} \text{H}_3\text{C}-\text{CH}-\text{CH}_3 \\ | \\ \text{CH}_3 \end{array}$
 (iv) $\begin{array}{c} \text{H}_3\text{C}-\text{C}=\text{CH}_2 \\ | \\ \text{CH}_3 \end{array}$

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

(d) (iii) and (iv)

Answer: Option c)

Unsaturated hydrocarbons have triple or double bond in the structure. Figure (ii) and (iv) have triple and double carbon bonds respectively.

Q25. 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

Answer: Option d)

C_4H_{10} does not belong to the same homogeneous series because the successive members of a homologous series differ by $-CH_2$ unit.

Q26. The name of the compound $CH_3 - CH_2 - CHO$ is

- a) Propanal
- b) Propanone
- c) Ethanol
- d) Ethanal

Answer: Option a)

The functional group present is aldehyde. It is propanal containing 3 carbon atoms in which 'propane' represents 3 carbon atoms while 'al' represents aldehyde group. Hence, propane + al will give propanal.

Q27. The heteroatoms present in

$CH_3 - CH_2 - O - CH_2 - CH_2Cl$ are

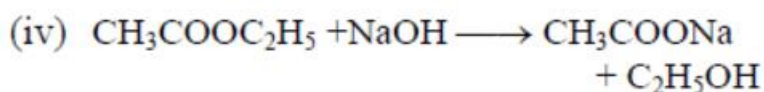
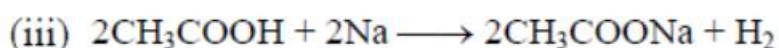
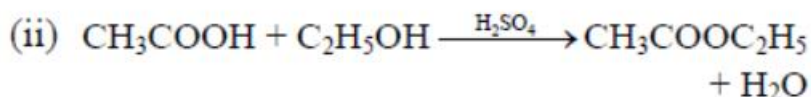
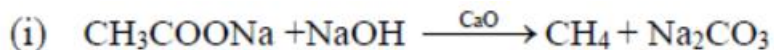
- i) Oxygen
- ii) Carbon
- iii) Hydrogen
- iv) Chlorine

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

Answer: Option d)

Atoms apart from Carbon and Hydrogen, if present in organic compound, are called as heteroatoms.

Q28. Which of the following represents saponification reaction?



Answer: Option d)

When an ester is heated with sodium hydroxide solution, the ester gets hydrolysed to form an alcohol and sodium salt of carboxylic acid, in a saponification reaction.

Q29. The first member of alkyne homologous series is

- a) ethyne
- b) ethene
- c) propyne
- d) methane

Answer: Option a)

The first member of alkyne homologous series is ethyne which is represented as C_2H_2 .

Short Answer Type Questions

Q30. Draw the electron dot structure of ethyne and also draw its structural formula.

Answer:

Ethane has molecular formula as C_2H_2

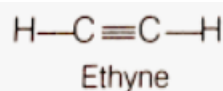
Electronic configuration of C = 2, 4 (valence electrons = 4).

Electronic configuration of $H = 1$ (valence electron = 1).

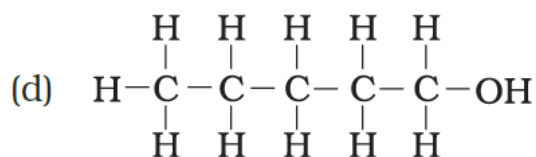
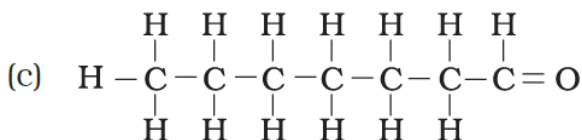
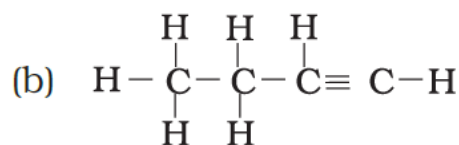
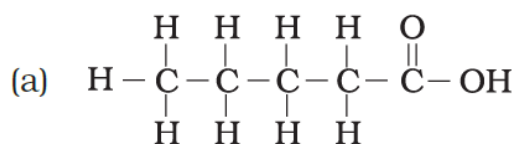
So, the electron dot structure;



Structural formula;



Q31. Write the names of the following compounds.



