

QUESTION BANK IN SCIENCE CLASS-X (TERM-II)

4

CARBON AND ITS COMPOUNDS

CONCEPTS

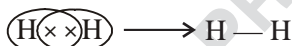
1. **Organogens** : The elements from which organic life starts are called organogens. Carbon is the backbone of organic life, supported by elements hydrogen, nitrogen and oxygen.

2. **States of carbon** :

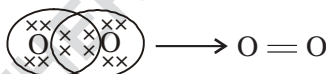
- (i) Carbon occurs in the free state as diamond, graphite and coal.
- (ii) Carbon occurs in the combined state as carbonates of metals, all kinds of living being, as petroleum and as carbon dioxide.

3. **Covalent bond or Molecular bond or Homopolar bond** : A chemical bond formed between two non-metallic elements by the mutual sharing of one or more electron pairs is called a **covalent bond**.

4. **Single covalent bond** : A chemical bond formed between two non-metallic elements by the mutual sharing of one electron pair only, is called a **single covalent bond**.



5. **Double covalent bond** : A chemical bond formed between two non-metallic elements by the mutual sharing of two electron pairs, is called a **double covalent bond**.



6. **Triple covalent bond** : A chemical bond formed between two non-metallic elements by the mutual sharing of three electron pairs, is called a **triple covalent bond**.



7. **Covalency** : The number of electron pairs which an atom of an element mutually shares with another atom or atoms of the same or different elements, so as to acquire a stable configuration like noble gases, is called **covalency**.

8. **Covalent compound or Molecular compound** : The chemical compound formed as a result of mutual sharing of electron pairs of two or more different kinds of atoms is called a **covalent compound**.

9. **Non-polar covalent compound** : A covalent compound in which the shared pair of electrons are equally distributed between two or more different atoms is called a **non-polar covalent compound**. For example, methane, ethane, etc.

10. **Polar covalent compound** : A covalent compound in which the shared pair of electrons are unequally distributed between the two atoms, is called a **polar covalent compound**. For example, water, hydrochloric acid, etc.

11. **Properties of covalent (molecular) compounds** :

- (i) They have low melting points and boiling points.

- (ii) They have low densities, *i.e.*, their density is generally less than that of water.
 - (iii) They are generally gaseous or volatile liquids or soft solids.
 - (iv) They are insoluble in water, but soluble in organic solvents.
 - (v) They are bad conductors of electricity.
12. Diamond is the purest crystalline form of carbon which is the hardest naturally occurring substance.
 13. Other pure crystalline forms of carbon are graphite and fullerenes. In Buckminsterfullerene, each molecule has 60 atoms arranged in hexagons and pentagons.
 14. **Catenation** : The property of carbon atoms to link with other carbon atoms or the atoms of other elements with single, double or triple covalent bonds, so as to form large number of compounds is called catenation.
 15. **Organic chemistry** : The branch of chemistry dealing with carbon compounds other than carbon monoxide, carbon dioxide and carbonates is called organic chemistry.
 16. **Organic compounds** : The compounds of carbon, other than CO, CO₂ and carbonates, hydrogen carbonates are called organic compounds.
 17. **Saturated organic compounds** : Organic compounds in which all the four valencies of carbon atoms are satisfied by single covalent bonds, are called saturated organic compounds.
 18. **Unsaturated organic compounds** : Organic compounds in which a double or a triple bond exists between two carbon atoms in a carbon chain, are called unsaturated organic compounds.
 19. **Hydrocarbons** : Organic compounds which contain only carbon and hydrogen atoms are called hydrocarbons.
 20. **Straight chain hydrocarbons** : Hydrocarbons, in which all the carbon atoms are linked to one another in a straight chain by single covalent bonds are called straight chain hydrocarbons.
 21. **Branched chain hydrocarbons** : Hydrocarbons, in which one or more carbon atoms are attached to the main straight chain of carbon atoms by a single covalent bond are called branched chain hydrocarbons.
 22. **Isomerism** : The phenomenon due to which there can exist two or more organic compounds, with different physical and chemical properties, due to the difference in the arrangement of carbon atoms in their structure, but have the same chemical formula is called isomerism.
 23. **Isomers** : Organic compounds having the same molecular formula but different structural formulae, and hence, different physical and chemical properties, are called isomers.
 24. **Straight chain unsaturated hydrocarbons** : Hydrocarbons, in which carbon atoms are arranged in a straight chain, such that there is a double or triple covalent bond between a pair of carbon atoms are called straight chain unsaturated hydrocarbons.
 25. **Ring chain saturated hydrocarbons** : Hydrocarbons, in which carbon atoms are arranged in the form of a ring and bonded by single covalent bonds are called ring chain saturated hydrocarbons.
 26. **Ring chain unsaturated hydrocarbons** : Hydrocarbons, in which carbon atoms are arranged in the form of a ring and are bonded by one or more double covalent bonds are called ring chain unsaturated hydrocarbons.
 27. **Alkanes [saturated hydrocarbons]** : Compounds of carbon and hydrogen, in which all the valencies of carbon atoms are satisfied by single covalent bonds are called saturated hydrocarbons or alkanes.
General formula of alkanes is C_nH_{2n+2} where 'n' stands for the number of carbon atoms.

- 28. Homologous series :** A group of members of the same class of organic compounds, which differ from each other by a $-\text{CH}_2$ group, when arranged in the order of ascending molecular mass, is called a homologous series.
- 29. Homologues :** The members of the same class of organic compounds, when arranged in the order of ascending molecular mass, such that they differ by 14 amu or a $-\text{CH}_2$ group are called homologues.
- 30. Alkenes :** A homologous series of unsaturated hydrocarbons, characterised by the presence of double covalent bond ($-\text{C}=\text{C}-$) in the straight chain of carbon atoms, are called alkenes. General formula of alkenes is C_nH_{2n} , where n stands for the number of carbon atoms in the carbon chain.
- 31. Alkynes :** A homologous series of unsaturated hydrocarbons, characterised by the presence of triple covalent bond ($-\text{C}\equiv\text{C}-$) in the straight chain of carbon atoms are called alkynes. General formula of alkynes is $\text{C}_n\text{H}_{2n-2}$, where 'n' stands for the number of carbon atoms in the carbon chain.
- 32. Alkyl Radical :** The fragment of an alkane molecule, from which one atom of hydrogen is removed from its straight chain is called an alkyl radical or alkyl group. General formula of alkyl group is $\text{C}_n\text{H}_{2n+1}$, where 'n' stands for number of carbon atoms in the carbon chain.
- 33. Functional group** in an organic compound is an atom or group of atoms bonded together in such a unique fashion, that it is usually the site of chemical reactivity of an organic compound.
- 34. Alcohols** are carbon compounds containing a $-\text{OH}$ group attached to the carbon atom of an alkyl chain. IUPAC name for alcohols is alkanols and their general formula is $\text{C}_n\text{H}_{2n+1}\text{OH}$.
- 35. Aldehydes** are carbon compounds containing a $-\text{CHO}$ group attached to the carbon atom of an alkyl chain. IUPAC name for aldehydes is alkanals and their general formula is $\text{C}_n\text{H}_{2n+1}\text{CHO}$.
- 36. Ketones** are the compounds containing >C=O group, in which the carbon atom of >C=O is attached to two carbon atoms of the same or different alkyl radicals.
- $$\begin{array}{c} \text{O} \\ || \\ \text{R}-\text{C}-\text{R}' \end{array}$$
- IUPAC name for ketone is alkanone, and general formula is $\text{R}-\text{C}(=\text{O})-\text{R}'$ where R and R' stand for same or different alkyl radicals, having the general formula $\text{C}_n\text{H}_{2n+1}$.
- 37. Carboxylic acids** are the compounds of carbon containing a $-\text{COOH}$ group attached to the carbon atom of an alkyl chain.
- IUPAC name of carboxylic acids is alkanoic acids and general formula is $\text{R}-\text{COOH}$ where R stands for alkyl radical having the general formula $\text{C}_n\text{H}_{2n+1}$.
- 38. Halo alkanes :** Halogen compounds of alkanes, obtained by replacing a hydrogen atom of an alkane with an atom of a halogen are called halo alkanes.
- General formula of halo alkanes is $\text{R}-\text{X}$ where 'R' stands for an alkyl radical and 'X' stands for a halogen atom.
- 39.** All allotropic forms of carbon as well as organic compounds burn in air/oxygen to form carbon dioxide and water (in the form of steam), with the release of a large amount of energy.

40. The process of rapid burning of carbon or its compounds in air/oxygen, with the release of a lot of energy and formation of carbon dioxide and water is called combustion.
41. The region of burning gases when a substance burnt is called **flame**.
42. Some metallic salts impart colour to the non-luminous flame.
43. Coal and petroleum were formed when organic matter (plants and animals) got buried deep inside the earth and then decomposed by anaerobic bacteria.
44. When organic compounds are slowly oxidised by using oxidising agents other than atmospheric oxygen, the compounds form new organic products. Acidified potassium dichromate or alkaline potassium permanganate are strong oxidising agents.
Copper (II) oxide, chromium oxide in acetic acid are mild oxidising agents.
45. A reaction which proceeds with the breaking of double or triple covalent bonds in organic compounds so as to form new organic compounds having single covalent bonds, is called an **addition reaction**.
46. The conversion of unsaturated vegetable oils into saturated vegetable oil by the absorption of hydrogen in the presence of finely divided nickel is called **hydrogenation of oils**.
47. A chemical reaction in which hydrogen atoms in a saturated hydrocarbon are replaced by the atoms of some other elements is called a **substitution reaction**.
48. Ethanol (i) is a colourless and inflammable liquid, (ii) is miscible in water in all proportions, (iii) has a boiling point of 78.2°C and freezing point of – 118°C and (iv) is a bad conductor of electricity.
49. Ethanol reacts with sodium and potassium to form their respective ethoxides and hydrogen gas.
50. Ethanol gets dehydrated to ethene when heated with conc. sulphuric acid at 443 K (170°C).
51. All kinds of alcoholic drinks contain ethanol.
52. A mixture of 20% petrol and 80% alcohol is called **power alcohol**. It is used in automobiles.
53. Ethanol is used as an antifreeze in the radiators of motorcars in cold countries.
54. Excessive drinking of alcohol is bad for health as it slowly damages the liver and kidneys.
55. **Methylated spirit** is ethanol in which methanol is mixed. This makes it unfit for drinking purposes, but is extensively used in paints and varnish industry.
56. Pure ethanoic acid is a colourless corrosive liquid having a strong smell like that of vinegar.
57. A chemical reaction between ethanoic acid and any alcohol to form an acetate of the alcohol (commonly called ester), which is a sweet smelling product, is called **esterification**.
58. The process by which an ester gets hydrolysed in the presence of sodium hydroxide to form the constituent alcohol and sodium salt of alkanoic acid is called **saponification**.
59. Any substance which has a cleansing action in water and does not harm the substance which is being cleaned is called a **detergent**.
60. Another name for detergents is **surfactants** as they reduce surface tension of liquids in which they are added.
61. **Soap** is a sodium salt of a long chain carboxylic acid (fatty acid), which has a cleansing action in water.

62. Synthetic detergents (soapless soaps) are either sodium salts of long chain benzene sulphonic acid or sodium salt of long chain alkyl hydrogen sulphate, which show cleansing properties in water.
63. The process of breaking down of bigger droplets of oil or grease into smaller droplets is called **emulsification** and the substance used to do so is called an **emulsifier**.
64. The long chain hydrocarbon part in soap/detergent is repelled by water molecules and is called **hydrophobic**. However, it is attracted by oil or grease molecules.
65. Sodium ions, forming the short ionic part in soap/detergent are attracted by water molecules and is called **hydrophilic**. However, it is repelled by oil or grease molecules.
66. The colloidal particles of soap suspended in water form clusters, which are commonly called **soap micelles**.
67. Soap loses its cleaning action in hard water and forms a sticky scum.
68. Synthetic detergents lather even in hard water and hence can be used for cleaning.

I. SUMMATIVE ASSESSMENT

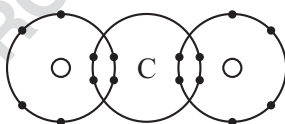
NCERT QUESTIONS WITH THEIR ANSWERS

SECTION A : IN-TEXT QUESTIONS

Page 61

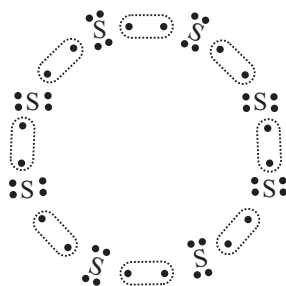
1. What would be electron dot structure of carbon dioxide which has a formula CO_2 .

Ans.



2. What would be the electron dot structure of a molecule of sulphur which is made up of 8 atoms of sulphur?

Ans.



Dot diagram of sulphur (S_8)

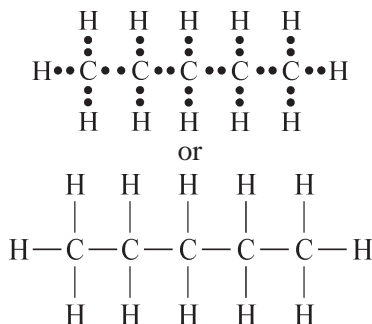
Page 68

1. How many dot structural isomers can you draw for pentane?

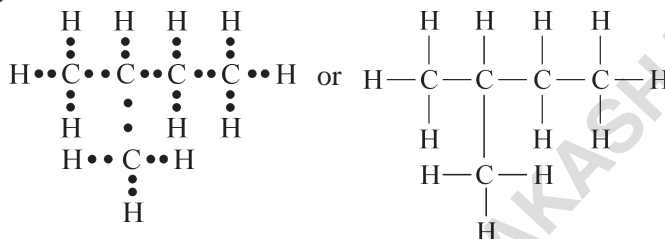
(V. Imp.)

