

Chapter - 4

Carbon and its Compounds

Multiple Choice Questions

1. 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

Soln:

Answer is (c) carbon dioxide only

2. 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)

Soln:

Answer is (d) (ii) and (iv)

Explanation:

Carbon compounds form covalent bonds hence they have very weak force of attraction. Carbon compounds are poor conductors of electricity.

3. 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

Soln:

Answer is (a) only single bonds

Explanation:

Nitrogen has three electron in its outermost shell and hydrogen has 1. 3 hydrogen atoms combine with 1 nitrogen atom to make ammonia. These bonds are single bonds.



Soln:

Answer is (b) oxidising agent

Explanation:

Two Hydrogen atoms are replaced by an atom of oxygen making oxidation of ethanol. Here addition of oxygen is provided by potassium.

7. 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

Soln:

Answer is (a) Addition reaction

Explanation:

Here Hydrogen is added to oil, hence it is an addition reaction.

8. In which of the following compounds, — OH is the functional group?

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

Soln:

Answer is (b) Butanol

Explanation:

Compound with OH Functional group will have a suffix ol in them hence answer is (b) Butanol.

9. 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

Soln:

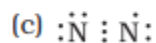
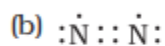
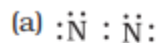
Answer is (a) hydrophilic head and a hydrophobic tail



Explanation:

Because of hydrophobic tail Oil and grease is trapped inside a micelle. Hydrophobic head makes the outer surface of micelle. Hence micelle is easily washed by water.

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

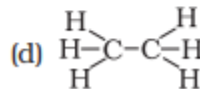
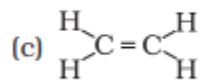
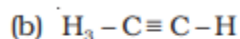
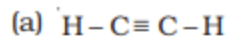
**Soln:**

Answer is d)

Explanation:

In this structure Nitrogen atoms gets 8 electron whereas in other options it is different.

11. Structural formula of ethyne is

**Solution:**

Answer is a)

Explanation:

Chemical formula of Ethyne is C_2H_2 , Hence answer is a)



12. 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)

Soln:

Answer is (d) (ii) and (iii)

Explanation:

Propene has double bond and Propyne is having triple bond. Hence they are unsaturated compounds.

13. 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

Soln:

Answer is (b) presence of sunlight

Explanation:

In presence of sunlight Chlorine reacts with Hydrocarbons and displaces Hydrogen atoms.

14. 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

Soln:

Answer is (a) the ionic end of soap is on the surface of the cluster while the carbon chain is in the interior of the cluster.



Explanation:

A micelle is a spherical aggregate soap molecules in soap solution. In the soap micelles the ionic end of soap is on the surface of the cluster while the carbon chain is in the interior of the cluster.

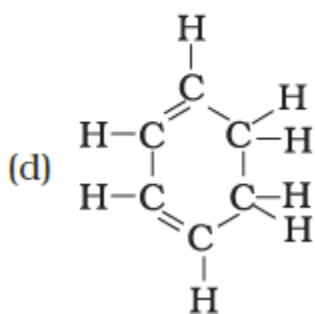
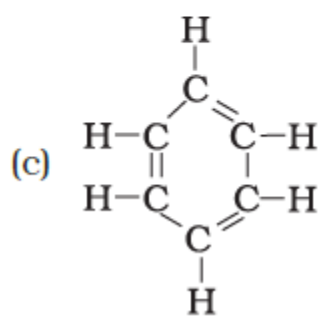
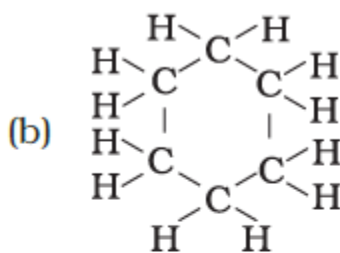
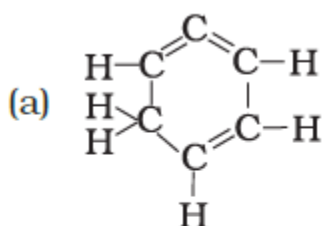
15. Pentane has the molecular formula C_5H_{12} . It has

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

Soln:

Answer is (c) 16 covalent bonds

16. Structural formula of benzene is



Soln:

Answer is c)

Explanation:

Chemical formula of Benzene is C_6H_6 . In option all the arms of carbon atoms are occupied hence it is the right answer.