Answer:

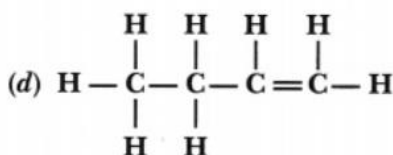
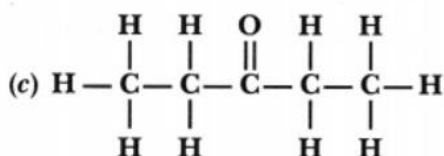
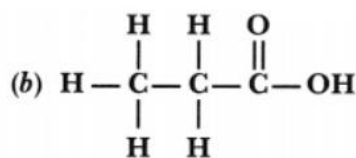
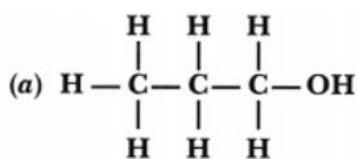
Pentanoic acid contains five C atoms and one $-\text{COOH}$ group.

Pentyne, due to the presence of five carbon atoms along with a triple bond.

Heptane, as it contains 7 carbon and a $-\text{CHO}$ group.

Pentanol, as it contains 5 carbon atoms and one $-\text{OH}$ group.

Q32. Identify and name the functional groups present in the following compounds.



Answer:

(a) —OH Hydroxyl/Alcohol

(b) $\begin{array}{c} \text{—C—OH} \\ || \\ \text{O} \end{array}$ Carboxylic acid

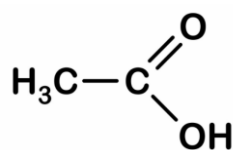
(c) $\begin{array}{c} \text{O} \\ || \\ \text{—C—} \end{array}$ Ketone

(d) $\begin{array}{c} | \quad | \\ \text{—C=C—} \end{array}$ Alkene

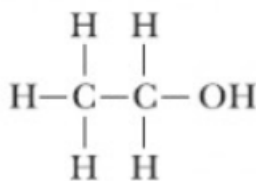
Q33. A compound X is formed by the reaction of a carboxylic acid $C_2H_4O_2$ and an alcohol in presence of a few drops of H_2SO_4 . The alcohol on oxidation with alkaline $KMnO_4$ followed by acidification gives the same carboxylic acid as used in this reaction. Give the names and structures of (a) carboxylic acid, (b) alcohol and (c) the compound X. Also write the reaction.

Answer:

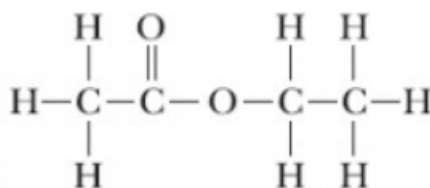
- a) Carboxylic acid which is having molecular formula $C_2H_4O_2$ is acetic acid or ethanoic acid. The structure is –



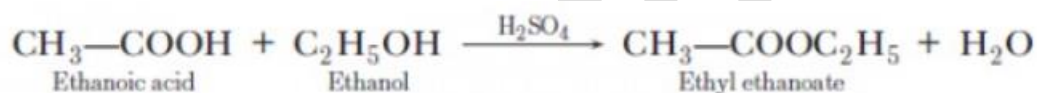
b) Alcohol is ethanol, whose structure is –



c) Compound X is ethanoate, whose structure is –



The reaction is as follows: -



Q34. Why detergents are better cleansing agents than soaps? Explain.

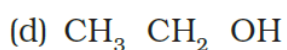
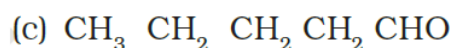
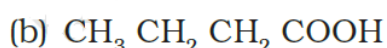
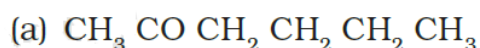
Answer:

Detergents are better cleansing because they are used even with hard water. The charged ends of detergent does not form insoluble precipitates with magnesium or carbon ions in hard water.

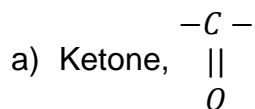
When soap is used for washing clothes it reacts with calcium and magnesium ions of hard water to form an insoluble precipitate called as scum.