Ans. There can be three dot structures for pentane.

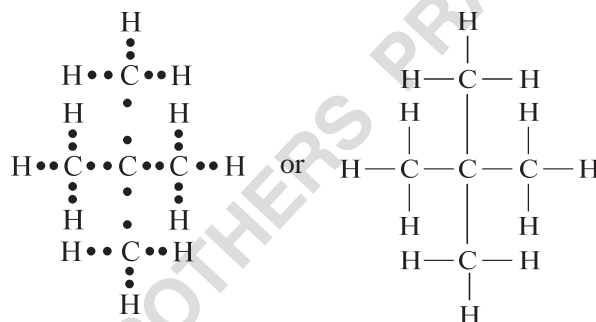
(i) Normal pentane



(ii) Iso-pentane



(iii) Neo-pentane



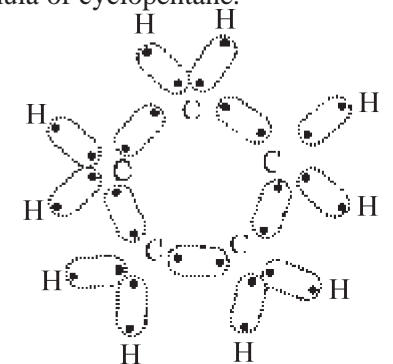
2. What are the two properties of carbon which lead to a huge number of carbon compounds we see around us? (V. Imp.)

Ans. 1. Carbon has a unique property of sharing electrons with other carbon atoms to form straight, branched or long chains.
2. Carbon being tetravalent can form covalent bonds with atoms of other elements such as hydrogen, oxygen and nitrogen.

3. What will be the formula and electron dot structure of cyclopentane?

[2008,2009]

Ans. C_5H_{10} is the molecular formula of cyclopentane.



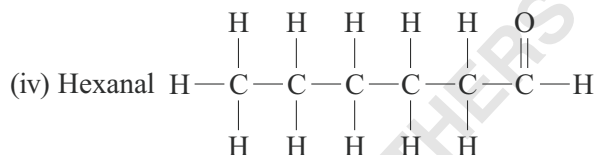
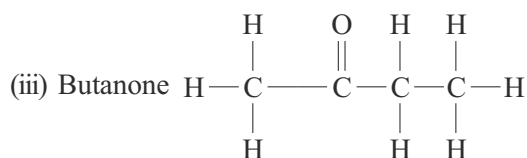
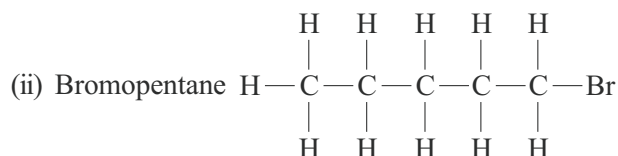
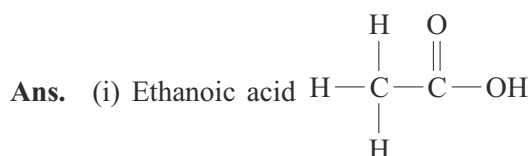
Electron dot structure of cyclopentane

4. Draw the structure of the following compounds.

[2011 (T-II)]

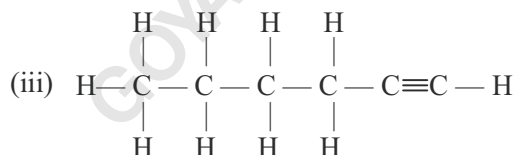
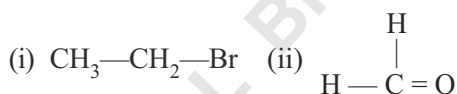
- (i) Ethanoic acid (ii) Bromopentane
(iii) Butanone (iv) Hexanal.

Are structural isomers possible for bromopentane?



Yes, structural isomers for bromopentane are possible.

5. How would you name the following compounds?



Ans. (i) Bromoethane. (ii) Methanal. (iii) Hexyne.

Page 71

1. Why is the conversion of ethanol to ethanoic acid an oxidation reaction? [2011 (T-II)]

Ans. When ethanol is oxidised, hydrogen is removed from its molecule and oxygen is added so as to form ethanoic acid. Thus, conversion of ethanol into acetic acid is an oxidation reaction.

2. A mixture of ethyne and oxygen is burnt for welding. Can you tell why a mixture of ethyne and air is not used? (Imp.)

Ans. Ethyne has only two hydrogen atoms and two carbon atoms in its molecule. It burns in air with a sooty flame, because the oxygen from air is insufficient to burn the carbon completely. Thus, pure oxygen is used which completely burns carbon and hydrogen and produces a very hot flame.

Page 74

1. How will you distinguish between alcohol and carboxylic acid experimentally? (V. Imp.)

Ans. Take two test tubes A and B and place about 1 g of sodium carbonate in them. Pour alcohol in test tube A and carboxylic acid in test tube B. Shake the contents of the test tubes.

The test tube in which a brisk effervescence takes place, with the liberation of a colourless gas (CO_2) is carboxylic acid. The test tube in which no reaction takes place is alcohol.

2. What are oxidising agents ?

Ans. The substances which add oxygen atom/atoms to the molecule/atom of a given substance or remove hydrogen atom/atoms from it, are called oxidising agents.

Page 76

1. Would you be able to check, if water is hard by using a detergent?

Ans. The answer is both yes or no.

In case the detergent is soap, then it is possible to check the hardness of water, as soap forms scum in hard water.

In case the detergent is synthetic, then it is not possible to check the hardness of water as synthetic detergent produces lather in hard water.

2. People use a variety of methods to wash clothes. Usually, after adding soap, they 'beat' the clothes on a stone, or beat it with a paddle, scrub with a brush or the mixture is agitated in a washing machine. Why is agitation necessary to get clean clothes? (Imp.)

Ans. Soap lowers the surface tension of water. The long chain non-ionic hydrocarbon group in soap sinks in the oil and grease droplets and thus loosen them from the fibres of clothes along with dirt. However, this loosening is insufficient to take out the tiny droplets of oil or grease along with dirt. Thus, the clothes are agitated by various methods, so that oil or grease droplets along with dirt are squeezed out.

SECTION B : QUESTIONS AT THE END OF THE CHAPTER

1. Ethane, with molecular formula C_2H_6 has :

(a) 6 covalent bonds

(b) 7 covalent bonds

(c) 8 covalent bonds

(d) 9 covalent bonds

Ans. (b)

2. Butanone is a four carbon compound with the functional group :

(a) carboxylic acid

(b) aldehyde.

(c) ketone

(d) alcohol.

Ans. (c)

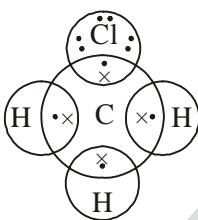
3. While cooking, if the bottom of the vessel is getting blackened on the outside, it means that

- (a) the food is not cooked completely (b) the fuel is not burning completely
(c) the fuel is wet (d) the fuel is burning completely

Ans. (b)

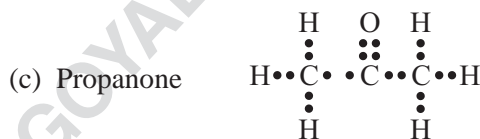
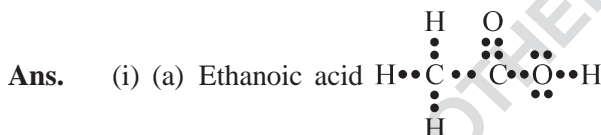
4. Explain the nature of the covalent bond using the bond formation in CH_3Cl .

Ans. Carbon has atomic number 6. An atom of carbon has 2 electrons in the K-shell and 4 electrons in the L shell. Hydrogen ($Z = 1$) has one electron in its K-shell while chlorine ($Z = 17$) has two electrons in the K-shell, 8 electrons in L shell and seven electrons in the M-shell. In order to achieve a noble gas configuration, carbon shares its 4 electrons in the L-shell with three hydrogen atoms and one chlorine atom. As a result all the atoms of the combining elements achieve a noble gas configuration. Such bonds which are formed by the sharing of electron pairs between two atoms are known as covalent bonds.



5. Draw the electron dot structures for :

- (i) (a) ethanoic acid, (b) H_2S , (c) propanone, (d) F_2
(ii) Which amongst (a) to (d) are not organic compounds and why?



- (ii) H_2S and F_2 are not organic compounds because they do not contain any carbon atom chain.

6. What is a homologous series? Explain with an example. **[2009]**

Ans. A group of members of the same class of organic compounds, which differ from each other by a $-\text{CH}_2$ group (14 amu), when arranged in the ascending order of molecular mass is called a homologous series.

For example, CH_3OH and $\text{C}_2\text{H}_5\text{OH}$ are the members of the alkanol series.

7. How can ethanol and ethanoic acid be differentiated on the basis of physical and chemical properties? (V.Imp.)

Ans. Physical properties :

1. Ethanol has a sharp spirit like smell whereas ethanoic acid has a sour vinegar like smell.
2. Ethanol has a sharp bitter burning taste, whereas ethanoic acid has a sour taste.
3. On cooling ethanol does not freeze, but ethanoic acid freezes.

Chemical Properties :

1. Ethanol gets dehydrated by conc. sulphuric acid, but ethanoic acid does not get dehydrated by conc. sulphuric acid.
 2. Ethanol does not displace hydrogen with zinc or magnesium, but ethanoic acid displaces hydrogen with zinc or magnesium.
8. Why does micelle formation take place when soap is added to water? Will a micelle be formed in other solvents such as ethanol also.

OR

What are micelles? How does the formation of a micelle help to clean the clothes.

[2011 (T-II)]

Ans. A molecule of soap is made up of two parts:

- (i) an ionic part which is hydrophilic (water loving) and (ii) a hydrocarbon chain which is hydrophobic (water hating).

When soap is at the surface of water, the hydrophobic tail of soap will not be soluble in water and the soap will align along the surface of water with the ionic end in water and the hydrocarbon 'tail' protruding out of water.

Inside water, the soap molecules form clusters to keep the hydrocarbon part out of water. In a cluster, the hydrophobic tails are in the interior of the cluster and the ionic ends are on the surface of the cluster. This formation is called a micelle.

Yes, micelle formation will also take place in ethanol.

9. Why are carbon and its compounds used as fuels for most applications?

Ans. Carbon and its compounds can easily burn in air at a moderate rate producing large amount of heat energy. The products produced during combustion pollute the atmosphere marginally, but are far superior as compared to products produced by burning substances like sulphur. Further, they are available in nature in large amount at an affordable price.

10. Explain the formation of scum when hard water is treated with soap. (Imp.)

Ans. A sample of water which contains Ca^{2+} or Mg^{2+} ions dissolved in it, is called hard water. Soap is a sodium salt of long chain carboxylic acid and is represented by RNa^+ where 'R' stands for the long chain of fatty acids.

When Ca^{2+} or Mg^{2+} ions come in contact with soap molecules they form compounds R_2Mg^{2+} or R_2Ca^{2+} which are insoluble in water and appear in the form of scum.

11. What change will you observe, if you test soap with litmus paper (red and blue)?

Ans. In case of blue litmus paper, no change will take place.

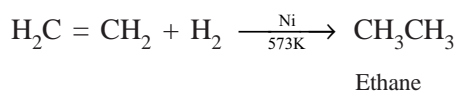
In case of red litmus paper, it changes to blue colour. It is because soap is basic in nature on account of the presence of some amount of free sodium hydroxide.

12. What is hydrogenation? What is its industrial application ?

OR

What is a hydrogenation reaction? Write an equation to represent this reaction. How is the reaction useful in vegetable ghee industry? [2011 (T-II)]

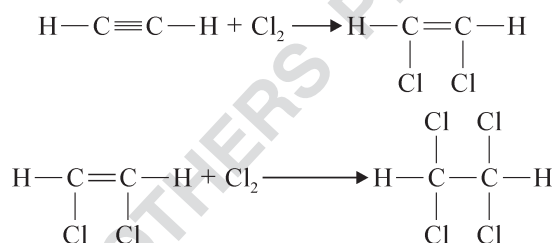
Ans. The process by which hydrogen atoms are added to unsaturated hydrocarbons in the presence of heated and finely divided nickel so as to form saturated hydrocarbons, is called hydrogenation. Industrially hydrogenation is used to convert unsaturated vegetable oils to saturated vegetable oils (commonly called vanaspati ghee) by passing hydrogen through them in the presence of finely divided nickel.



13. Which of the following hydrocarbons undergo addition reactions? Support your answer by a chemical equation. [2011 (T-II)]

C_2H_6 , C_3H_8 , C_2H_2 and CH_4

Ans. Only C_2H_2 will undergo addition reaction.



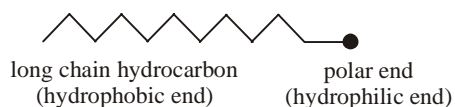
14. Give a test that can be used to differentiate chemically between butter and cooking oil.

