Carbon and its Compounds

Improve your learning

Q. 1. Name the simplest hydrocarbon.

Answer : The simplest hydrocarbon is CH_4 (methane)

Note: Hydrocarbons are the compounds containing only carbon and hydrogen in their molecules.

Q. 2. What are the general molecular formula of alkanes, alkenes, and alkynes.

Answer :

Alkanes

i. Hydrocarbons containing only one single bond between carbon atoms are called alkanes.

ii. The general formula is C-C.

Alkenes

iii. Hydrocarbons containing at least one double bond between carbon atoms are called alkenes.

iv. The general formula is C=C.

Alkynes

v. Hydrocarbons containing at least one triple bond between carbon atoms are called alkynes.

vi. The general formula is C≡C.

Q. 3. Name the carboxylic acid used as a preservative.

Answer : Acetic acid (ethanoic acid) is widely used as a preservative in pickles.

Q. 4. Name the product other than water formed on burning of ethanol in air.

Answer : When ethanol is burnt in the presence of air, it forms CO_2 gas and water.

$CH_3CH_2OH \rightarrow 2CO_2 + H_2O$

Q. 5. Give the IUPAC name of the following compounds. If more than one compound is a possible to name all of them.

i. An aldehyde derived from ethane.
ii. A ketone derived from butane.
iii. A chloride derived from propane.
iv. An alcohol derived from pentane.

Answer :

i. Ethanal

Explanation: For an aldehyde, we have to add the suffix "—al". Thus, IUPAC name of an aldehyde derived from ethane will be ethanal.

ii. Butanone

Explanation: For a ketone, we have to add the suffix "—one". Thus, IUPAC name of a ketone derived from butane will be butanone.

iii. Chlropropane

Explanation: For a chloride, we have to add the prefix "chloro-". Thus, IUPAC name of a chloride derived from propane will be chlropropane.

iv. Pentanol

Explanation: For an alcohol, we have to add the suffix "—ol". Thus, IUPAC name of a ketone derived from butane will be butanone.

Q. 6. A mixture of oxygen and ethyne is burnt for welding can you tell why a mixture of ethyne and air is not used?

Answer : A mixture of ethyne and air is not used for welding because when ethyne is burnt in air, it gives sooty flame which is not suitable for welding.

Q. 7. Explain with the help of a chemical equation, how an addition reaction is used in vegetable ghee industry.

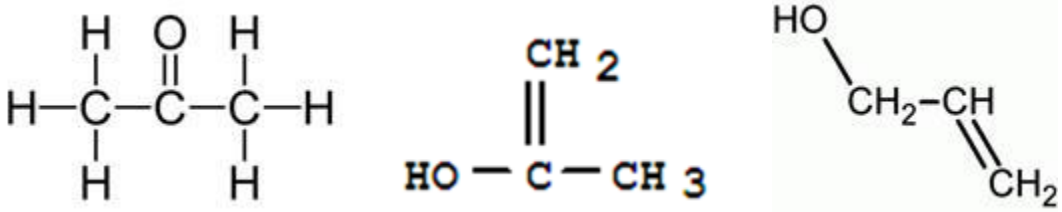
Answer : In addition reaction, the unsaturated fatty acids(oil) are converted to saturated fatty acids (ghee).

Vegetable oil (saturated) **Vegetable ghee (unsaturated)**

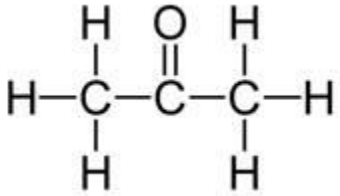
Q. 8. a. What are the various possible structural formulae of a compound having molecular formula C_3H_6O?

b. Give the IUPAC names of the above possible compounds and represent them in structure
c. What is the similarity in these compounds?

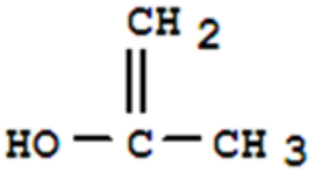
Answer : a. The three possible structural formula of C_3H_6O are:



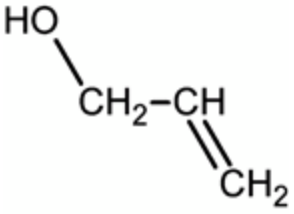
b. The IUPAC name of the above possible structures are:



Propanone



Prop-2-en-1-ol



Prop-1-en-1-ol

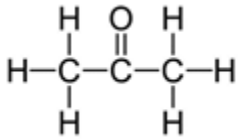
c. The similarity in all the above compounds is that all the compounds are unsaturated (contain at least one double bond).