Detergents also have a stronger cleansing action compared to soaps and are more soluble in water than soaps.

Q35. Name the functional groups present in the following compounds.



Answer:



b) Carboxylic acid, $-COOH$

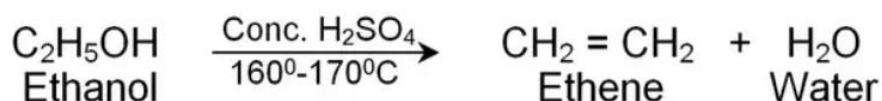
c) Aldehyde, $-CHO$

d) Alcohol, $-OH$

Q36. How is ethene prepared from ethanol? Give the reaction involved in it.

Answer:

Ethene is formed by the dehydration of ethyl alcohol in the presence of concentrated H_2SO_4 at $160^\circ C - 170^\circ C$.



Q37. Intake of small quantity of methanol can be lethal. Comment.

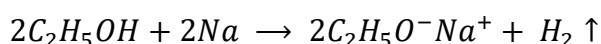
Answer:

Methanol is poisonous since it is oxidised to methanal in the liver. Methanal reacts rapidly with the components of cells and causes the protoplasm to get coagulated. Methanol affects the optic nerve causing blindness.

Q38. A gas is evolved when ethanol reacts with sodium. Name the gas evolved and also write the balanced chemical equation of the reaction involved.

Answer:

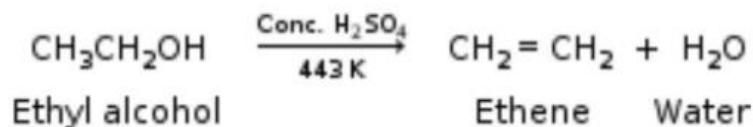
The evolved gas when ethanol reacts with sodium is hydrogen.



Q39. Ethene is formed when ethanol at 443 K is heated with excess of concentrated sulphuric acid. What is the role of sulphuric acid in this reaction? Write the balanced chemical equation of this reaction.

Answer:

When we heat ethanol with excess of concentrated sulphuric acid at 443 K, it gets dehydrated to form ethene.



In this reaction, concentrated sulphuric acid acts as a dehydrating agent which removes water molecule from the ethanol molecule.

Q40. Carbon, group (14) element in the periodic table, is known to form compounds with many elements. Write an example of a compound formed with

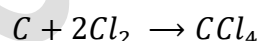
- Chlorine (group 17 of periodic table)**
- Oxygen (group 16 of periodic table)**

Answer:

- The electronic configuration of carbon (C) = 2, 4

The electronic configuration of chlorine (Cl) = 2, 8, 7

With chlorine, carbon can form carbon tetrachloride



The dot structure and the structural formula of carbon tetrachloride are:



- Electronic configuration of Oxygen (O) = 2, 6

The dot structure and structural formula of carbon dioxide are:



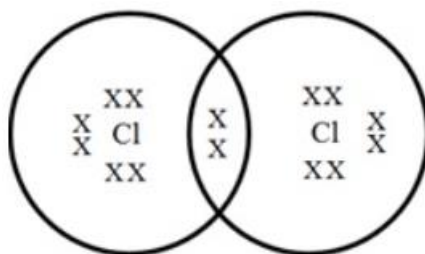
With 2 molecules of oxygen the carbon forms the carbon dioxide.

Q41. In electron dot structure, the valence shell electrons are represented by crosses or dots.

- The atomic number of Chlorine is 17. Write its electronic configuration.
- Draw the electron dot structure of Chlorine molecule

Answer:

- The electronic configuration of Cl = 2, 8, 7
- The electron dot structure of chlorine molecule is



Cl – Cl or Cl₂ (Chlorine molecule)

Q42. Catenation is the ability of an atom to form bonds with other atoms of the same element. It is exhibited by both carbon and silicon. Compare the ability of catenation of the two elements. Give reasons.

Answer:

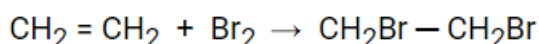
Carbon and silicon both have same valence shell electronic configuration, that is, both have 4 electrons in the valence shell and hence they show the phenomenon of catenation.