Ans. Butter is chemically saturated fatty acid, whereas cooking oil is unsaturated fatty acid. They can be differentiated by adding them to bromine solution. The bromine solution will decolourise in case of cooking oil, but not in case of butter.

15. Explain the mechanism of the cleansing action of soaps. [2008]

Ans. A molecule of soap is made up of two parts:

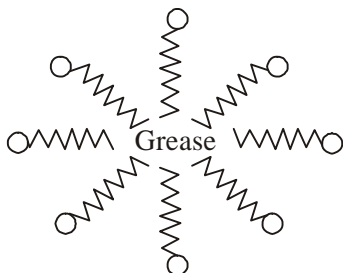
- An ionic part which is hydrophilic, i.e., water soluble.
- A hydrocarbon chain which is hydrophobic, i.e., water repellent (oil soluble).



When soap is at the surface of water, the hydrophobic tail protrudes out of water while the ionic end remains inside water.

Inside water, the molecules form clusters with the hydrophobic tails in the interior of the cluster and the ionic ends on the surface of the cluster. This formation is called a micelle.

Soap, in the form of micelle collects the oily dirt in the centre of the micelle. The micelles stay in solution as a colloid and do not precipitate due to ion-ion repulsion. Thus, the dirt suspended in water is washed away during rinsing.



A micelle entrapping grease particle.

ADDITIONAL QUESTIONS (As per CCE Pattern)

A. Very Short Answer Questions

[1 Mark]

Previous Years' Questions

1. "Saturated hydrocarbons burn with a blue flame while unsaturated hydrocarbons burn with a sooty flame". Why? [2011 (T-II)]

Ans. An unsaturated hydrocarbon has high concentration of carbon, which does not get oxidised by the atmospheric oxygen. Thus, unburnt carbon appears in the form of soot and hence the flame is sooty.

2. Write the next higher homologue of the following : [2011 (T-II)]

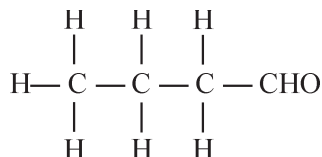


Ans. (i) C_4H_8



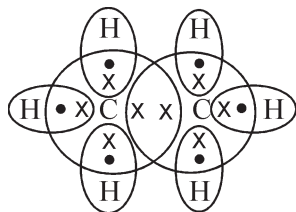
3. Write the name and structure of an aldehyde with 4 carbon atoms. [2011 (T-II)]

Ans. (i) C_3H_7CHO (Propanal)



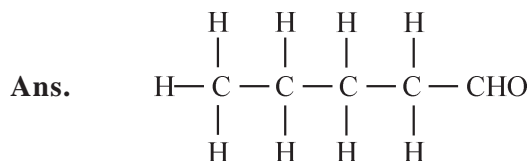
4. Draw the electron dot structure of ethane (C_2H_6). [2011 (T-II)]

Ans.

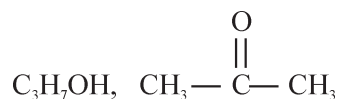


5. Draw the structure of pentanal (C_4H_9CHO).

[2011 (T-II)]

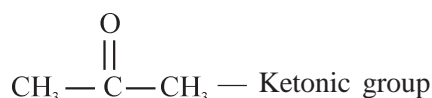


6. Name the functional group present in each of the following compounds.



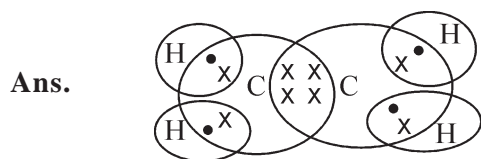
[2011 (T-II)]

Ans. C_3H_7OH — Alcoholic group



7. Draw the structure of ethene molecule (C_2H_4).

[2011 (T-II)]



8. Name the functional group present in propanal (C_3H_6O).

[2011 (T-II)]

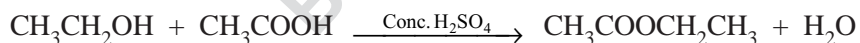
Ans. Aldehyde group

9. Name the fourth (4th) member of alkene series.

[2011 (T-II)]

Ans. Butene

10. Name the type of reaction represented by the following equation :



[2011 (T-II)]

Ans. Esterification

11. Give reasons for the following observation:

[2009, 2011 (T-II)]

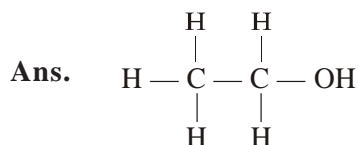
The element carbon forms a very large number of compounds.

Ans. (i) Carbon has the unique ability to form bonds with other carbon atoms, so as to form long straight chains, branched chains and closed rings, giving rise to a large number of molecules.

(ii) Carbon atom has four valence electrons, therefore, it can bind itself with four more carbon atoms with single covalent bonds, or with different atoms of monovalent elements.

12. Draw the structure of ethanol molecule.

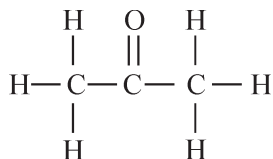
[2009, 2011 (T-II)]



13. Draw the structure of the simplest ketone.

[2011 (T-II)]

Ans. $\text{CH}_3 - \text{C} - \text{CH}_3$ (Acetone or dimethyl ketone)

$$\begin{array}{c} \text{O} \\ || \\ \text{CH}_3 - \text{C} - \text{CH}_3 \end{array}$$


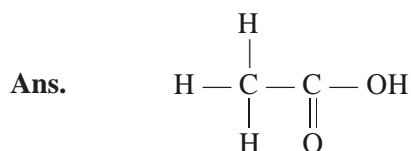
14. Why is the conversion of ethanol to ethanoic acid considered an oxidation reaction?

[2011 (T-II)]

Ans. Conversion of ethanol to ethanoic acid is considered an oxidation reaction since it involves:
(i) addition of oxygen to the ethanol molecule (ii) removal of hydrogen from the ethanol molecule.

15. Draw the structure of CH_3COOH molecule.

[2009]



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

[2009]

Ans. Ethyl ethanoate (an ester)

17. Write a chemical equation to represent the reaction of ethanol with acidified solution of potassium dichromate.

[2009]

Ans.

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

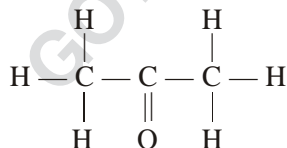
[2009]

Ans. Sodium reacts with ethanol to form sodium ethoxide and liberates hydrogen gas.



19. Name the compound:

[2009]



Ans. Acetone or propanone

20. Why does carbon form compounds mainly by covalent bonding?

[2008]

Ans. Carbon has four valence electrons. Thus, it is not in a position to donate/accept four electrons so as to acquire a stable neon gas like structure. Thus, in order to enter into a chemical reaction, it shares its valence electrons with other elements.

21. (i) What would be observed on adding a 50% solution of alkaline potassium permanganate drop by drop to some warm ethanol taken in a test tube?

[2008]

- (ii) Write the name of the compound formed during the chemical reaction.
- Ans.** (i) The pink colour of potassium permanganate would be discharged.
(ii) Ethanoic acid.
- 22.** How would you distinguish experimentally between an alcohol and a carboxylic acid on the basis of a chemical property ? **[2008]**
- Ans.** Ethanol does not react with sodium carbonate. However, carboxylic acid reacts with sodium carbonate with the liberation of carbon dioxide gas which turns limewater milky.
- 23.** Name the gas evolved when ethanoic acid is added to sodium carbonate. How would you prove the presence of this gas? **[2008]**
- Ans.** Carbon dioxide gas.
The gas when passed through limewater turns the limewater milky.
- 24.** Name the compound $\text{CH}_3\text{CH}_2\text{OH}$ and identify its functional group. **[2008]**
- Ans.** Ethyl alcohol
Alcoholic group.
- 25.** What is a functional group in a carbon compound. Identify the functional group present in CH_3COOH and $\text{C}_2\text{H}_5\text{OH}$. **[2008]**
- Ans.** An atom or a group of atoms which gives the same characteristic properties to a compound is called a functional group.
Functional group in : CH_3COOH — Carboxylic acid group
 $\text{C}_2\text{H}_5\text{OH}$ — Alcoholic group
- 26.** What is the difference in the molecular formula of any two consecutive members of a homologous series of organic compounds? **[2008]**
- Ans.** CH_2
- 27.** Why are covalent compounds generally poor conductors of electricity? **[2008]**
- Ans.** Covalent compounds are formed by the sharing of valence electrons. As such they do not have cations or anions which could migrate to the opposite poles of an electrolytic cell. Thus, they do not conduct electric current.
- 28.** Write the names of the functional groups in : **[2008]**
- (i) $\begin{array}{c} \text{R} \\ \diagup \\ \text{C}=\text{O} \\ \diagdown \\ \text{R} \end{array}$ (ii) $\begin{array}{c} \text{R} \\ \diagup \\ \text{C}=\text{O} \\ \diagdown \\ \text{H} \end{array}$
- Ans.** (i) Ketonic group (ii) Aldehydic group
- 29.** Name the compound CH_3COOH and identify its functional group. **[2008]**
- Ans.** Acetic acid
Functional group — COOH (Carboxylic acid group)

Other Important Questions

- 1.** What do you understand by the term covalent bond? **(Imp.)**
- Ans.** A chemical bond formed between two non-metallic elements by mutual sharing of one or more electron pairs is called a covalent bond.

2. What is a covalent compound?

Ans. A chemical compound formed as a result of mutual sharing of electron pairs between two or more different kind of atoms, is called a covalent compound.

3. Name three crystalline forms of carbon.

(Imp.)

Ans. (i) Diamond, (ii) Graphite, (iii) Fullerenes.

4. Fill in the blank spaces:

A diamond crystal has usually eight sides, forming _____, whereas in graphite crystal carbon atoms are arranged in the form of _____ in flat planes.

Ans. 1. double pyramids 2. hexagonal rings.

5. What is general formula of alkanoic acid? Give the name of any alkanoic acid.

Ans. General formula of alkanoic acid is $C_nH_{2n+1}COOH$. Ethanoic acid (acetic acid) is a member of alkanoic acids.

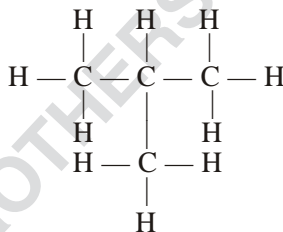
6. What do you understand by the term catenation?

(V. Imp.)

Ans. The property of carbon atoms to link with other carbon atoms or the atoms of other elements with a single, double or triple covalent bonds, so as to form large number of compounds is called catenation.

7. Give one example of a branched chain hydrocarbon and show its structure.

Ans. Isobutane is a branched chain hydrocarbon.



8. Complete and balance the equation given below:



Ans. $2C_4H_{10} + 13O_2 \text{ (excess)} \longrightarrow 8CO_2 + 10H_2O$.

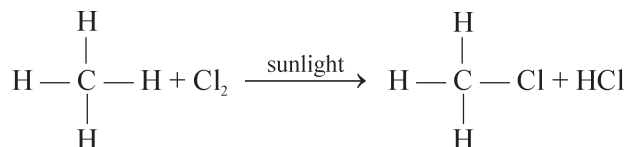
9. Complete the statement given below:

The process of burning hydrocarbons in the presence of excess of air to give carbon dioxide, water, heat and light is known as _____.

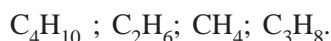
Ans. Combustion.

10. Give a reaction other than oxidation, which is a characteristic of saturated hydrocarbons. **(Imp.)**

Ans. The reaction is called substitution reaction.



11. Which of the following will give addition reaction and why? **(Imp.)**



Ans. Only C_3H_8 will give addition reaction because, it is the only unsaturated hydrocarbon, amongst the list of hydrocarbons given above.

12. Name two metals which react with ethyl alcohol and displace hydrogen gas.

Ans. The metals are sodium and potassium.

13. What is the main advantage of using synthetic detergents over soaps? **(V.Imp.)**

Ans. Synthetic detergents lather in hard water as well as in acidic water. Thus, they can clean clothes, which is not possible in case of soaps.

14. What do you understand by the term emulsifier?

Ans. The substance used in breaking down the droplets of oil or grease into extremely small droplets is called an emulsifier.

15. What do you understand by the term detergent?

Ans. Any material which has a cleansing action in water and does not harm the substance which is being cleaned, is called a detergent.

16. What is rectified spirit?

Ans. Ethanol, containing less than 5% of water, is called rectified spirit. **(Imp.)**

17. Carbon, group (14) element in the periodic table, is known to form compounds with many elements. **[HOTS]**

Write an example of a compound formed with

(a) chlorine (Group 17 of periodic table)

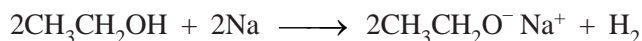
(b) oxygen (Group 16 of periodic table)

Ans. (a) Carbon tetrachloride (CCl_4)

(b) Carbon dioxide (CO_2)

18. A gas is evolved when ethanol reacts with sodium. Name the gas evolved and also write balanced chemical equation of the reaction. **[HOTS]**

Ans. The gas evolved is hydrogen.