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

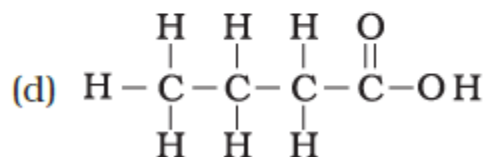
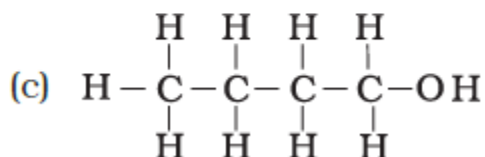
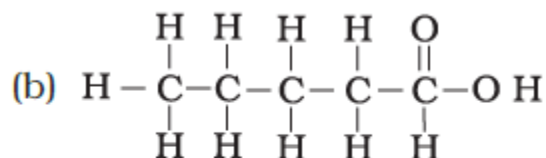
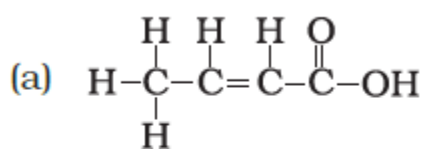
- (a) sodium ethanoate and hydrogen
- (b) sodium ethanoate and oxygen
- (c) sodium ethoxide and hydrogen
- (d) sodium ethoxide and oxygen

Soln:

Answer is (c) sodium ethoxide and hydrogen

Explanation:

18. The correct structural formula of butanoic acid is

**Soln:**

Answer is d)

19. 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

Soln:

Answer is (c) 5% – 8% acetic acid in water



20. 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)

Soln:

Answer is (a) (i) and (iv)

Explanation:

Mineral acids are completely ionized whereas carboxylic acids are partially ionized. Hence mineral acids are stronger than carboxylic acids.

21. 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

Soln:

Answer is (b) neon

Explanation:

After sharing four valence electrons with univalent atoms. Electronic configuration of Carbon becomes 2.8 which is same as electronic configuration of Neon.

22. 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) $\text{H} : \text{O} : \text{H}$

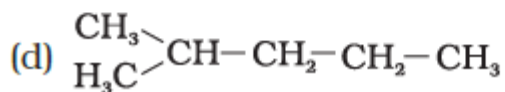
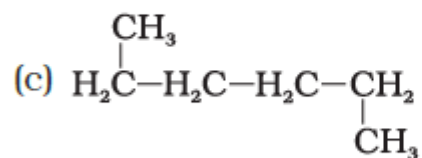
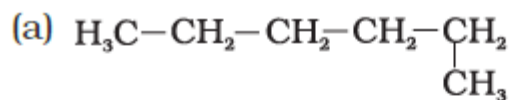
Soln:

Answer is c)

Explanation:

Option c) represents complete octet configuration . Hence it is the right answer.

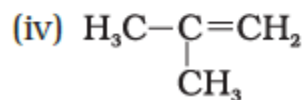
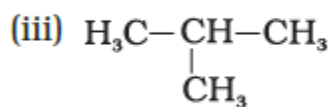
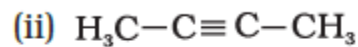
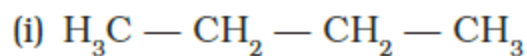
23. Which of the following is not a straight chain hydrocarbon?



Soln:

Answer is d)

24. Which among the following are unsaturated hydrocarbons?



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

Soln:

Answer is (c) (ii) and (iv)

Explanation:

Option (ii and (iv having double and triple bonds, hence they are unsaturated hydrocarbons.

25. 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

Soln:

Answer is (d) C_4H_8

Explanation

General formula for C_4H_8 is C_nH_{2n} and for other option it is $\text{C}_n\text{H}_{2n+2}$

26. The name of the compound $\text{CH}_3 - \text{CH}_2 - \text{CHO}$ is

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

Soln:

Answer is (a) Propanal

Explanation:

This compound has 3 carbon atoms and an aldehyde which add suffix al to 3 carbon compound.

27. The heteroatoms present in $\text{CH}_3 - \text{CH}_2 - \text{O} - \text{CH}_2 - \text{CH}_2\text{Cl}$ 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)

Soln:

Answer is (d) (i) and (iv)



Explanation:

Oxygen and chlorine are not among essential components of Hydrocarbon hence they are heteroatoms.