Carbon exhibits catenation more than silicon because of its smaller size which makes the C – C bonds strong while the Si – Si bonds are weaker because of its larger size. Due to greater strength of C – C over Si – Si bonds, so carbon shows catenation to a greater extent compared to silicon.

Q43. Unsaturated hydrocarbons contain multiple bonds between the two C – atoms and show addition reaction. Give the best test to distinguish ethane from ethene.

Answer:

Bromine solution in CCl_4 has orange colour, when a drop of ethene is added to the ethene, the orange disappears because the formation of the colourless ethylene dibromide. This is an addition reaction.



Saturated hydrocarbon generally gives a clear flame while unsaturated hydrocarbon gives a yellow flame with lots of black smoke.

Q44. Match the reactions given in Column I with the names given in Column II.

S/No.	Column I	Column II
1.	$CH_3OH + CH_3COOH \rightarrow CH_3COOCH_3 + H_2O$	Addition reaction
2.	$CH_2 = CH_2 + H_2 \rightarrow CH_3 - CH_3$	Substitution reaction
3.	$CH_4 + Cl_2 \rightarrow CH_3Cl + HCl$	Neutralisation reaction
4.	$CH_3COOH + NaOH \rightarrow CH_3COONa + H_2O$	Esterification reaction

Answer:

S/No.	Column I	Column II
1.	$CH_3OH + CH_3COOH \rightarrow CH_3COOCH_3 + H_2O$	Esterification reaction
2.	$CH_2 = CH_2 + H_2 \rightarrow CH_3 - CH_3$	Addition reaction
3.	$CH_4 + Cl_2 \rightarrow CH_3Cl + HCl$	Substitution reaction
4.	$CH_3COOH + NaOH \rightarrow CH_3COONa + H_2O$	Neutralisation reaction

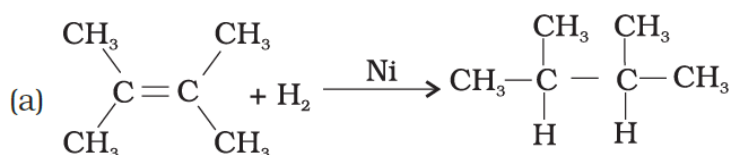
Q45. Write the structural formulae of all isomers of hexane.

Answer:

S/No.	Isomers of Hexane	Structural Formulae
i)	Hexane	$CH_3-CH_2-CH_2-CH_2-CH_2-CH_3$
ii)	2-methyl pentane	$ \begin{array}{c} CH_3-CH-CH_2-CH_2-CH_3 \\ \\ CH_3 \end{array} $
iii)	3-methyl pentane	$ \begin{array}{c} CH_3-CH_2-CH-CH_2-CH_3 \\ \\ CH_3 \end{array} $
iv)	2, 3 dimethyl butane	$ \begin{array}{c} CH_3-CH-CH-CH_2-CH_3 \\ \quad \\ CH_3 \quad CH_3 \end{array} $

v)	2, 2 dimethyl butane	$ \begin{array}{c} \text{CH}_3 \\ \\ \text{CH}_3 - \text{C} - \text{CH}_2 - \text{CH}_3 \\ \\ \text{CH}_3 \end{array} $
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Q46. What is the role of metal or reagents written on arrows in the given chemical reaction?



Answer:

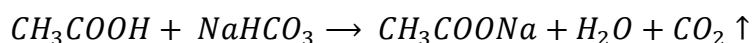
- Nickel (Ni) behaves as a catalyst during the reaction. It will absorb the hydrogen molecule on its surface and then the alkene molecule simultaneously. The 2 hydrogen atoms will add across the double bond of alkene to produce the addition product, that is 2, 3 – dimethyl butane.
- Concentric H_2SO_4 increases the rate of the forward reaction by removing water formed during the reaction. So, we can say that Concentric H_2SO_4 is a dehydrating agent.
- Alkaline KMnO_4 behaves like an oxidising agent and oxidises ethanol to ethanoic acid.

Long Answer Type Question

Q47. A salt X is formed and a gas is evolved when ethanoic acid reacts with sodium hydrogen carbonate. Name the salt X and the gas evolved. Describe an activity and draw the diagram of the apparatus to prove that the evolved gas is the one which you have named. Also, write chemical equation of the reaction involved.