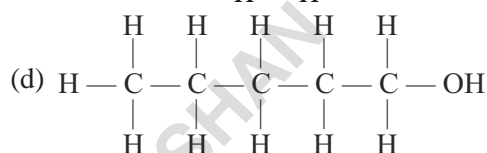
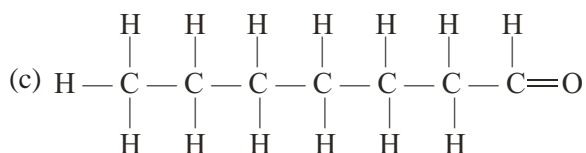
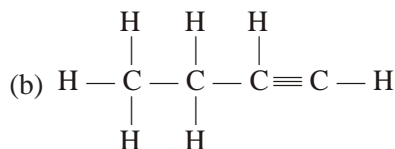
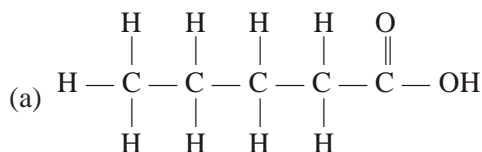
19. Name two isomers of butane and write their condensed formula.

Ans. (i) $CH_3-CH_2-CH_2-CH_3$ is n-butane.

(ii) $CH_3-\underset{\substack{| \\ CH_3}}{CH}-CH_3$ is iso-butane.

B. Short Answer Questions - I**[2 Marks]****Previous Years' Questions**

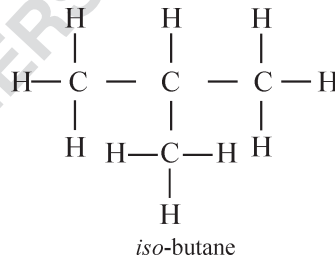
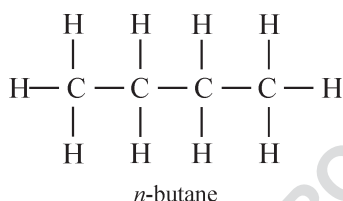
1. Write the names of the following compounds.

[2011 (T-II)]**Ans.** (a) Pentanoic acid

(b) Butyne

(c) Heptanal

(d) Pentanol

2. What are isomers? Draw the structures of two isomers of butane (C_4H_{10}).**[2011 (T-II)]****Ans.** Organic compounds having the same molecular formula but different structural formulae, and hence, different physical and chemical properties are called isomers. n - butane and *iso*-butane are two isomers of butane (C_4H_{10}).3. (a) Give a chemical test to identify the compound CH_3COOH .

(b) Name the gas evolved when this compound acts on solid sodium carbonate. How would you identify this gas?

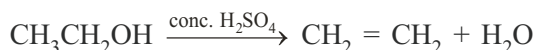
[2008, 2011 (T-II)]**Ans.** (a) To the compound CH_3COOH add some amount of ethanol and then a few drops of conc. sulphuric acid. Warm the mixture in a water bath for a few minutes. A fruity smell will be given off on account of the formation of an ester. This is a confirmatory test for carboxylic acid. Therefore the compound is identified as acetic acid.

(b) Carbon dioxide. The gas turns clear limewater milky when bubbled through it.

4. Write the name and molecular formula of an organic compound having its name suffixed with 'ol' and having two carbon atoms in the molecule. With the help of a balanced chemical equation indicate what happens when it is heated with excess of conc. H_2SO_4 ? **[2010]**

Ans. Ethanol – C₂H₅OH

When ethanol is heated with excess of conc. H₂SO₄ it gets dehydrated to form ethene.



5. What happens when wood is burnt in a limited supply of oxygen? Name the residue left behind after the reaction and state two advantages of using this residue as a fuel over wood. [2010]

Ans. When wood is burnt in a limited supply of oxygen, destructive distillation takes place with the formation of wood charcoal.

The residue left after the reaction is wood charcoal.

Advantages of using wood charcoal over wood:

- Wood charcoal burns without smoke.
 - It does not liberate any poisonous gases on burning.
6. What is a homologous series? Which two of the following organic compounds belong to the same homologous series ? [2010]



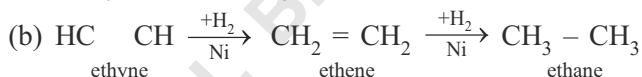
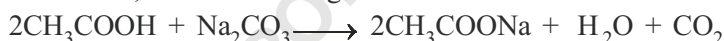
Ans. A group of members of the same class of organic compounds, which differ from each other by a – CH₂ group, when arranged in the ascending order of molecular mass is called a homologous series.

CH₄O and C₂H₆O are homologues since they differ by a – CH₂ group.

7. (a) Describe a chemical test to distinguish between ethanol and ethanoic acid.
(b) Write a chemical equation to represent what happens when hydrogen gas is passed through an unsaturated hydrocarbon in the presence of nickel acting as a catalyst.

[2009]

Ans. (a) Ethanoic acid liberates carbon dioxide on reacting with carbonates or hydrogen carbonates, while ethanol gives no such reaction.



8. (a) What is a 'homologous series' of substances?
(b) In an organic compound, which parts largely determine its physical and chemical properties? [2009]

Ans. (a) A group or series of organic compounds having the same general formula and similar graded physical and chemical properties is called a homologous series.

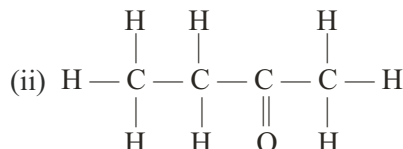
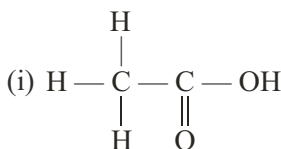
- (b) The functional group of an organic compound determines its physical and chemical properties.

9. Draw the structures of the following compounds:

[2008]

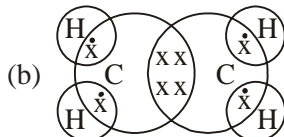
(i) Ethanoic acid

(ii) Butanone



10. (a) Write the name of the following : (i) $\text{CH}_3\text{CH}_2\text{COOH}$ (ii) $\text{CH}_3\text{CH}_2\text{Br}$ [2008]
 (b) Draw the electron dot structure of ethene

Ans. (a) (i) Propanoic acid (ii) Bromoethane



11. What will happen if ethanoic acid reacts with ethanol in the presence of an acid as a catalyst? Name the reaction. Write the chemical equation for this reaction. [2008]

Ans. A sweet smelling compound, ethyl ethanoate (an ester) is formed.

The reaction is known as esterification reaction.



12. (a) Give a chemical test to distinguish between ethanol and ethanoic acid.
 (b) Name the product formed when an organic acid reacts with an alcohol in the presence of an acid catalyst. What is the name assigned to this type of reaction. [2008]

Ans. (a) Ethanoic acid liberates carbon dioxide gas on reacting with sodium carbonate or sodium hydrogen carbonate. Ethanol gives no such reaction with sodium carbonate or sodium hydrogen carbonate.

(b) Ester

Esterification

13. Why are soaps ineffective in hard water? [2008]

Ans. Hard water contains dissolved Ca^{2+} and Mg^{2+} ions which react with soap to form their respective insoluble salts, commonly called scum.

The scum not only wastes soap but sticks to the clothes which are being cleaned. Therefore, soaps are ineffective in hard water.

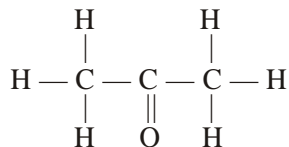
14. (a) (i) Name the products formed when ethanol burns in air.
 (ii) What two forms of energy are liberated on burning alcohol?
 (b) Why is the reaction between methane and chlorine considered as a substitution reaction. [2008]

Ans. (a) (i) Ethanoic acid and water

(ii) Heat energy, chemical energy

(b) The reaction between methane and chlorine is considered as a substitution reaction since the hydrogen atoms of methane are replaced by chlorine atoms.

15. (a) Name the following compound:



(b) Name the gas evolved when ethanoic acid is added to sodium carbonate. How would you prove the presence of this gas? [2008]

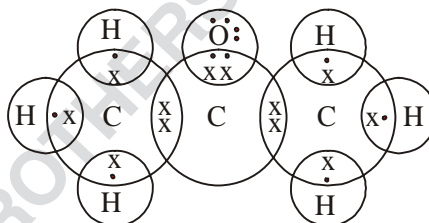
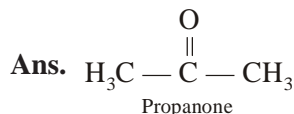
- Ans.** (a) The compound is propanone or acetone (common name).
 (b) The gas evolved is carbon dioxide. The presence of this gas can be confirmed by passing it through limewater. The limewater turns milky.

Other Important Questions

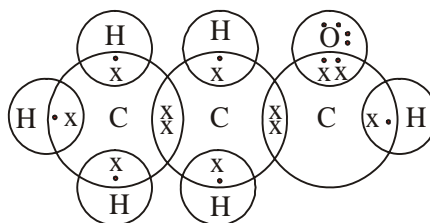
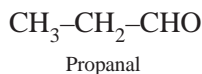
- Two non-metals react with each other by sharing electrons to form a compound C.
 - Name the type of chemical bond in C.
 - State whether C will have a high boiling point or a low boiling point.
 - State whether C will be soluble in water or in organic solvents.
 - State whether C is a good conductor of electricity or not.

- Ans.** (i) The chemical bond is covalent in nature.
 (ii) C will have low boiling point.
 (iii) C will dissolve in organic solvents.
 (iv) C will not conduct electric current.

- Draw the possible isomers of the compound with molecular formula C_3H_6O and also give their electron dot structures. [HOTS]



Electron dot structure of propanone



Electron dot structure of propanal

- 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. [HOTS]

- Ans.** Carbon exhibits catenation much more than silicon or any other element due to its smaller size which makes the C–C bonds strong while the Si–Si bonds are comparatively weaker due to the large size of the atoms.

4. Match the reaction given in column (A) with the names given in column (B).

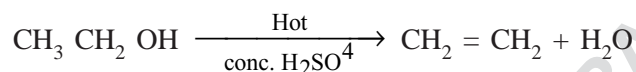
| Column (A) | Column (B) |
|---|-------------------------------|
| (a) $\text{CH}_3\text{OH} + \text{CH}_3\text{COOH} \xrightarrow{\text{H}^+} \text{CH}_3\text{COOCH}_3 + \text{H}_2\text{O}$ | (i) Addition reaction |
| (b) $\text{CH}_2 = \text{CH}_2 + \text{H}_2 \xrightarrow{\text{Ni}} \text{CH}_3 -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

Ans. (a) – (iv) (b) – (i) (c) – (ii) (d) – (iii)

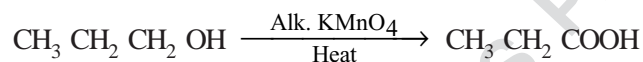
5. How would you bring about the following conversions? Name the process and write the reaction involved. **[HOTS]**

(a) ethanol to ethene (b) propanol to propanoic acid.

Ans. (a) By the dehydration of ethanol in the presence of concentrated H_2SO_4



(b) By the oxidation of propanol using oxidising agent such as alkaline KMnO_4 .

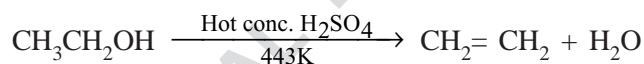


6. Intake of small quantity of methanol can be lethal. Comment. **[HOTS]**

Ans. Methanol is oxidised to methanal in the liver. Methanal reacts rapidly with the components of the cells. It causes the protoplasm to coagulate. It also affects the optic nerve causing blindness.

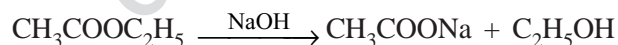
7. Ethene is formed when ethanol is heated with excess of concentrated sulphuric acid at 443 K. What is the role of sulphuric acid in this reaction? Write balanced chemical equation of this reaction. **[HOTS]**

Ans. Sulphuric acid acts as a dehydrating agent.



8. What is saponification? Write the reaction involved in this process. **[HOTS]**

Ans. Saponification is the process of converting esters into salts of carboxylic acids and ethanol by treating them with a base.



9. By giving one example define:

(i) Non-polar covalent compound (ii) Polar covalent compound

Ans. (i) A covalent compound in which the shared pair of electrons are equally distributed between two or more different atoms is called a non-polar covalent compound.

Example: Carbon tetrachloride

(ii) A covalent compound in which the shared pair of electrons are unequally distributed between the two atoms is called a polar covalent compound.

Example: Hydrogen chloride

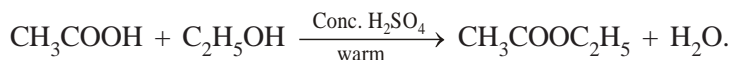
10. What are soaps? How do soaps differ from synthetic detergents? (V.Imp.)

Ans. A sodium salt of a long chain carboxylic acid (fatty acid) which has cleansing action in water is called soap.

A sodium salt of a long chain benzene sulphonic acid or a long chain alkyl hydrogen sulphate is called synthetic detergent.

11. What is esterification? Support your answer by a chemical equation. (V.Imp.)

Ans. A chemical reaction in which an alcohol reacts with an alkanolic acid to form a sweet smelling compound (ester) is called esterification.



12. What are alkenes? Give two examples.

Ans. A homologous series of unsaturated hydrocarbons, characterised by the presence of double bond ($-\text{C}=\text{C}-$) in the straight chain of carbon atoms are called alkenes.

Ethene and propene are the members of alkene series.