Q. 9. Name the simplest ketone and write its molecular formula.

Answer :

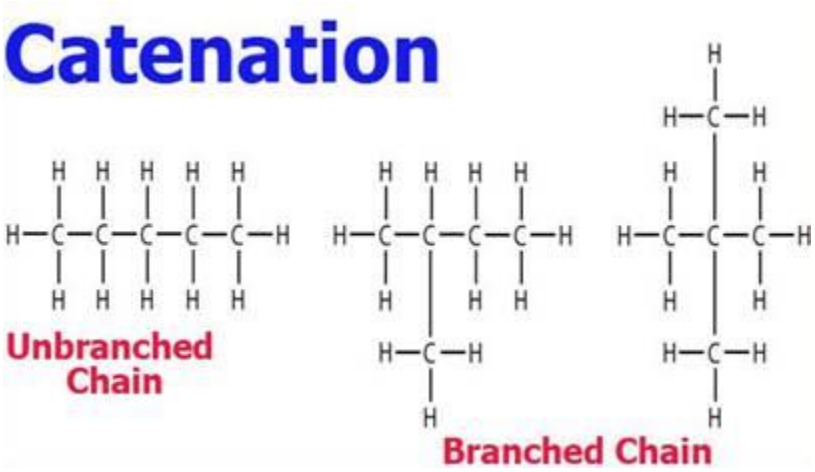
The simplest ketone is propanone.

The structure of propanone is:



Q. 10. What do we call the self-linking property of carbon?

Answer : Self-linking property of carbon is called catenation. If any element forms bond between its own atoms to give big molecules. This property is called catenation.



Note: This ability of carbon to form a bond in so many ways made it as a versatile element in nature.

Q. 11. Name the compound formed by heating ethanol at 443K with an excess of conc. H_2SO_4

Answer : When ethanol is heated in the presence of concentrated H_2SO_4 in excess, the compound formed is ethene.

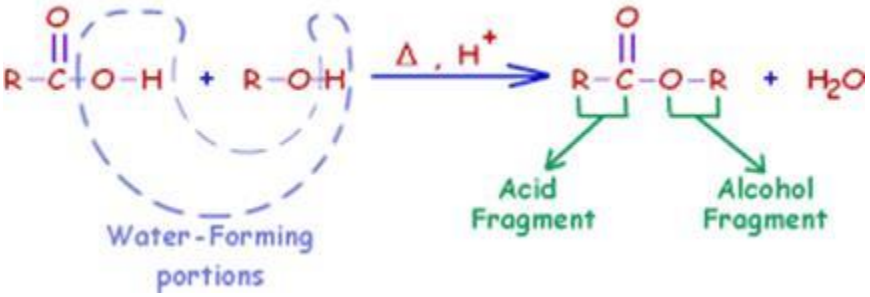
$$CH_3CH_2OH + \text{conc. } H_2SO_4 \rightarrow CH_2{=}CH_2 + H_2O$$

Ethanol — Ethene

Note: The above reaction is a dehydration reaction. H_2SO_4 is a dehydrating agent and removes water (H_2O).

Q. 12. Give an example of esterification reaction.

Answer : **<u>Esterification reaction</u>**—The reaction between carboxylic acid and an alcohol in the presence of con. H_2SO_4 to form ester is called esterification.



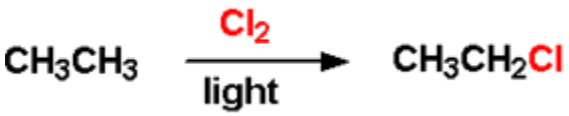
Q. 13. Name the product obtained when ethanol is oxidized by either anhydride or alkaline potassium permanganate

Answer : When ethanol is oxidized by either anhydride or alkaline potassium permanganate, the compounds formed are ethanol and ethanoic acid.

Q. 14. Write the chemical equation representing the reaction of preparation of ethanol from ethane.

Answer : Preparation of ethanol from ethane

Step 1: Ethane reacts with chlorine in the presence of sunlight to form chloroethane.



Step 2: Now, chloroethane reacts with NaOH to form ethanol by the replacement of Cl atom by OH.

$CH_3CH_2Cl + NaOH \rightarrow CH_3CH_2OH$

Q. 15. Write the IUPAC name of the next homologous of $CH_3OHCH_2CH_3$

Answer : The IUPAC name of the given compound ($CH_3OHCH_2CH_3$) is propane-2-ol. The IUPAC name of the next homologous of $CH_3OHCH_2CH_3$ is but-2-ol.