28. Which of the following represents saponification reaction?

- (a) $\text{CH}_3\text{COONa} + \text{NaOH} \rightarrow \text{CH}_4 + \text{Na}_2\text{CO}_3$
- (b) $\text{CH}_3\text{COOH} + \text{C}_2\text{H}_5\text{OH} \rightarrow \text{CH}_3\text{COOC}_2\text{H}_5 + \text{H}_2\text{O}$
- (c) $2\text{CH}_3\text{COOH} + 2\text{Na} \rightarrow 2\text{CH}_3\text{COONa} + \text{H}_2$
- (d) $\text{CH}_3\text{COOC}_2\text{H}_5 + \text{NaOH} \rightarrow \text{CH}_3\text{COONa} + \text{C}_2\text{H}_5\text{OH}$

Soln:

Answer is (d) $\text{CH}_3\text{COOC}_2\text{H}_5 + \text{NaOH} \rightarrow \text{CH}_3\text{COONa} + \text{C}_2\text{H}_5\text{OH}$

Explanation:

Saponification is a reaction in which ethanol and sodium ethanoate are produced upon treatment of ester with an alkali.

29. The first member of alkyne homologous series is

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

Soln:

Answer is (b) ethene

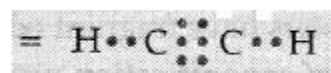
Short Answer Questions

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

Soln:

Molecular formula= C_2H_2

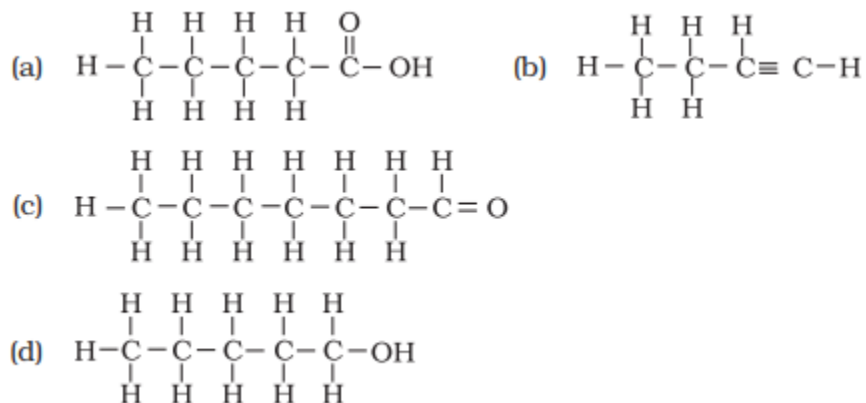
Electronic Formula



Structural formula= $\text{H}-\text{C}\equiv\text{C}-\text{H}$



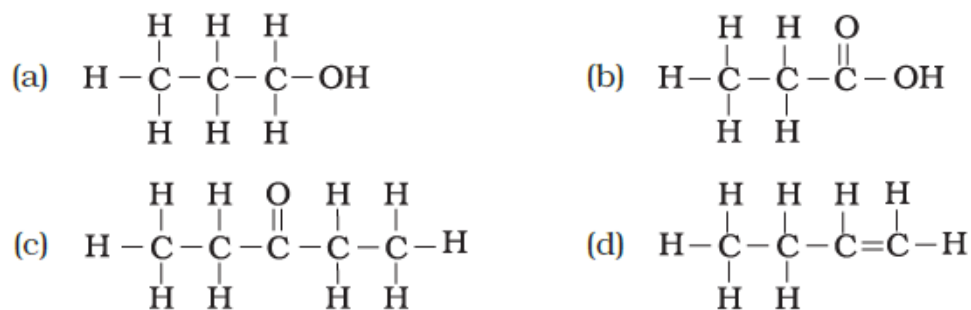
31. Write the names of the following compounds



Soln:

- a) Pentanoic acid
- b) Butyne
- c) Heptanal
- d) Pentanol

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



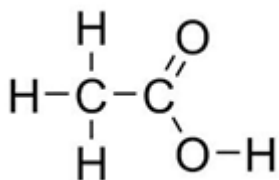
Soln:

- a) Alcohol
- b) Carboxylic acid
- c) Ketone
- d) Alkene

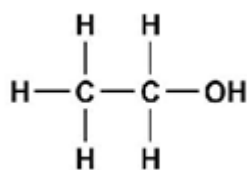
33. A compound X is formed by the reaction of a carboxylic acid $C_2H_4O_2$ and an alcohol in presence of a few drops of H_2SO_4 . The alcohol on oxidation with alkaline $KMnO_4$ followed by acidification gives the same carboxylic acid as used in this reaction. Give the names and structures of (a) carboxylic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

Soln:

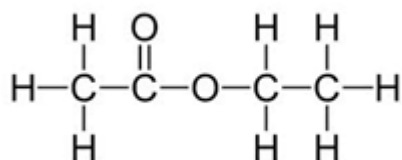
Carboxylic acid = CH_3COOH ethanoic acid



Alcohol = CH_3CH_2OH ethanol



X = $CH_3COOCH_2CH_3$ ethyl ethanoate



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

Soln:

Detergents are better than soaps because detergents are ammonium or sulphonate salts of long chain carboxylic acids. Charged ends of these will not form precipitate with calcium and magnesium present in hard water. On the other hand soaps will form precipitate with calcium and magnesium ions present in the hard water.

35. Name the functional groups present in the following compounds

(a) $\text{CH}_3\text{COCH}_2\text{CH}_2\text{CH}_3$

(b) $\text{CH}_3\text{CH}_2\text{CH}_2\text{COOH}$

(c) $\text{CH}_3\text{CH}_2\text{CH}_2\text{CHO}$

(d) $\text{CH}_3\text{CH}_2\text{OH}$

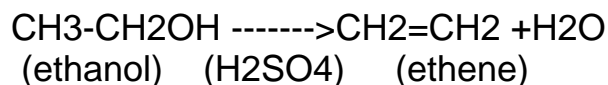
Soln:

- a) Ketone
- b) Carboxylic acid
- c) Aldehyde
- d) Alcohol

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

Soln:

Ethanol is heated at 443K along with excess Sulphuric acid to obtain Ethene.



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

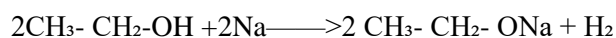
Soln:

Methanol gets converted to Methanal and liver and kills all the cells. Methanol also affects the optic nerves and causes blindness. Hence intake of small quantity of methanol can be lethal.

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

Soln:

When ethanol reacts with sodium it gives Sodium ethoxide with the liberation of Hydrogen gas.

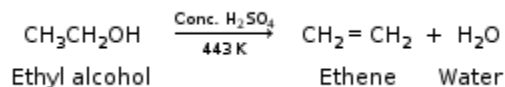


39. Ethene is formed when ethanol at 443 K is heated with excess of concentrated sulphuric acid. What is the role of sulphuric acid in this reaction? Write the balanced chemical equation of this reaction.



Soln:

Sulphuric acid acts as a catalyst and a dehydrating agent in the formation of ethene.



40. Carbon, Group (14) element in the Periodic Table, is known to form compounds with many elements. Write an example of a compound formed with

- (a) chlorine (Group 17 of Periodic Table)**
- (b) oxygen (Group 16 of Periodic Table)**

Soln:

- a) CCl_4 - Carbon Tetra chloride
- b) Carbon-di-oxide- CO_2

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

- (a) The atomic number of chlorine is 17. Write its electronic configuration**
- (b) Draw the electron dot structure of chlorine molecule**

Soln:

- a) KLM- 2,8,7



42. 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.

Soln:

Catenation is shown by both Silicon and Carbon. Silicon bonds are less stable and reactive whereas bonds formed by Carbon bonds are very strong hence carbon shows better catenation than Silicon.

43. Unsaturated hydrocarbons contain multiple bonds between the two C-atoms and show addition reactions. Give the test to distinguish ethane from ethene.

Soln:

Saturated Hydrocarbons burns with clean flame and produce no soot where as non-saturated Hydrocarbons burns with yellow flame and produces lot of soot. Ethane is saturated hydrocarbon and it burns with clean flame with no soot. Ethene is unsaturated hence it burns with yellow flame producing lot of soot.