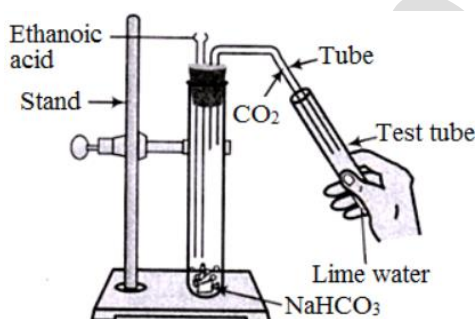
Answer:

As ethanoic acid (CH_3COOH) reacts with sodium hydrogen carbonate ($NaHCO_3$), sodium ethanoate will be produced. Hence, X is sodium ethanoate (CH_3COONa) and the gas evolved will be carbon dioxide (CO_2).

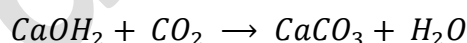


Activity: -

- i) Set-up the experimental apparatus.



- ii) Let's take $NaHCO_3$ in a test tube.
 iii) Adding 2 mL of ethanoic acid
 iv) CO_2 gas is evolved with brisk effervescence.
 v) Now, pass the gas through freshly prepared lime water.
 vi) Which will turn the milk due to the formation of insoluble calcium carbonate.



Q48. a) What are hydrocarbons? Give examples.

b) Give the structural differences between saturated and unsaturated hydrocarbons with two examples each.

c) What is functional group? Give examples of four different functional groups.

Answer:

- a) The compounds which are made up of carbon and hydrogen atoms are called as hydrocarbons, example, methane (CH_4), ethane (CH_3CH_3). Ethyne (C_2H_2), cyclohexane (C_6H_{12}) etc.

b) In saturated hydrocarbons, all 4 valences of carbon are satisfied by a single covalent bond while in unsaturated hydrocarbons, double or triple bonds are required to the valences, example: -

i) Saturated hydrocarbons

Methane (CH_4), Ethane ($CH_3 - CH_3$)

ii) Unsaturated hydrocarbons

Ethene ($H_2C = CH_2$), Ethyne ($HC \equiv CH$)

c) An atom or group of atoms that defines the structure of organic compounds is called as functional group. Examples are: -

i) $-OH$ (Alcohol)

ii) $-COOH$ (Carboxylic acid)

iii) $-CHO$ (Aldehyde)

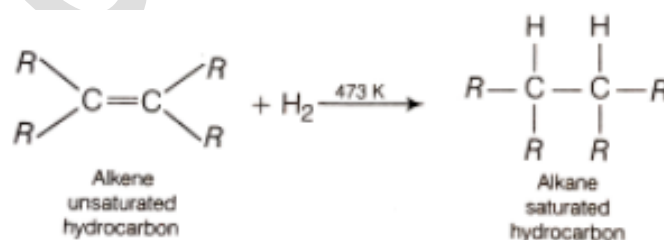
iv) $-X$ (Halogens)

Q49. Name the reaction which is commonly used in the conversion of vegetable oils to fats. Explain the reaction involved in detail.

Answer:

The reaction is called as hydrogenation reaction. When a vegetable oil is treated with hydrogen and passed over finely divided nickel or palladium at $200^\circ C$, the hydrogen molecules are added to unsaturated carbon-carbon bonds and hence, saturated vegetable fats are obtained.

Example: -

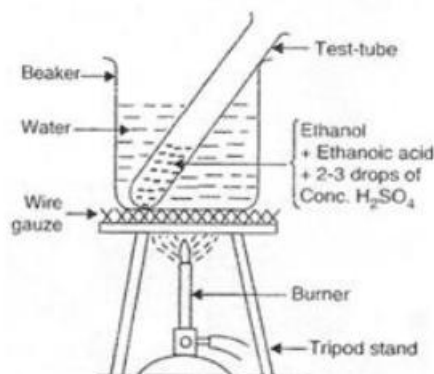


Here, R represents any alkyl group, that is, $-CH_3$, $-C_2H_5$ etc.

Q50. a) Write the formula and draw electron dot structure of carbon tetrachloride.

b) What is saponification? Write the reaction involved in this process.