Q. 16. Define homologous series of carbon compound: Mention any two characteristics of homologous series.

Answer : <u>Homologous series:</u> The series of carbon compounds in which two successive compounds differ by $–CH_2$ unit is called homologue series.

Example:

● CH_4, C_2H_6, C_3H_8…..

● CH_3OH, C_2H_5OH, C_3H_7OH….

<u>Characteristics</u>

i. They have one general formula.

ii. Each compounds in the series differs by $–CH_2$ group.

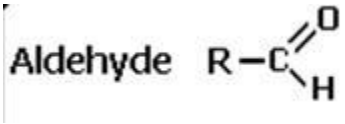
iii. They have similar chemical properties due to the same functional group.

Q. 17. Give the name of functional groups.

(i) -CHO (II) –C=O.

Answer :

i. Aldehyde



ii. Ketone

Q. 18. Why does carbon form the compound mainly by covalent bonding?

Answer : Carbon forms the compound mainly by covalent bonding due to the following reasons below:

i. The electronic configuration of carbon is 2, 4.

ii. If four electrons are added to the second orbit of carbon, its octet becomes complete and its electronic configuration becomes stable like that of the nearest inert gas neon (2, 8).

iii. Therefore, the valency of carbon is 4. However, this occurs by sharing of electron rather than a give and take of electrons.

iv. That's why a carbon atom can form four covalent bonds with other carbon atoms or atoms of different elements.

Q. 19. Allotropy is a property shown by which class substance element, compound, and mixtures? Explain allotropy with suitable examples.

Answer :

Allotropy

i. Some elements occur in nature in more than one form.

ii. The chemical properties of these different forms are the same but their physical properties are different. This property of elements is called allotropy.

iii. Like carbon, sulphur and phosphorus also exhibit allotropy.

iv. The different forms of the element are called allotropes.

The allotropes of carbon are classified into two types

i. Amorphous forms – coal, coke, wood, charcoal, animal charcoal etc.

ii. Crystalline forms – diamond, graphite, and fullerene

Q. 20. Explain how sodium ethoxide is obtained from ethanol? Give chemical equation.

Answer : Ethanol reacts with metallic sodium to form sodium ethoxide and hydrogen is liberated. The chemical equation is given below:

$$2C_2H_5OH + 2Na \rightarrow 2C_2H_5ONa + H_2$$

Ethanol — Sodium Ethoxide

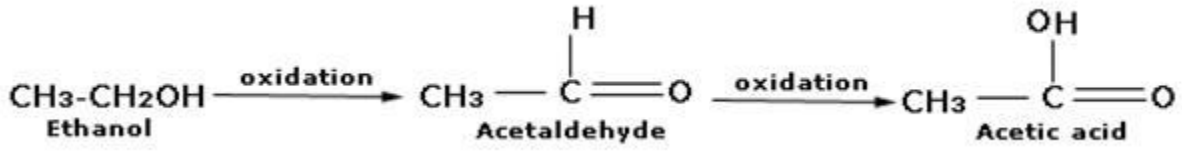
Q. 21. Describe with the chemical equation how ethanoic acid may be obtained from ethanol

Answer :

By oxidation of ethanol

When ethanol is oxidized by either anhydride or alkaline potassium permanganate, the compound formed is ethanol. On further oxidation, it forms ethanoic acid.

The chemical reaction is given below:



Q. 22. Explain the cleansing action of soap.

Answer :

Cleansing action of soap

i. Soap has one polar end and one non-polar end.

ii. The polar end is hydrophilic in nature and attracted towards water whereas the non-polar end is hydrophobic in nature and attracted towards the oil or grease

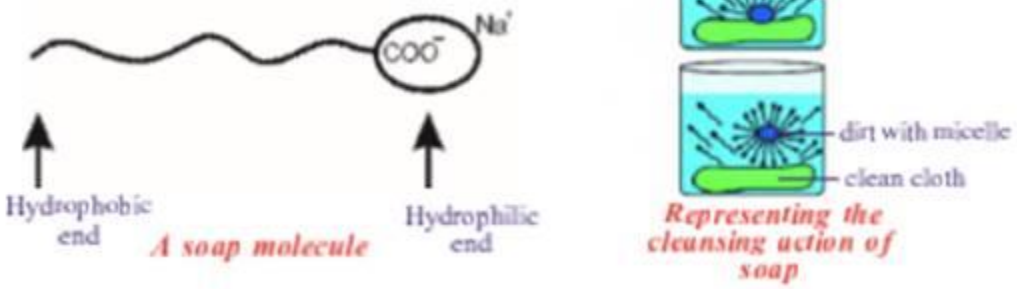
iii. When soap is dissolved in water, its hydrophobic ends attach to the dirt.

iv. The hydrophobic ends try to pull out the dirt.

v. The molecules of soap surround the dirt particles at the center of the cluster and form a spherical structure called micelle.