13. What are alkanols? Give two examples.

Ans. Alkanols are carbon compounds containing $-\text{OH}$ as functional group, which is attached to the carbon atom of an alkyl chain. Methanol and ethanol are the examples of alkanols.

C. Short Answer Questions - II

[3 Marks]

Previous Years' Questions

1. Give reasons for the following :

(a) Unsaturated hydrocarbons show addition reactions but not saturated hydrocarbons.

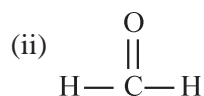
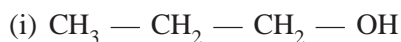
(b) Carbon only forms covalent compounds.

[2011 (T-II)]

Ans. (a) Unsaturated hydrocarbons such as ethene (C_2H_4) and ethyne (C_2H_2) have double or triple covalent bonds respectively. Hence they show addition reactions to form new single covalent bond while saturated hydrocarbons have only single covalent bonds so they do not show addition reaction.

(b) Carbon has four valence electrons. Thus, it is not in a position to donate/accept four electrons so as to acquire a stable neon gas like structure. Thus, in order to enter into a chemical reaction, it shares its valence electrons with other elements. So it forms only covalent compounds.

2. (a) Define the term functional group. Identify the functional group present in the following compounds :



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

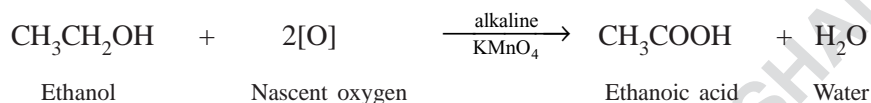
[2011 (T-II)]

Ans. (a) **Functional group :** The functional group in an organic compound is an atom or a group of atoms bonded together in such a unique fashion, that it is usually the site of chemical reactivity of an organic molecule.

(i) $\text{CH}_3 - \text{CH}_2 - \text{CH}_2 - \text{OH}$ Alcoholic group

(ii) $\begin{array}{c} \text{O} \\ || \\ \text{H} - \text{C} - \text{H} \end{array}$ Aldehydic group

(b) On adding a 5% alkaline potassium permanganate solution, the pink colour of potassium permanganate fades at once, continue adding drops of potassium permanganate, till the colour stops fading. At this stage the ethanol is completely oxidised to ethanoic acid.



3. (a) Write the names of :

(i) $\text{CH}_3 - \text{CH}_2 - \text{CHO}$

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

(b) Name the gas evolved when an alcohol reacts with sodium. Give chemical equation for the reaction involved.

(c) Which two of the following compounds belong to same homologous series?

$\text{C}_2\text{H}_6\text{O}$, $\text{C}_2\text{H}_6\text{O}_2$, C_2H_6 , CH_4O

[2011 (T-II)]

Ans. (a) (i) Propanal

(ii) Ethanol

(b) Ethanol reacts with sodium to give sodium ethoxide and hydrogen gas.



(c) $\text{C}_2\text{H}_6\text{O}$ and CH_4O are of same homologous series.

4. What are detergents chemically? Why are they more effective than soaps in cleansing action? How can detergent molecules be altered to make them biodegradable? [2011 (T-II)]

Ans. Detergents are sodium salt of long chain benzene sulphonic acid or sodium salt of long chain alkyl hydrogen sulphate.

Synthetic detergents are more effective than soaps because their calcium and magnesium salts are soluble in water and do not form scum.

If a straight chain hydrocarbon is used in the detergent instead of a branched chain hydrocarbon, then the detergent becomes biodegradable.

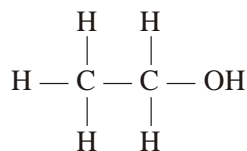
5. What is ethanol? Draw the structure of ethanol molecule. How does ethanol behave with the following: [2009, 2011 (T-II)]

(a) Sodium

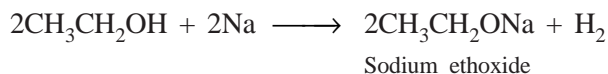
(b) Excess of conc. sulphuric acid at 443 K?

Write chemical equation for each reaction.

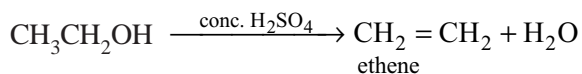
Ans. Ethanol is the second member of the homologous series of alcohols.



(a) Ethanol reacts with sodium to liberate hydrogen gas.

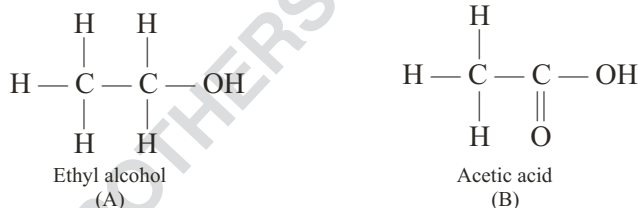


(b) Concentrated hydrochloric acid dehydrates ethanol to ethene.

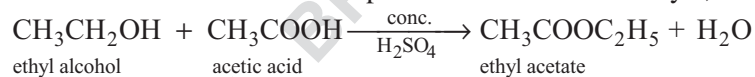


6. An organic compound 'A' is an essential constituent of wine and beer. Oxidation of 'A' yields an organic acid 'B' which is present in vinegar. Name the compounds 'A' and 'B' and write their structural formula. What happens when 'A' and 'B' react in the presence of an acid catalyst? Write the chemical equation for the reaction. **[2010, 2011 (T-II)]**

Ans. Ethyl alcohol is an essential constituent of wine and beer. Therefore, A is ethyl alcohol. Oxidation of ethyl alcohol gives acetic acid. Vinegar contains acetic acid. Therefore, B is acetic acid.



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

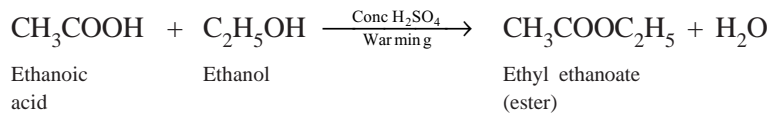


7. (a) Distinguish between esterification and saponification reactions of organic compounds.
 (b) With a labelled diagram describe an activity to show the formation of an ester. **[2009]**

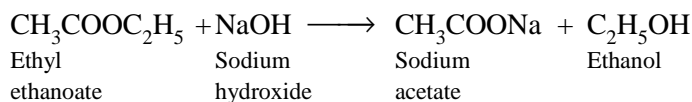
OR

Describe an activity to show the formation of an ester in the school laboratory. **[2011 (T-II)]**

Ans. (a) A chemical reaction in which an alcohol reacts with alkanoic acid to form a sweet smelling compound (ester) is called **esterification**.

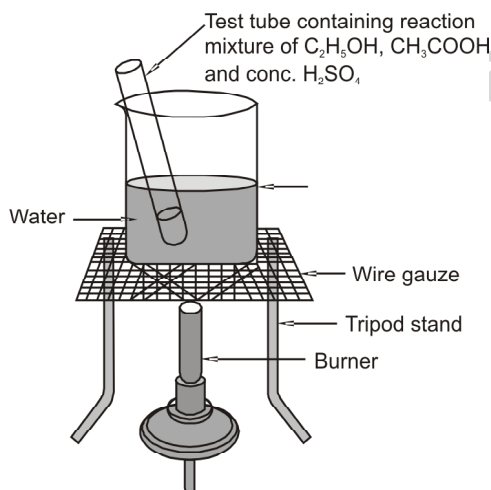


A chemical reaction in which an ester gets hydrolysed in the presence of sodium hydroxide to form the constituent alcohol and sodium salt of the alkanoic acid is called **saponification**.



(b) Activity

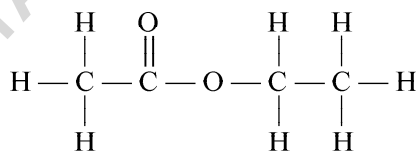
- Pour 1 ml of ethanol (absolute alcohol in a test tube).
- Pour 1 ml of glacial acetic acid in the alcohol and then a few drops of conc. sulphuric acid.
- Warm the contents of the test tube in a hot water bath for 10 minutes.
- Pour the contents of the test tube in another beaker containing 20 ml of water.
- Smell the contents of the beaker. You will find a sweet fruity smell. This smell is due to the formation of the ester, ethyl ethanoate.



Formation of ester

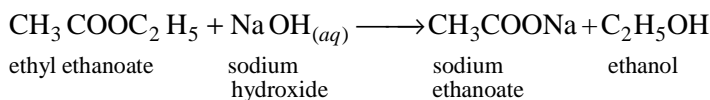
8. An ester has the molecular formula $\text{C}_4\text{H}_8\text{O}_2$. Write its structural formula. What happens when this ester is heated in the presence of sodium hydroxide solution? Write balanced chemical equation for the reaction and name the products. What is a saponification reaction? **[2010]**

Ans.



ethyl ethanoate

When ethyl ethanoate is heated in the presence of sodium hydroxide solution, hydrolysis of the ester occurs with the formation of sodium ethanoate and ethanol.

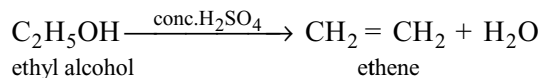


The reaction between an ester and an alkali to form the sodium salt of an alkanolic acid and an alcohol is known as saponification.

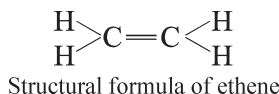
9. What is ethanol? State its two properties. What happens when it is heated with excess of conc. H_2SO_4 at 443 K? What role does conc. H_2SO_4 play in this reaction? Write chemical equation of the reaction involved and the structural formula of the main product formed. [2010]

Ans. Ethanol is the second member of the homologous series of alcohols.

When ethanol is heated with excess of conc. H_2SO_4 at 443 K it dehydrates to form ethene.



Concentrated H_2SO_4 acts as a dehydrating agent.



10. (a) What is vinegar?
(b) Describe with a chemical equation, what happens when sodium hydrogen carbonate reacts with ethanoic acid [2009]

Ans. (a) A 5 – 8% solution of acetic acid in water is known as vinegar.

(b) When sodium hydrogen carbonate reacts with ethanoic acid, carbon dioxide gas is liberated.



11. Soap does not work well with hard water. Name the class of compounds which can be used as cleansing agent in place of soap. Write the name of one such compound. Explain in brief the mechanism of its cleansing action when used in hard water. [2009]

Ans. Detergents

Sodium n-dodecylbenzene sulphonate.

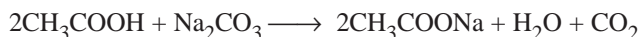
Hard water contains dissolved calcium and magnesium ions. Detergents are sodium salts of long chain benzene sulphonic acid or sodium salt of long chain alkyl hydrogen sulphate. When detergents react with hard water, the respective soluble salts of calcium and magnesium are formed. Since no scum is formed, detergents can be used to clean clothes even when the water is hard.

12. What is ethanoic acid? Write the formula of the functional group present in this acid. What special name is given to its 5—8% solution in water. How does ethanoic acid react with sodium carbonate? Write the chemical equation of the reaction and common name of the salt produced. [2009]

Ans. Ethanoic acid is the second member of the homologous series of alkanoic acid. Functional group in ethanoic acid is — COOH.

5—8% solution of ethanoic acid in water is known as vinegar.

Ethanoic acid reacts with sodium carbonate to liberate carbon dioxide gas.



The salt produced is sodium acetate.

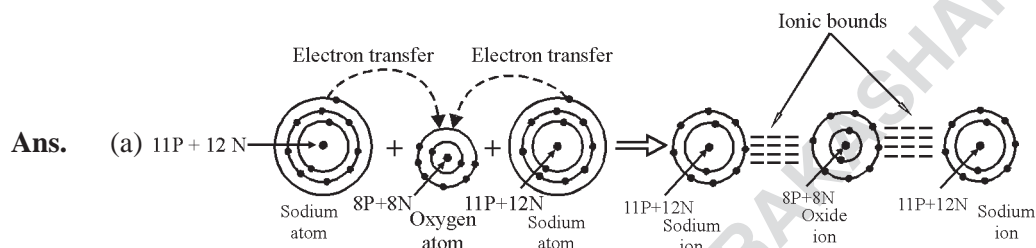
13. What is a homologous series of compounds? List any two characteristics of a homologous series. [2008]

Ans. A group of members of the same class of organic compounds which differ from each other by a $-\text{CH}_2$ group when arranged in the ascending order of molecular mass is called a homologous series.

Characteristics of a homologous series :

- (i) All members of a homologous series can be represented by a general formula.
- (ii) Each member of a homologous series differs from the next member by a $-\text{CH}_2$ group.

- 14.** (a) Show the formation of Na_2O by the transfer of electrons between the combining atoms.
 (b) Why are ionic compounds usually hard?
 (c) How is it that ionic compounds in the solid state do not conduct electricity and they do so when in the molten state? **[2008]**



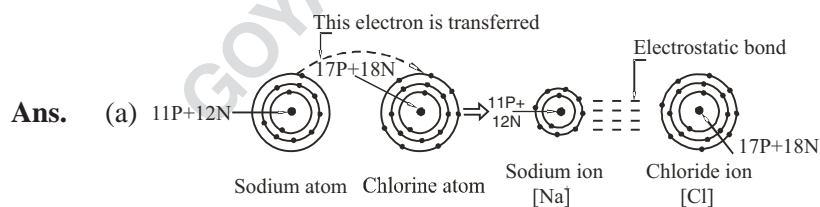
(b) Ions in the ionic compounds are held very tightly by strong electrostatic forces. This makes ionic compounds hard.