44. Match the reactions given in Column (A) with the names given in column (B).

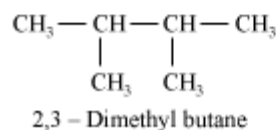
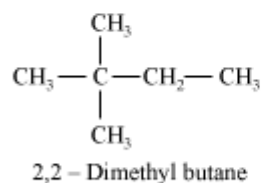
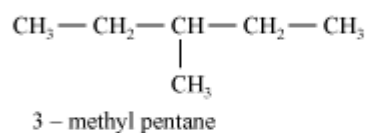
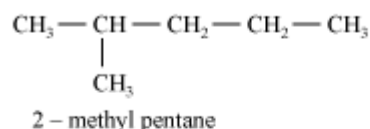
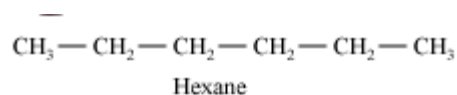
Column A	Column B
(a) $\text{CH}_3\text{OH} + \text{CH}_3\text{COOH} \rightarrow \text{CH}_3\text{COOCH}_3 + \text{H}_2\text{O}$	(i) Addition reaction
(b) $\text{CH}_2 = \text{CH}_2 + \text{H}_2 \rightarrow \text{CH}_3 - \text{CH}_3$	(ii) Substitution reaction
(c) $\text{CH}_4 + \text{Cl}_2 \xrightarrow{\text{Sunlight}} \text{CH}_3\text{Cl} + \text{HCl}$	(iii) Neutralisation reaction
(d) $\text{CH}_3\text{COOH} + \text{NaOH} \rightarrow \text{CH}_3\text{COONa} + \text{H}_2\text{O}$	(iv) Esterification reaction

Soln:

Column A	Column B
(a) $\text{CH}_3\text{OH} + \text{CH}_3\text{COOH} \rightarrow \text{CH}_3\text{COOCH}_3 + \text{H}_2\text{O}$	(iv) Esterification reaction
(b) $\text{CH}_2 = \text{CH}_2 + \text{H}_2 \rightarrow \text{CH}_3 - \text{CH}_3$	(i) Addition reaction
(c) $\text{CH}_4 + \text{Cl}_2 \xrightarrow{\text{Sunlight}} \text{CH}_3\text{Cl} + \text{HCl}$	(ii) Substitution reaction
(d) $\text{CH}_3\text{COOH} + \text{NaOH} \rightarrow \text{CH}_3\text{COONa} + \text{H}_2\text{O}$	(iii) Neutralisation reaction

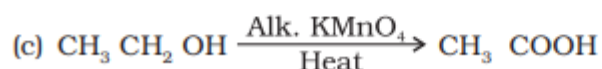
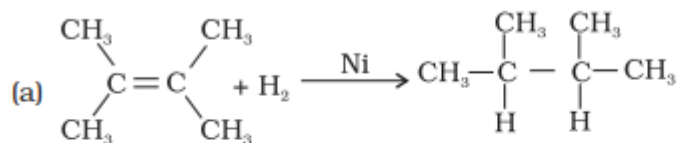
45. Write the structural formulae of all the isomers of hexane.

Soln:



46. What is the role of metal or reagents written on arrows in the given chemical reactions?

Soln:



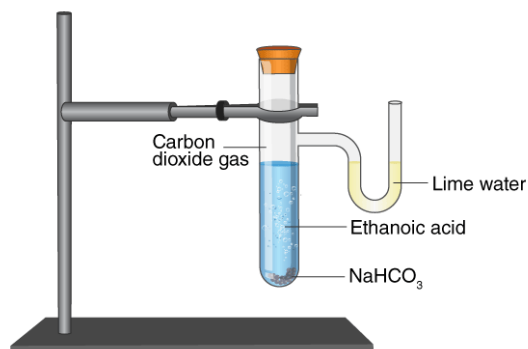
47. A salt X is formed and a gas is evolved when ethanoic acid reacts with sodium hydrogencarbonate. Name the salt X and the gas evolved. Describe an activity and draw the diagram of the apparatus to prove that the evolved gas is the one which you have named. Also, write chemical equation of the reaction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

Soln:

When ethanoic acid reacts with Sodium Hydrogen Carbonate with production of Sodium Ethanoate and producing Carbon-di-oxide gas.



Here salt X is Sodium Ethanoate and gas evolved is Carbon-di-oxide.