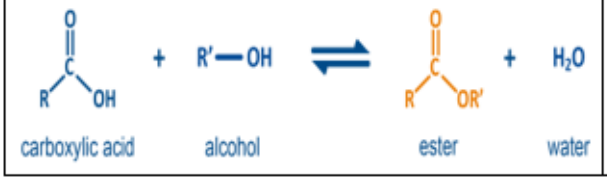
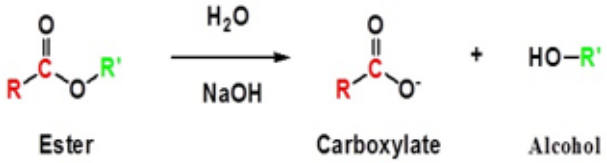
vi. The dust particles remain trapped in micelles which are easily rinsed away with water.

vii. That's how soap clean the clothes.



Q. 23. Distinguish between esterification and saponification reactions of organic compounds.

Answer :

Esterification	Saponification
1. The reaction between carboxylic acid and an alcohol in the presence of con. H_2SO_4 to form ester is called esterification.	When an ester is reacted with the alkali sodium hydroxide, the corresponding alcohol and carboxylic acid (in the form of its sodium salt) are obtained back. This reaction is called saponification reaction,
	

Q. 24. Explain the structure of graphite in ten of bonding and give one property based on this structure.

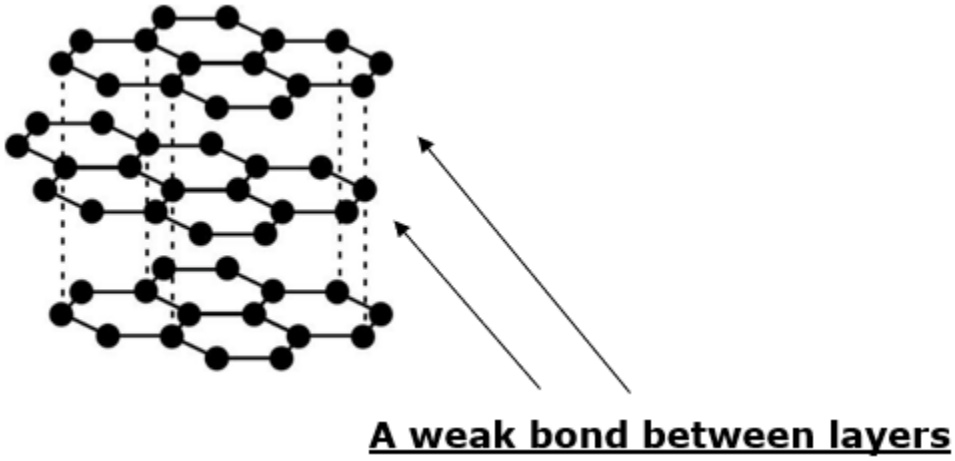
Answer :

Structure of graphite

i. In graphite, every carbon atom is bonded to three other carbon atoms by covalent bonds.

ii. A graphite crystal is hexagonal.

iii. The regular arrangement of atoms in graphite is in hexagonal layers.



Property – A good lubricant

iv. The layers are loosely bounded with each other.

v. As there is a weak force of attraction present between them, hence the layers slide with each other.

vi. This makes the graphite slippery and thus it used as a lubricant.

Q. 25. Name the acid present in vinegar.

Answer : Carboxylic acid is present in vinegar.

Q. 26. What happens when a small piece of sodium is dropped into ethanol?

Answer : When a small piece of sodium is dropped into ethanol, it forms sodium ethoxide (C_2H_5ONa). The reaction is given below:

$$2C_2H_5OH + 2Na \rightarrow 2C_2H_5ONa + H_2$$

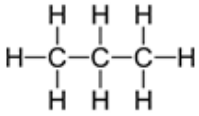
Ethanol — Sodium Ethoxide

Q. 27. Two carbon compounds A and B have molecular formula C_3H_8 and C_3H_6respectively. Which one of the two is most likely to show addition? Justify your answer.