(c) In the solid state, the ions in the ionic compounds are not free to migrate towards the cathode and anode and hence they do not conduct electricity.

However, in the fused state, the ions are free to migrate towards the cathode and anode and hence conduct electricity.

- 15.** (a) Show the formation of NaCl from sodium and chlorine atoms by the transfer of electron(s).
 (b) Why does sodium chloride have a high melting point?
 (c) Name the anode and the cathode used in electrolytic refining of impure copper metal.

[2008]



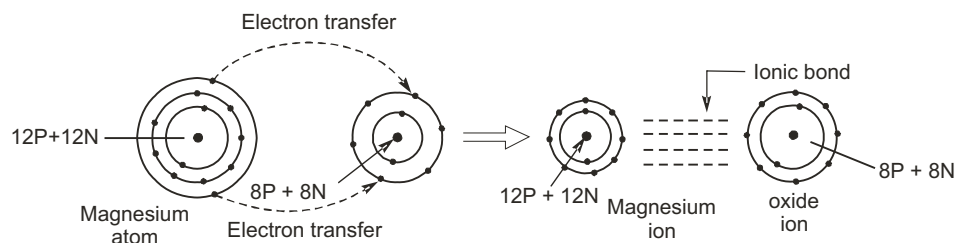
(b) Sodium and chloride ions are held by very strong electrostatic (ionic) bond in sodium chloride molecule. Thus, it requires a lot of energy to break this strong bond. This in turn raises its melting point.

(c) (i) Anode is impure copper (ii) Cathode is a thin pure copper plate.

- 16.** (a) Show on a diagram the transfer of electrons between the atoms in the formation of MgO .
 (b) Name the solvent in which ionic compounds are generally soluble.

(c) Why are aqueous solutions of ionic compounds able to conduct electricity? [2008]

Ans. (a)



(b) Ionic compounds are generally soluble in water.

(c) Aqueous solutions of ionic compounds consists of cations and anions. On the passage of current through this solution, the cations migrate towards the cathode and anions toward the anode. As the cations and anions discharge the electric current flows.

Other Important Questions

1. Identify the type of bonds you would expect to find in the molecules of the following substances:

(i) hydrogen, (ii) iodine, (iii) magnesium chloride, (iv) sodium oxide, and (v) carbon dioxide.

Ans. (i) Covalent bond (ii) Covalent bond (iii) Ionic bond
(iv) Ionic bond (v) Covalent bond

2. Choose from the list below, the substance or the substances which have :

- (i) single covalent bond only
- (ii) double covalent bond only
- (iii) triple covalent bond only
- (iv) single and double covalent bonds
- (v) single and triple covalent bonds
- (vi) polar covalent bonds

List : NH_3 , Cl_2 , N_2 , O_2 , C_2H_4 and C_2H_2

Ans. (i) Chlorine (Cl_2) (ii) Oxygen (O_2)
(iii) Nitrogen (N_2) (iv) Ethene (C_2H_4)
(v) Ethyne (C_2H_2) (vi) Ammonia (NH_3)

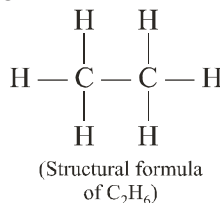
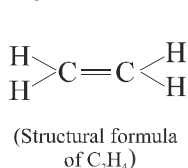
3. Taking carbon tetrachloride as an example, state four characteristics of covalent compounds.

Ans. (i) Carbon tetrachloride is a volatile liquid
(ii) Carbon tetrachloride has a low boiling point
(iii) Carbon tetrachloride is insoluble in water, but soluble in organic solvents
(iv) Carbon tetrachloride is a bad conductor of electricity.

4. C_2H_6 , C_2H_4 , C_4H_{10} , C_3H_6 are the molecular formulae of some organic compounds belonging to different homologous series. Write the name of the homologous series to which they belong and give the structural formula of C_2H_4 and C_2H_6 .

Ans. (i) C_2H_6 and C_4H_{10} belong to alkane homologous series.

(ii) C_2H_4 and C_3H_6 belong to alkene homologous series.



5. Write the general formula of the following

(i) alkanes, (ii) alkenes, (iii) alkynes, (iv) alkanols,

(v) alkanals, (vi) alkanones

Ans. (i) Alkanes : C_nH_{2n+2}

(ii) Alkenes : C_nH_{2n}

(iii) Alkynes : C_nH_{2n-2}

(iv) Alkanols : $C_nH_{2n+1}OH$

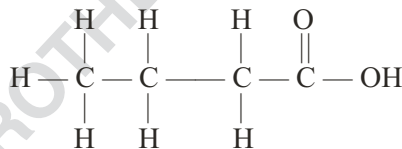
(v) Alkanals : $C_nH_{2n+1}CHO$

(vi) Alkanones : $R - \overset{\overset{O}{\parallel}}{C} - R'$ where R and R' stand for same or different alkyl radicals.

6. Write the molecular formula and structural formula of the following :

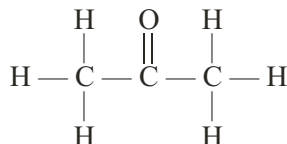
(i) Butanoic acid, (ii) Methanal, (iii) Propanone.

Ans. (i) Molecular formula of butanoic acid C_3H_7COOH



(ii) Molecular formula of methanal is $HCHO$

(iii) Molecular formula of the propanone is CH_3COCH_3



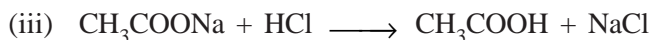
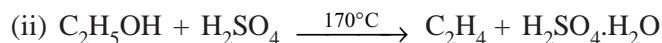
7. Write balanced equations for the following reactions.

(i) $C_3H_6 + O_2 \longrightarrow$

(ii) $C_2H_5OH + H_2SO_4 \longrightarrow$

(iii) $CH_3COONa + HCl \longrightarrow$

Ans. (i) $2C_3H_6 + 9O_2 \longrightarrow 6CO_2 + 6H_2O$

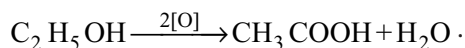


8. How will you convert ethanol to acetic acid?

(V.Imp.)

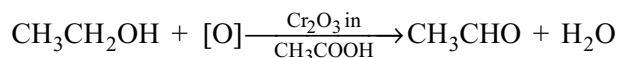
Ans. 1. Warm 5 ml of ethanol in a water bath.

2. To the above mixture add few drops of 5% alkaline potassium permanganate and continuously stir the mixture. The alkaline permanganate solution acts as an oxidising agent and oxidises ethanol to acetic acid.



9. How is ethanol converted into ethanal?

Ans. When ethanol is treated with 5% solution of chromium oxide in glacial ethanoic acid, it is oxidised to acetaldehyde (ethanal). Chromium oxide acts as a mild oxidising agent.



10. Give three advantages of synthetic detergents.

Ans. 1. Synthetic detergents can be used for cleaning, even in hard water.

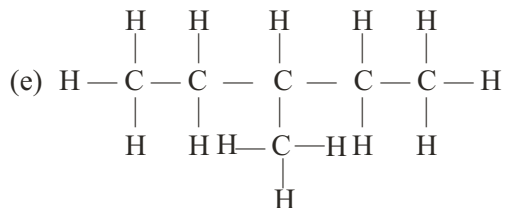
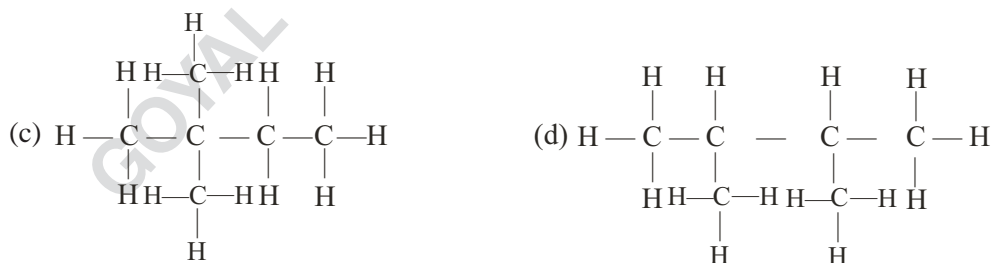
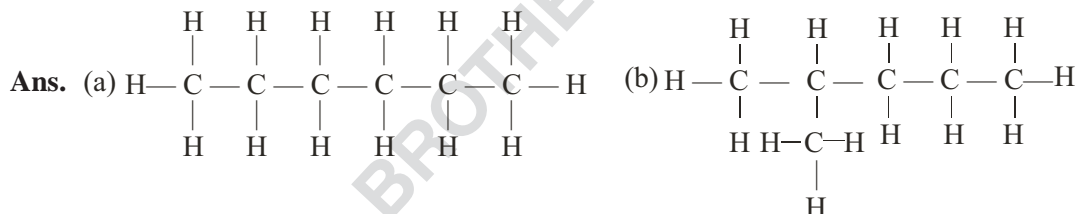
(Imp.)

2. Synthetic detergents can be used for cleaning, even when the water is acidic.

3. Synthetic detergents are cheaper as they are prepared from petroleum products.

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

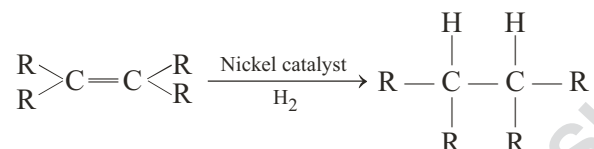
[HOTS]



12. Name the reaction which is commonly used in the conversion of vegetable oils to fats. Explain the reaction involved in detail. [HOTS]

Ans. Hydrogenation reaction

Most of the vegetable oils are unsaturated fatty acids having double bond in the long carbon chain. When these vegetable oils are heated to 300° C in the presence of finely divided nickel and hydrogen gas is passed through it, the double bond between the carbon atoms breaks to form single bonds and two hydrogen atoms are added at the reaction site. Thus unsaturated vegetable oil changes to saturated vegetable oil, commonly called hydrogenated oil.

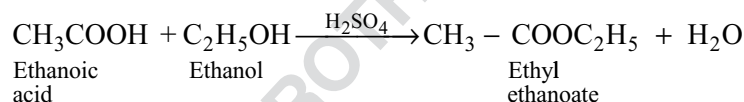


13. A compound X is formed by the reaction of a carboxylic acid $\text{C}_2\text{H}_4\text{O}_2$ and an alcohol in presence of a few drops of H_2SO_4 . The alcohol on oxidation with alkaline KMnO_4 followed by acidification gives the same carboxylic acid as used in this reaction. Give the names and structures of (a) carboxylic acid (b) alcohol and (c) the compound X. Also write the reaction. [HOTS]

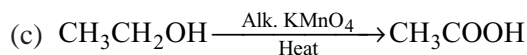
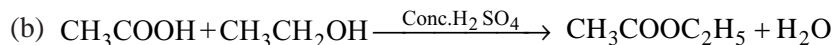
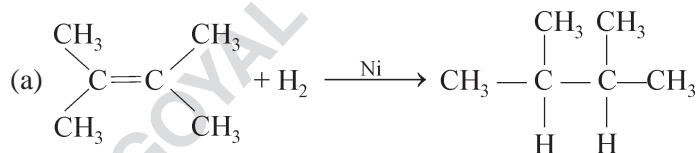
Ans. (a) The carboxylic acid is ethanoic acid.

(b) The alcohol is ethanol.

(c) X is ethyl ethanoate



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



[HOTS]

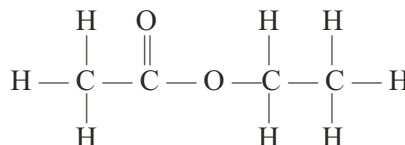
Ans. (a) Ni acts as a catalyst.

(b) Concentrated H_2SO_4 acts as a catalyst and a dehydrating agent.

(c) Alkaline KMnO_4 acts as an oxidising agent.

D. Long Answer Questions**[5 Marks]****Previous Years' Questions**

1. (a) The structural formula of an ester is :



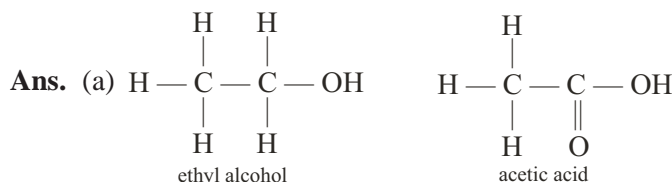
Write the structural formulae of the corresponding alcohol and the acid.

- (b) (i) Mention the experimental conditions involved in obtaining ethene from ethanol.

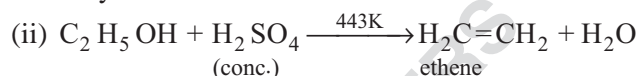
(ii) Write the chemical equation for the above reaction.

- (c) Explain the cleansing action of soap.

[2009, 2011 (T-II)]



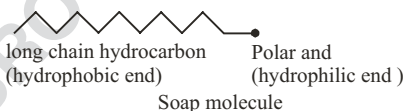
- (b) (i) When ethanol is heated with excess of concentrated sulphuric acid at 443 K, it gets dehydrated to form ethene.