Activity

- Set up the experiment as shown in figure.
- Take a spoon full of Sodium Hydrogen Carbonate in a test-tube and add 2ml of dilute ethanoic acid.
- Brisk effervescence occur in testtube.
- Pass the produce gas into lime water
- Lime water turn milky confirming the evolution of CO₂

48. (a) What are hydrocarbons? Give examples.

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

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

Soln:

- Compounds of Carbon and hydrogen are called as Hydrocarbons. Ex: Ethane, Methane
- All the bond in saturated Hydrocarbons are single bonds whereas bonds in the unsaturated Hydrocarbons are either double or triple bonds.
Saturated Hydrocarbon Ex: Ethane, Methane
Unsaturated Hydrocarbons-Ethyne, Ethene
- Functional groups are set of atoms joined in a specific manner which are responsible for characteristic chemical property of the compound.Ex: CHO-Aldehyde, OH-Hydroxyl , COOH- Carboxylic acid.

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

Soln:

Addition reaction is involved in the conversion of oils into fats. This process is known as Hydrogenation. Here Unsaturated vegetable are converted to saturated fats which have saturated carbons.

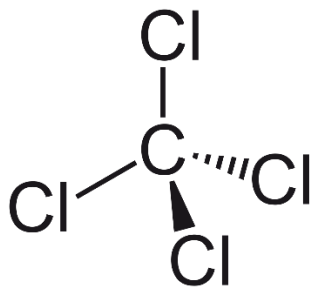
Nickel is used as a catalyst in the hydrogenation process and the reaction is given below



50. (a) Write the formula and draw electron dot structure of carbon tetrachloride.
(b) What is saponification? Write the reaction involved in this process.

Soln:

- a) Carbon tetra chloride- CCl_4



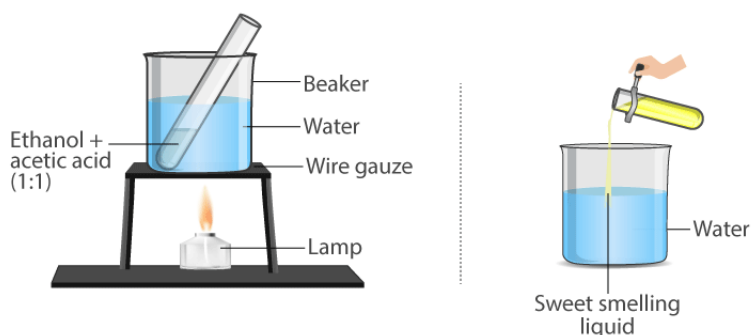
- b) The reaction of an ester in the presence of base to give sodium salt of carboxylic acid and alcohol is known as saponification and it is used in the preparation of soap.

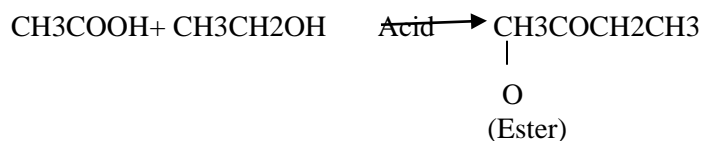


51. Esters are sweet-smelling substances and are used in making perfumes. Suggest some activity and the reaction involved for the preparation of an ester with well labeled diagram.

Soln:

In a test- tube take 1ml ethanol and 1 ml glacial acetic acid and add few drops of concentrated H_2SO_4 . Warm the testtube for 5 minutes over a waterbath. Transfer the content in a beaker. Sweet smell confirms the formation of Ester.



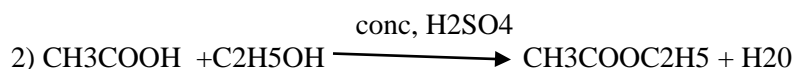


52. A compound C (molecular formula, $\text{C}_2\text{H}_4\text{O}_2$) reacts with Na - metal to form a compound R and evolves a gas which burns with a pop sound. Compound C on treatment with an alcohol A in presence of an acid forms a sweet smelling compound S (molecular formula, $\text{C}_3\text{H}_6\text{O}_2$). 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.

Soln:

1) Compound C is Ethanoic acid [Acetic acid]

It reacts with sodium metal to form a compound called R. R is Sodium Ethanoate.



so compound S is Ester or Ethyl ethanoate and compound A is Ethanol



so compound R is again Sodium Ethanoate.