Answer : C_3H_6 is most likely to show addition reaction.

Explanation:

The addition reaction is shown by the unsaturated compounds which contain double bonds or triple bonds like alkenes and alkynes.

C_3H_8 –  is a saturated hydrocarbon as it does not contain double bonds or triple bonds.

On the other hand, C_3H_6 –  is an unsaturated hydrocarbon as it contains a double bond. Thus, C_3H_6 undergoes addition reaction.

Q. 28. Suggest a test to find the hardness of water and explain the procedure.

Answer :

To find the hardness of water

Step 1: Take some distilled water in a test tube and hand pump water in another test tube.

Step 2: Add some drops of soap solution to both the tubes.

Step 3: Shake both the tubes together. Observe the foam formed.

The test tube having distilled water shows more foam whereas the test tube having hand pump water forms a white precipitate due to the presence of calcium and magnesium ions. This indicates that it is a hard water.

Q. 29. Suggest a chemical test to distinguish between ethanol and ethanoic acid and explain the procedure.

Answer :

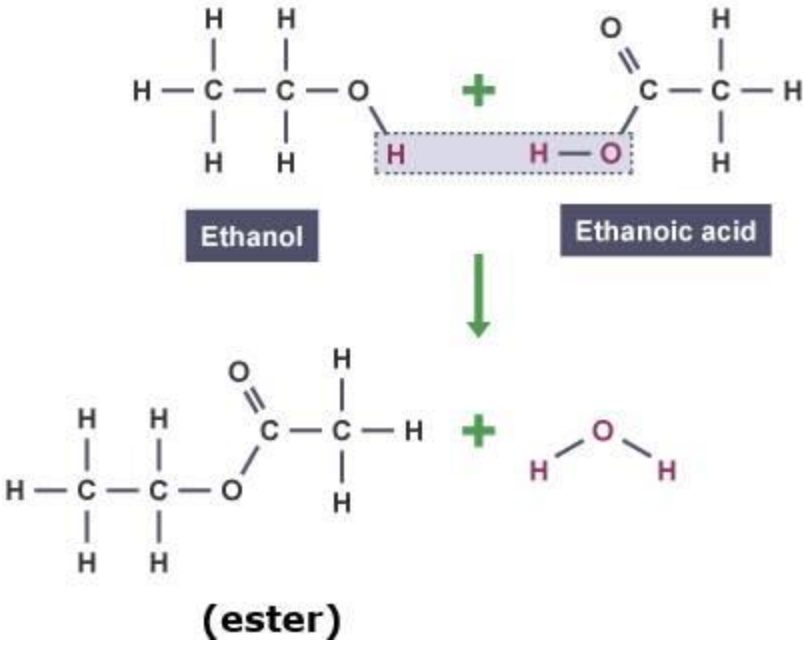
Ethanol	Ethanoic acid
i. Ethanol does not give a reaction with sodium bicarbonate. $CH_3CH_2OH + Na_2CO_3 \rightarrow$ No reaction	i. Ethanoic acid reacts with sodium carbonate (Na_2CO_3) to form sodium acetate and liberate CO_2 $CH_3COOH + Na_2CO_3 \rightarrow CH_3COONa + CO_2$

Q. 30. An organic compound 'X' with a molecular formula C_2H_6O undergoes oxidation with alkaline $KMnO_4$ and forms the compound Y', that has molecular formula $C_2H_4O_2$

a. Identify 'X' and 'Y'
b. Write your observation regarding the product when the compound 'X' is made to react with compound 'Y' which is used as a preservative for pickles.

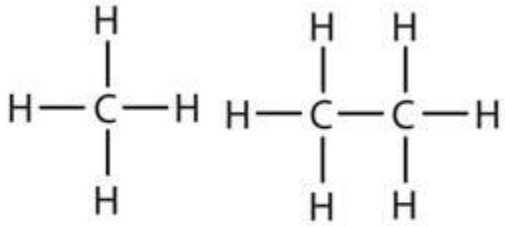
Answer : a. 'X' is ethanol (CH_3CH_2OH) and 'Y' is ethanoic acid (CH_3COOH)

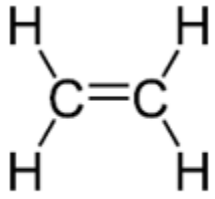
b. When the ethanol(alcohol) is made to react with ethanoic acid (carboxylic acid), the compound formed is ester and this process is called esterification.