- i) Take 1 mL ethanol and 1 mL acetic acid along with few drops of concentrated sulphuric acid in a test tube.
- ii) Heat the contents in a water bath for 5 minutes.
- iii) Pour the content into a beaker containing 20-50 mL of water.
- iv) Resulting mixture would have sweet smell.



Q52. A compound C (molecular formula $C_2H_4O_2$) reacts with Na metal to form a compound R and evolves a gas which burns with a pop sound. Compound C on treatment with an alcohol A in the presence of an acid forms a sweet-smelling compound S (molecular formula $C_3H_6O_2$). On addition of $NaOH$ to C, it also gives R and water. S on treatment with $NaOH$ solution gives back R and A.

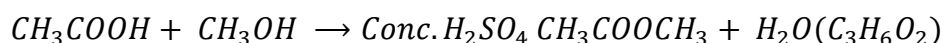
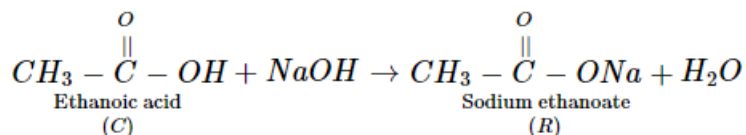
Identify C, R, A, S and write down the reactions involved.

Answer:

- Compound C contains two oxygen atoms, so it may be a carboxylic acid, that is, ethanoic acid (CH_3COOH).
- Ethanoic acid reacts with a base, that is, sodium metal to evolve a gas which burns with a pop sound along with the formation of compound (R), so R is a salt, that is, sodium ethanoate and the gas which burns with a pop sound is H_2 gas.

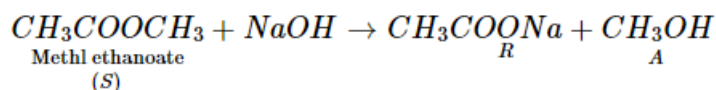


Compound R is sodium ethanoate, because when ethanoic acid reacts with $NaOH$ it gives R which is sodium ethanoate with water.

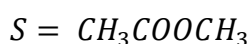
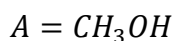
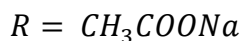
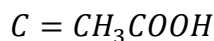


Compound C on treatment with an alcohol A in the presence of acid generates a sweet smell compound S, so, S is methyl ethanoate (ester).

Ester S has 3 carbon atoms and acid C has two carbon atoms so, alcohol A must have one C atom, that is, A is a methanol.

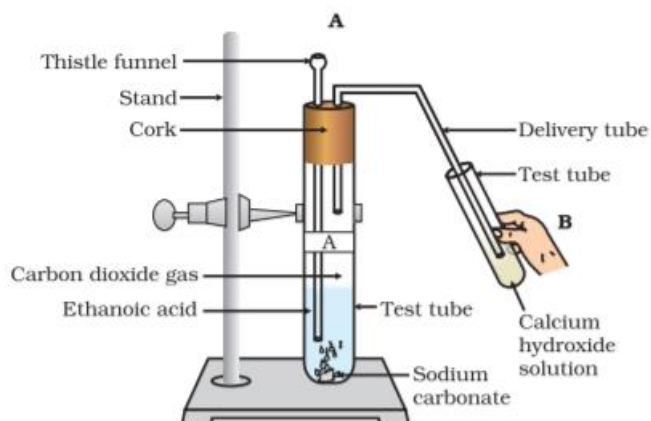


Hence,



Q53. Look at the figure and answer the following question.

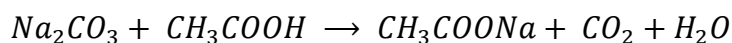
- What change would you observe in the calcium hydroxide solution taken in tube B?
- Write the reaction involved in test tubes A and B respectively.



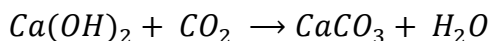
- If ethanol is given instead of ethanoic acid, would you expect the same change?
- How can a solution of lime water be prepared in the laboratory?