So compound C is Ethanoic acid

A is Ethanol

S is Ester R is sodium Ethanoate.

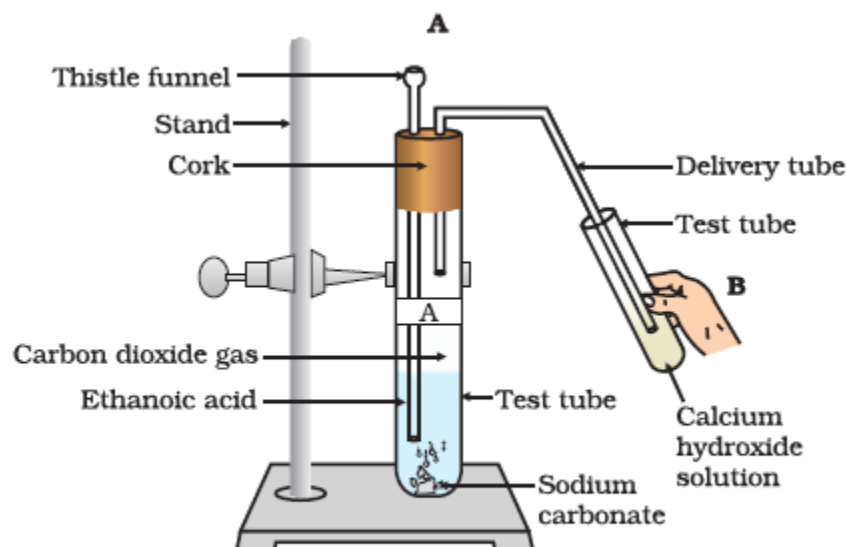
53. Look at Figure 4.1 and answer the following questions

(a) What change would you observe in the calcium hydroxide solution taken in tube B?

(b) Write the reaction involved in test tubes A and B respectively.

(c) If ethanol is given instead of ethanoic acid, would you expect the same change?

(d) How can a solution of lime water be prepared in the laboratory?



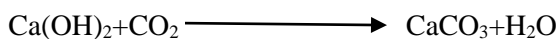
Flg. 4.1

Soln:

- a) Calcium Hydroxide solution would become milky
 b) Reaction in Tube A

$$\text{CH}_3\text{COOH} + \text{NaHCO}_3 \longrightarrow \text{CH}_3\text{COONa} + \text{CO}_2 + \text{H}_2\text{O}$$

Reaction in tube B



- c) Ethanol will not react with Sodium Hydrge carbonate. Hence same change will not be observed.
 d) In a beaker take distilled water and mix Calcium carbonate powder and mix thoroughly. Allow the solution to settle and decant the clear solution to obtain the lime water.

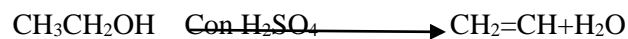
54. How would you bring about the following conversions? Name the process and write the reaction involved.

(a) ethanol to ethene.

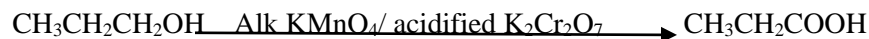
b) propanol to propanoic acid. Write the reactions.

Soln:

- a) Ethene is formed when ethanol is heated at 443 K with excess of concentrated sulphuric acid.

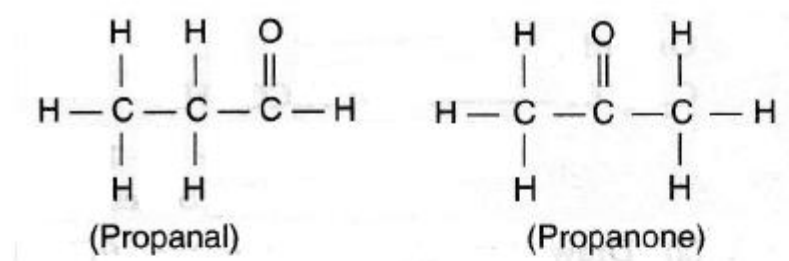


- b) Propanol is treated with alkaline Potassium permanganate or acidified Potassium-di-chromate to obtain propanoic acid.