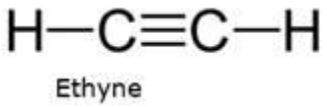


Q. 31. Prepare models of methane, ethane, ethene and ethyne molecules using clay halls and match sticks.

Answer :







Q. 32. Collect information about artificial ripening of fruits by ethylene.

Answer : i. Calcium carbide is one of the main artificial ripening agents of fruits. It speeds up the ripening process.

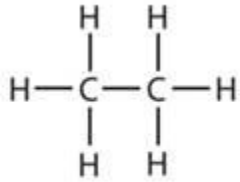
ii. When calcium carbide comes in contact with air, it produces ethylene.

iii. Ethylene effects of ripening are almost similar as natural ripening agents.

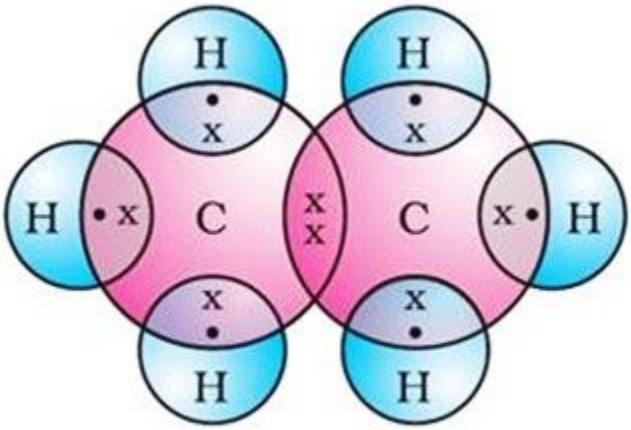
iv. That why it is most preferred.

Q. 33. Draw the electronic dot structure of ethane molecule (C_2H_6).

Answer :



Ethane



Electronic dot structure of ethane

Q. 34. How do you appreciate the role of esters in everyday life.

Answer :

Role of esters in everyday life

1. Esters have sweet odouring substances.

2. Majority of fruits owe their odour to a particular ester present in them.

3. Esters are used for making fragrances, perfumes and flavouring agents.

4. Esters are used in the saponification to prepare soaps.

Q. 35. How do you condemn the use of alcohol as a social practice.

Answer : i. Consumption of small quantities of dilute ethanol shows its effect even though is condemned still it has remained socially widespread practice.

ii. Consumption of alcohol harms health in a number of ways.

iii. It adversely affects the physiological processes.

iv. It damages the central nervous system.

v. Consumption of even a small quantity of pure ethanol (called absolute alcohol) can be lethal.

Q. 36. An organic compound with molecular formula $C_2H_4O_2$ produces brisk effervescence on addition of sodium carbonate /bicarbonate. Answer the following

a. Identify the organic compound.
b. Write the chemical equation for the above reaction.
c. Name the gas evolved.
d. Now will you test the gas evolved?
e. List two important uses of the above compound.

Answer :

a. The organic compound is CH_3COOH.

b. Ethanoic acid (CH_3COOH) reacts with sodium carbonate (Na_2CO_3) to form sodium acetate and liberate CO_2

$CH_3COOH + Na_2CO_3 \rightarrow CH_3COONa + CO_2$

c. The gas evolved is CO_2.

d. The CO_2 gas of the effervescence passes through the gas delivery tube and reacts with the lime water in the small test tube. ‘Lime water turning milky’ is the test of carbon dioxide gas.

e. Two important uses of ethanoic acid are:

i. It is used as a preservative for pickles.

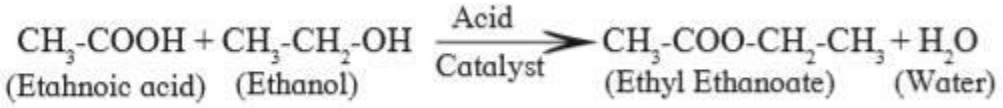
ii. It used in making vinegar.

Q. 37. I ml glacial acetic acid and I ml of ethanol arc mixed together in a test tube. Few drops of concentrate sulphuric acid is added in the mixture are warmed in a water bath for 5 min. Answer the following

a. Name the resultant compound formed.
b. Represent the above change by a chemical equation.
c. What term is given to such an reactions.
d. What are the special characteristics of the compound formed?

Answer : a. The resultant compound formed is ester.

b.



c. The term given to such reaction is esterification reaction.

d. The compound formed is ester which has sweet-smelling and is used to make perfumes and fragrances.