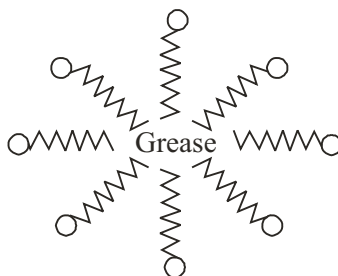
- (c) A molecule of soap is made up of two parts:

(i) An ionic part which is hydrophilic, i.e., water soluble.

(ii) A hydrocarbon chain which is hydrophobic i.e., water-repelling and oil soluble.

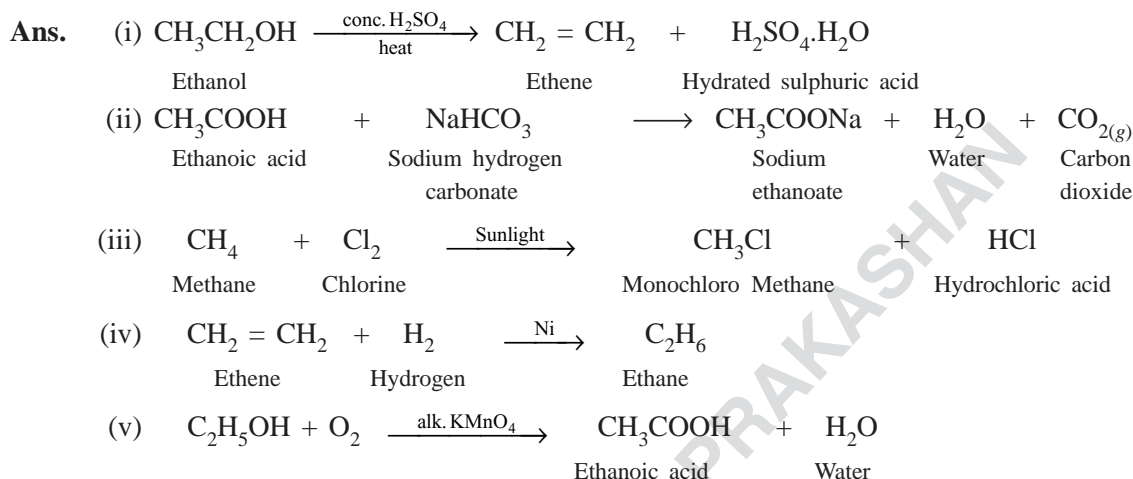


When soap is at the surface of water, the hydrophobic tail protrudes out of water while the ionic end remains inside water. Inside water, the molecules form clusters with the hydrophobic tails in the interior of the cluster and the ionic ends on the surface of the cluster. This formation is called a micelle. Soap, in the form of micelle collects the oily dirt in the centre of the micelle. The micelles stay in solution as a colloid and do not precipitate due to ion-ion repulsion. Thus, the dirt suspended in water is washed away during rinsing.



A micelle entrapping grease particle

(i) $\text{CH}_3\text{CH}_2\text{OH} \xrightarrow[\text{heat}]{\text{conc. H}_2\text{SO}_4}$ (ii) $\text{CH}_3\text{COOH} + \text{NaHCO}_3 \rightarrow$
(iii) $\text{CH}_4 + \text{Cl}_2 \xrightarrow{\text{Sunlight}}$ (iv) $\text{CH}_2 = \text{CH}_2 + \text{H}_2 \xrightarrow{\text{Ni}}$
(v) $\text{C}_2\text{H}_5\text{OH} + \text{O}_2 \xrightarrow{\text{alk. KMnO}_4}$ **[2011 (T-II)]**



- What type of organic compounds show substitution reaction?
- How will you convert ethanol into unsaturated hydrocarbon?
- How is carboxylic acid different from mineral acids?

[2011 (T-II)]

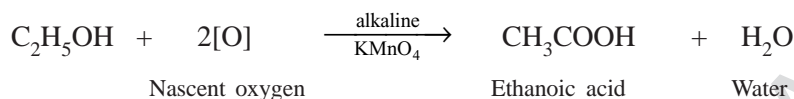
(ii) By the reaction with conc. sulphuric acid (H_2SO_4).
(iii) Carboxylic acid is weaker than mineral acids.

Two oxygen atoms share two electron pairs mutually and attain stable configuration of neon. A ***double covalent bond*** is formed between ***two oxygen atoms***, which forms a ***molecule of oxygen***, as illustrated by the dot diagram.

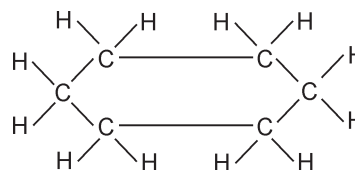
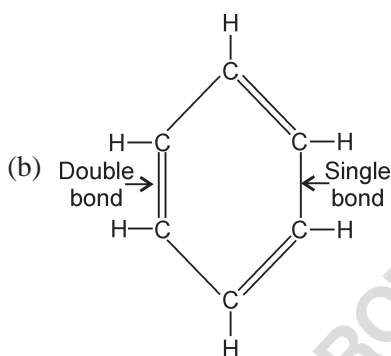
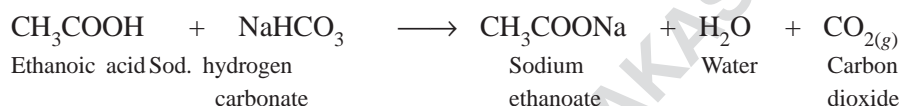
| | | | | |
|--------------------------|--|-------------|-----------------|--------------------------------------|
| | $:\ddot{\text{O}}: + :\ddot{\text{O}}: \rightarrow :\ddot{\text{O}}::\ddot{\text{O}}: \quad \text{or} \quad \text{O}=\text{O}$ | | | Double covalent bond \downarrow |
| Name of shell | L | L | L | |
| No. of valence electrons | 6 | 6 | 8 | |
| | Oxygen atom | Oxygen atom | Oxygen molecule | |

4. (a) An organic compound A is liquid at room temperature. It is also a good solvent and has the molecular formula C_2H_6O . A on oxidation gives compound B which gives effervescence with sodium hydrogen carbonate. A reacts with B in the presence of conc. sulphuric acid to give another compound C, which has a pleasant smell. Identify A and C. Also write the chemical equations for the reactions involved in the formation of B and C.
- (b) Draw the structures of benzene C_6H_6 and cyclohexane C_6H_{12} .
- (c) What is the difference between vegetable oil and animal fat? [2011 (T-II)]

Ans. (a) The compound A is C_2H_5OH . It is a good solvent. On oxidation it will give ethanoic acid.



Ethanoic acid gives effervescence with sodium hydrogen carbonate as carbon dioxide gas is produced.

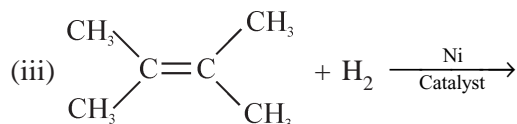


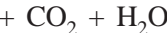
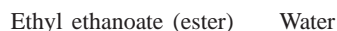
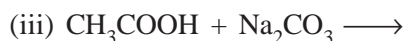
- (c) Most of the vegetable oils are unsaturated fatty acids having double bond in a long carbon chain. They do not solidify like butter or animal fat on cooling.

When vegetable oils are heated to 300°C in the presence of finely divided nickel and hydrogen gas is passed through it, the double bond between the carbon atoms break to form single bonds and two hydrogen atoms are added at the reaction site.

Thus, the unsaturated vegetable oil changes to saturated vegetable oil. It is commonly called *hydrogenated oil* or *vanaspati ghee*.

5. (a) Complete the following reactions and name the main product formed in each case.




$$(i) \text{CH}_3 - \text{CH} = \text{CH}_2 + \text{H}_2 \xrightarrow{\text{Ni-catalyst}}$$


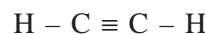
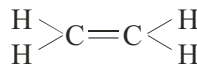
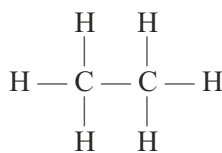
[2011 (T-II)]



Next homologue of butanal ($\text{CH}_3\text{CH}_2\text{CH}_2\text{CHO}$) is pentanal ($\text{CH}_3\text{CH}_2\text{CH}_2\text{CH}_2\text{CHO}$).

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

Ethanol Oxygen

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


Unsaturated hydrocarbons

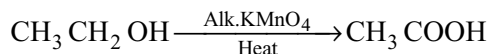
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10. Explain the given reactions with examples :

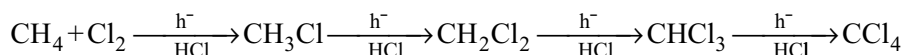
(a) (i) Oxidation reaction (ii) Substitution reaction (iii) Addition reaction

(b) What is glacial acetic acid? Why is it named so? State its two uses. [2011 (T-II)]

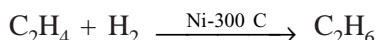
Ans. (a) (i) Ethanol is oxidised to ethanoic acid in the presence of alkaline KMnO_4 on heating.



(ii) In the presence of sunlight, chlorine replaces all the atoms of hydrogen in a hydrocarbon.



(iii) Ethene add hydrogen in presence of heated nickel or palladium to form ethane.



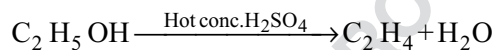
(b) Ethanoic acid freezes below 16.5°C to form an icy mass, which is known as glacial acetic acid. Its looks icy so, named glacial acetic acid. Its two uses are

(i) In the formation of vinegar

(ii) As a solvent for a large number of organic compounds.

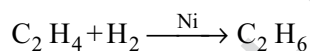
11. An organic compound A on heating with concentrated H_2SO_4 forms a compound B which on addition of one mole of hydrogen in the presence of Ni forms a compound C. One mole of compound C on combustion forms two moles of CO_2 and 3 moles of H_2O . Identify the compounds A, B and C and write the chemical equations of the reactions involved. [2011 (T-II)]

Ans. Since compound C gives 2 moles of CO_2 and 3 moles of H_2O , it shows that it has the molecular formula C_2H_6 (ethane). C is obtained by the addition of one mole of hydrogen to compound B so the molecular formula of B should be C_2H_4 (ethene). Compound B is obtained by heating compound A with concentrated H_2SO_4 which shows it to be an alcohol. So compound A could be $\text{C}_2\text{H}_5\text{OH}$ (ethanol).



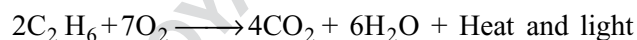
(A)

(B)



(B)

(C)



(C)

12. 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 the 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.

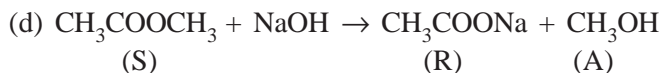
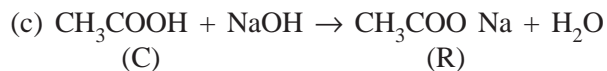
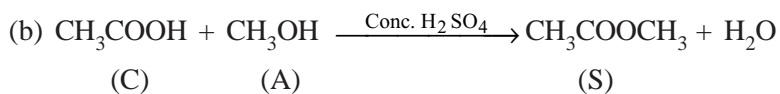
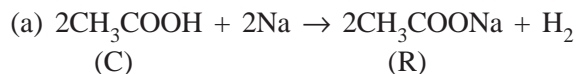
[2011 (T-II)]

Ans. C — Ethanoic acid

R — Sodium salt of ethanoic acid (sodium acetate) and gas evolved is hydrogen.

A — Methanol

S — Ester (methyl acetate)

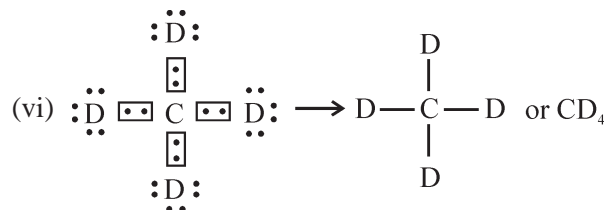
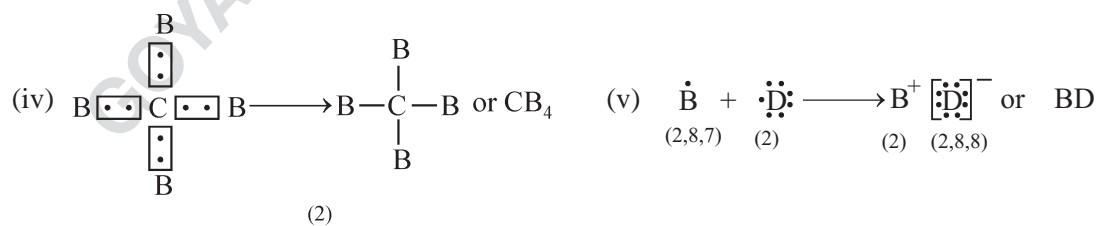
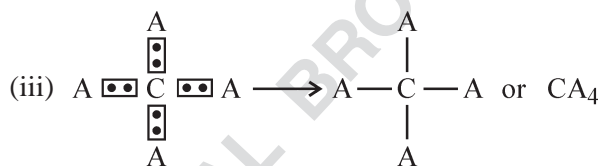
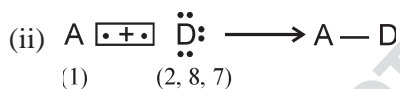
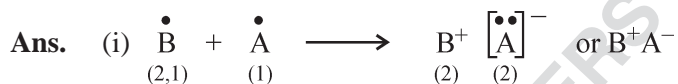


Other Important Questions

| | | | | | |
|----|--------------------------|--------|-----------|-----------|--------------|
| 1. | Elements | A | B | C | D |
| | Electronic configuration | 1, ... | 2, 1, ... | 2, 4, ... | 2, 8, 7, ... |

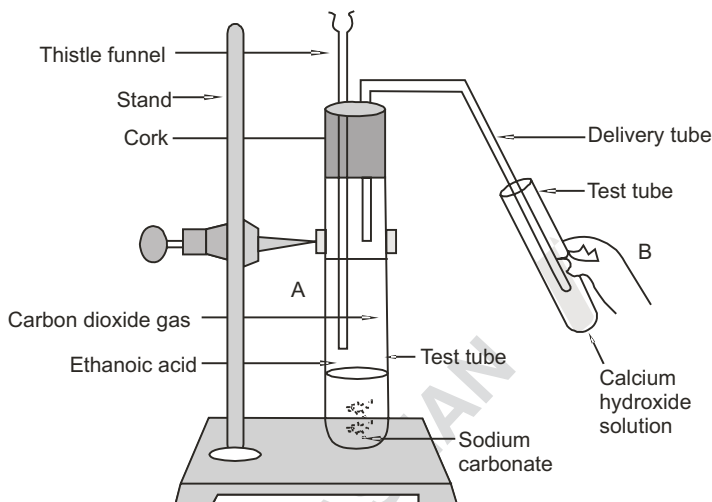
The table above shows the electronic configurations of elements from A to D. By drawing dot diagrams show the formation of compounds between :

- (i) A and B (ii) A and D (iii) A and C (iv) B and C
 (v) B and D (vi) C and D



4. Look at the figure and answer the following questions

- What change would you observe in the calcium hydroxide solution taken in test 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? **[HOTS]**



Ans. (a) It will turn milky.