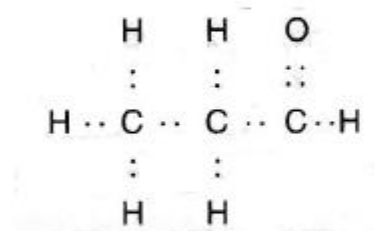


55. Draw the possible isomers of the compound with molecular formula C₃H₆O and also give their electron dot structures.

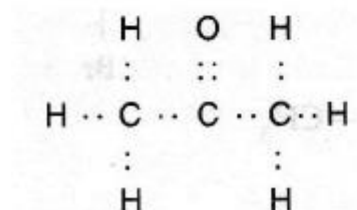
Soln:



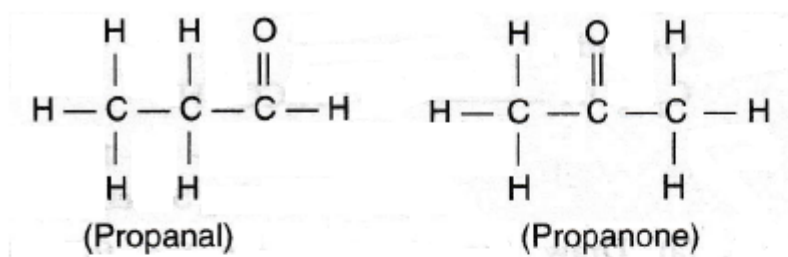
(ii) Electron dot structure of propanal.



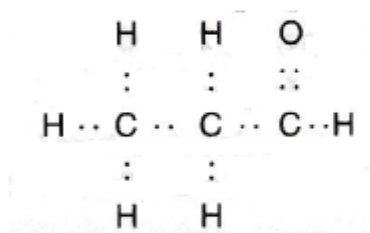
Electron dot structure of propanone



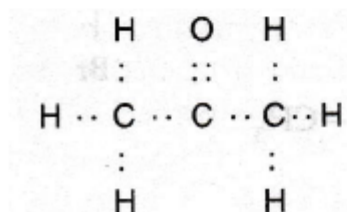
(i) The two possible isomers of the compound with molecular formula C_3H_6O are :



(ii) Electron dot structure of propanal.



Electron dot structure of propanone

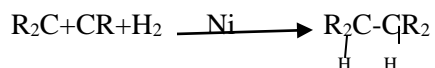


56. Explain the given reactions with the examples

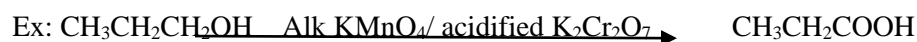
- (a) Hydrogenation reaction
- (b) Oxidation reaction
- (c) Substitution reaction
- (d) Saponification reaction
- (e) Combustion reaction

Soln:

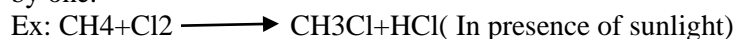
a) Addition of Hydrogen to unsaturated Hydrocarbons to convert into saturated Hydrocarbons is called as Hydrogenation. This process is used in the conversion of unsaturated vegetable oil into saturated fats.



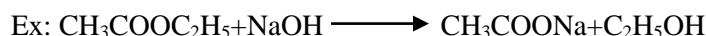
b) When oxygen is added to alcohol to form carboxylic acid the process is known as oxidation.



c) Saturated hydrocarbons are fairly unreactive. But in the presence of sunlight chlorine substitutes Hydrogen one by one.



d) When Ester is treated with alkali, the reaction gives ethanol and Sodium ethanoate. This reaction is called saponification.



e) Combustion is the burning of a substance in presence of Oxygen.

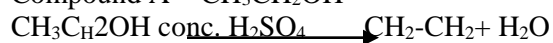


57. An organic compound A on heating with concentrated H₂SO₄ forms a compound B which on addition of one mole of hydrogen in presence of Ni forms a compound C. One mole of compound C on combustion forms two moles of CO₂ and 3 moles of H₂O. Identify the compounds A, B and C and write the chemical equations of the reactions involved.

Soln:

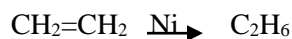
Compound A is Ethanol

Compound A = CH₃CH₂OH



Compound B is Ethene

Compound B = CH₂=CH₂



Compound C = CH₃—CH₃