Answer:

- Whenever CO_2 is passed through calcium hydroxide solution, that is, the lime water, it turns milky due to the formation of insoluble calcium carbonate ($CaCO_3$).
- Test Tube – A



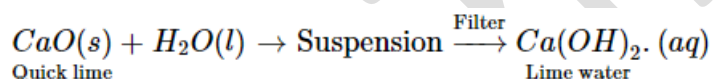
Test Tube – B



- c) When ethanol is taken instead of ethanoic acid, then there will be no change because ethanol is a very weak acid and hence cannot decompose Na_2CO_3 to give CO_2 gas.



- d) When a quick lime is added to water in a test tube. Some part of it will be dissolved to form a calcium hydroxide while major portion will remain suspended. After filtering the clear solution obtained will be the lime water.



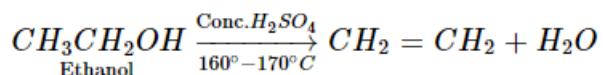
Q54. How would you bring about the following conversions? Name the process and write the reaction involved.

- Ethanol to ethane
- Propanol to propanoic acid

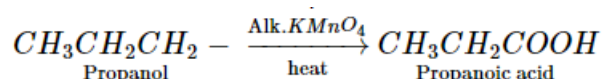
Write the reactions.

Answer:

- a) The reaction taking place here is dehydration.



- b) The reaction taking place here is oxidation reaction.

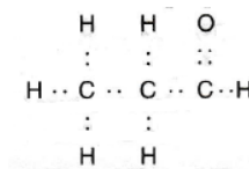
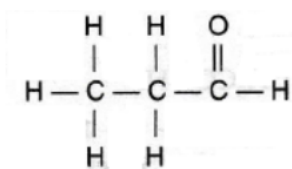


Q55. Draw the possible isomers of the compound with molecular formula C_3H_6O and also give their electron dot structures.

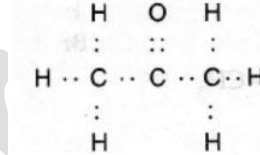
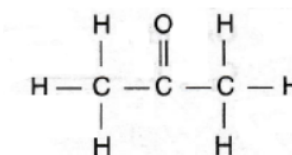
Answer:

There are two isomers possible for molecular formula C_3H_6O with their dot structure:

1. Propanal



2. Propanone

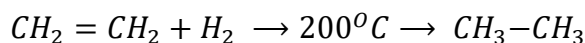


Q56. Explain the given reaction with the examples.

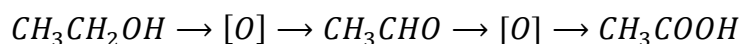
- Hydrogenation reaction
- Oxidation reaction
- Substitution reaction
- Saponification reaction
- Combustion reaction

Answer:

- a) Hydrogenation reaction – it is the addition of hydrogen with unsaturated molecule to make it saturated.



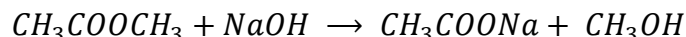
- b) Oxidation reaction – it is the reaction where an oxidising agent supply nascent oxygen for oxidation.



- c) Substitution reaction – when an atom or group of atoms replace another atom or a group of atoms from the molecule.



- d) Saponification reaction – when ester are hydrolysed in the presence of a base then the reaction is called as saponification reaction.



- e) Combustion reaction – in this reaction, organic compounds burn readily in air to form CO_2 and water vapour along with lot of heat.



Q57. An organic compound A on heating with concentrated H_2SO_4 forms a compound B which on addition of one mole of hydrogen in presence of Ni forms a compound C. One mole of compound C on combustion forms two moles of CO_2 and three moles of H_2O . Identify the compounds A, B and C and write the chemical equation of the reactions involved.

Answer:

- i) Compound C on combustion forms two moles of CO_2 and three moles of H_2O , compound C needs to contain two carbon atoms and six hydrogen atoms. Hence, compound C is ethane (C_2H_6).



Thus,

$A = \text{ethanol } (CH_3CH_2OH)$

$B = \text{ethene } (CH_2 = CH_2)$

$C = \text{ethane } (CH_3 - CH_3)$

- ii) Compound C is obtained by the addition of 1 mole of H_2 in presence of Ni to compound B, so, compound B is ethene (C_2H_4).



- iii) Compound B is generated by heating compound A with concentrated H_2SO_4 , so, compound A must be ethanol (C_2H_5OH).