With excess CO_2 , milkiness disappears



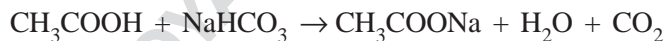
(c) As $\text{C}_2\text{H}_5\text{OH}$ and Na_2CO_3 do not react, a similar change is not expected.



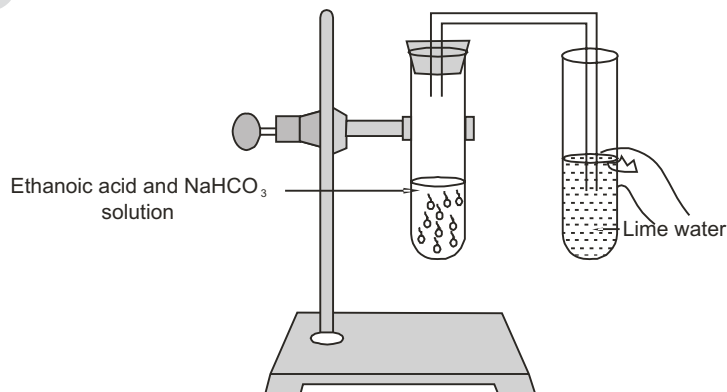
(d) Lime water is prepared by dissolving calcium oxide in water and decanting the supernatant liquid.

5. 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. **[HOTS]**

Ans. X is sodium ethanoate



The gas evolved is carbon dioxide.



A few crystals of sodium hydrogen carbonate is taken in a test tube and acetic acid is slowly added to it. A rubber cork fitted with a delivery tube is fixed at the mouth of the test tube. The other end of the delivery tube is dipped in a test tube containing lime water. Bubbles of gas escape from the test tube as soon as acetic acid comes in contact with sodium carbonate. This gas turns lime water milky. Thus the gas is identified as carbon dioxide.

II. FORMATIVE ASSESSMENT

A. Experiments

Experiment 1

[May be demonstrated by the teacher or performed by the students]

Objective

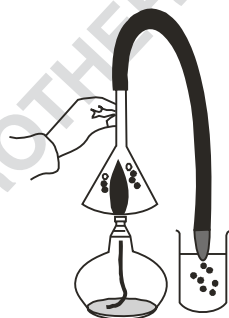
To study oxidation reactions of alcohol.

Materials required

Ethanol, 1% alkaline potassium permanganate solution, freshly prepared clear lime water, a measuring cylinder (10 ml), a beaker (250 ml), a funnel, a rubber tubing, a funnel, two boiling tubes, baking soda [NaHCO_3], a small glass tubing with jet.

Procedure

(A) Complete combustion of ethanol by burning it in air



Complete combustion of ethanol

1. Take a spirit lamp. In this ethanol acts as a fuel.
2. To the stem of the funnel, attach a rubber tubing. To the other end of the rubber tubing attach the glass tubing with jet. Check that the inner surface of the funnel is completely dry.
3. Hold the funnel in an inverted position so that just the end of the jet tubing is immersed in lime water, contained in the beaker. [Fig.]
4. Light the spirit lamp and hold the funnel in an inverted position over the flame for 2 minutes.

Quiz

1. What do you see on the inner surface of the funnel?
2. What colour change takes places in lime water?
3. What do you infer from the colour change in lime water?

4. What do you infer by looking at the inner surface of the funnel?
5. What are the products of the reaction on complete combustion of ethanol?
6. Write a balanced equation for the complete combustion of ethanol.

(B) Oxidation of ethanol using an oxidising agent

1. Measure 3 ml of ethanol and transfer it to a boiling tube.
2. Place the boiling tube in a water bath maintained at 60°C for 5 minutes. In this time the ethanol will acquire the temperature of the water bath.
3. To the contents of the boiling tube add 2 or 3 drops of alkaline potassium permanganate solution and shake the tube.
4. Again warm the tube for another 5 minutes in the water bath. Make your observations and record them.
5. To the contents of the reaction mixture add a pinch of baking soda and shake. Make your observations and record them.

Quiz

1. What is the colour of the reaction mixture, when 2 or 3 drops of alkaline potassium permanganate are added?
2. What is the colour of the reaction mixture, after warming it for 5 minutes?
3. What happened in the reaction mixture that led to the colour change?
4. What product is formed in the above reaction?
5. What was observed when baking soda was added in the reaction mixture?
6. Guess which gas is responsible for the observations in (5).
7. Why is this reaction called an oxidation reaction?

Precautions

1. Ethanol is extremely volatile and inflammable. Take care while handling it.
2. Alkaline potassium permanganate should be very dilute. Do not add more than three drops. If excess of it is used, it will not decolourise the liquid.

Experiment 2

Objective

To study esterification reaction between alcohol and carboxylic acid

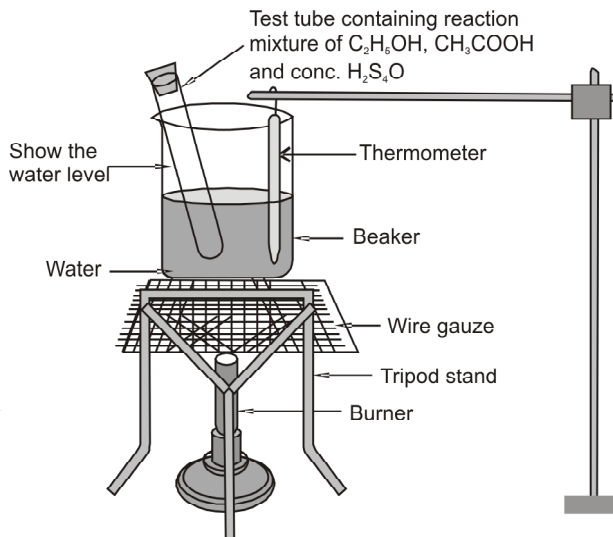
Materials required

Glacial ethanoic acid (2 ml), ethanol (2 ml), conc. sulphuric acid (few drops), sodium hydrogen carbonate, test tube, beaker, water, bunsen flame, tripod stand, wire gauze and a cork loosely fitting in the test tube.

Procedure

1. Take a clean test tube and pour 2 ml of glacial ethanoic acid in it.
2. Add 2 ml of ethanol in the ethanoic acid and shake well.
3. Add four drops of conc. sulphuric acid with the help of a dropper. Fix a cork loosely in the mouth of the test tube.

- Fill half the beaker with water. By placing the beaker on a wire gauze and tripod stand, heat it on a bunsen flame, till the temperature rises to 60°C . At this stage lower the flame so that the temperature stays around 60°C .
- Place the test tube containing the reaction mixture in the water bath as shown in the figure. Heat the test tube for 5 minutes and shake it occasionally.
- Pour the reaction mixture into a beaker containing aqueous solution of sodium hydrogen carbonate. This will remove the unreacted acid. You will also see effervescence in the solution and vapours coming out of it.
- Fan the vapours coming out of the reaction mixture with your hand towards your nose and smell them.



Formation of ester

Now discuss the following questions

- What is the smell of ethanol like?
- What is the smell of ethanoic acid like?
- How is the smell of the ester that is formed? Does it resemble the smell of ethanol or ethanoic acid?
- Write a chemical equation for the reaction between ethanol and ethanoic acid.
- What is the chemical name of the ester formed?
- What is purpose of adding a few drops of conc. sulphuric acid? Give two reasons.
- Which gas is liberated when the reaction mixture is poured in the aqueous solution of sodium hydrogen carbonate?
- To what use are esters put to?

Precautions

- Organic compounds are generally volatile and combustible. Never heat organic compounds on direct flame. Always use a water bath.
- Sulphuric acid is highly corrosive and can cause painful blisters on the skin. Take maximum care while using it.

B. Activities

Activity 1

Objective

To show that soaps or detergent can remove oil or oily substance and hence are cleansing agents.

Materials required

Three test tubes, any vegetable oil, a dropper, distilled water, soap solution, any detergent powder, a test tube stand.

Procedure

1. Take three test tubes and label them A, B and C. Pour 2 drops of any vegetable oil in each of the test tubes.
2. Now pour 10 ml of water in each of the test tubes A, B and C.
3. Keep the test tube A as it is, but add 2 ml of soap solution in test tube B and a small amount of detergent powder in test tube C.
4. Shake the components of each test tube A, B and C vigorously and then leave the test tubes undisturbed for 10 minutes.

You will notice that a thin layer of oil is formed over the surface of water in test tube A, but no layer of oil is formed in case of test tube B and C.

From the above observations, it can be concluded that soaps and detergents can remove oil or oily substances, and hence, are cleansing agents.

Activity 2

Objective

To study the comparative cleansing capacity of a sample of soap solution and a detergent in soft and hard water.

Materials required

Three test tubes, a test tube stand, distilled water, hard water, soap solution, detergent solution.

Procedure

1. Take three test tubes and label them A, B and C.
2. Pour 10 ml of distilled water in test tube A and 10 ml of hard water in each of the test tubes B and C. If hard water is not available, you can make hard water by dissolving 1g of magnesium chloride or magnesium sulphate in 50 ml of distilled water or tap water.
3. Arrange the test tubes A, B and C in the test tube stand. Now, pour 2 ml of soap solution in test tube A, 2 ml of detergent solution in test tube B and 2 ml of soap solution in test tube C.
4. Shake the contents of each test tube vigorously.

You will observe

- (i) In test tube A, lather is formed. From this it implies that distilled water or soft water is fit for removing dirt from clothes.
- (ii) In test tube B, lather is formed. From this it implies that detergents can lather in hard water, and hence, can be used for removing dirt from clothes, even if the water is hard.
- (iii) In test tube C, a curdy white precipitate is formed instead of lather. This precipitate is sticky in nature. From this it implies that soap solution is not fit for removing dirt from clothes when the water is hard.

Activity 3

Objective

To make soap from coconut oil

Materials required

100 g of coconut oil , 25 g of caustic soda, A china mug of capacity 100 ml or more, A steel bowl of 500 ml capacity or more, A steel spoon with long hand, 5 empty ice-cream cups.

Procedure

1. Buy 25 g of caustic soda and 100 g of coconut oil from the local grocer. Please ask him to pack caustic soda in a plastic bag. **Do not touch caustic soda with bare hands as it causes burns on the skin.**
2. A day before starting the project, pour caustic soda in the china mug and then add 100 ml of water to it. Stir the contents with the steel spoon till the caustic soda completely dissolves. Cover the mug with some cardboard and keep it there for a day.
3. Transfer the coconut oil in the steel bowl. If the coconut oil is in the solid state, warm it, so that it melts.
4. Pour slowly about 10 ml of caustic soda solution in the coconut oil and stir vigorously till it mixes to form a whitish paste.
5. Go on adding 10 ml of caustic soda solution each time with vigorous stirring, till all of it is consumed.
6. Go on stirring till a thick white paste is formed.
7. Pour out this paste in empty ice cream cups. This is soap. Allow it to solidify for 4 to 5 days. Peel off the paper of ice-cream cups to obtain solid cakes of soap.

C. Models

By using coloured plastic beads, tooth picks and fevicol or fevistick make models of the molecules of :

- | | |
|--------------|-------------------|
| (i) methane | (ii) ethane |
| (iii) ethene | (iv) ethyne |
| (v) ethanol | (v) ethanoic acid |

D. Charts

Prepare multicoloured charts for the first five members of the homologous series. Write their IUPAC name, condensed formula, structural formula and electronic formula.

- | | |
|---------------|--------------------|
| (i) Alkanes | (ii) Alkenes |
| (iii) Alkynes | (iv) Alkanols |
| (v) Alkanals | (v) Alkanoic acids |