

CLASS X: SCIENCE
Chapter 4: Carbon and Its Compounds

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Q1. What would be the electron dot structure of carbon dioxide which has formula CO_2 ?

Ans. In carbon dioxide molecule, the two oxygen atoms are bonded on either side with carbon atom by double bonds. Thus there are 2 double bonds in CO_2 . Carbon share its two electrons in the formation of a double bond with one oxygen atom and another two electrons with another oxygen atom.

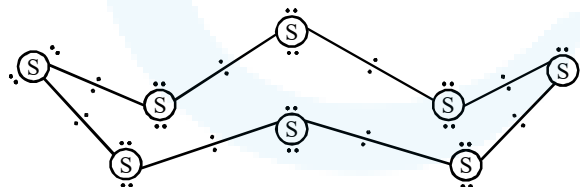
In this process, both the oxygen atoms and the carbon atom acquire the stable electronic configuration of the noble gas neon. The formation of CO_2 molecule is shown below.



Valencies of C and O are 4 and 2 respectively.

Q2. What would be the electron dot structure of a molecule of sulphur which is made up of eight atoms of sulphur?

Ans. The eight atoms of sulphur are joined together in the form of a puckered ring (crown shape).



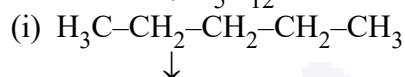
Electron dot structure of sulphur



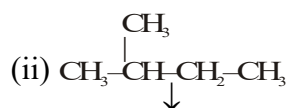
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Q1. How many structural isomers can you draw for pentane?

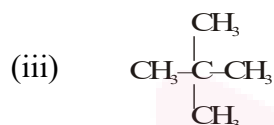
Ans. Pentane \longrightarrow C_5H_{12}



↓
Pentane or n-pentane



↓
2-Methylbutane or iso-pentane



↓
2,2-Dimethylpropane or neo-pentane

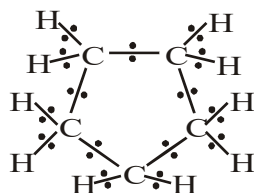
Q2. What are the two properties of carbon which led to the huge number of carbon compounds we see around us?

Ans. (i) Catenation (ii) Tetravalency

Q3. What will be the formula and electron dot structure of cyclopentane?

Ans. Cyclopentane C_5H_{10}

Electron dot structure





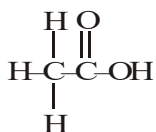
Q4. Draw the structure for the following compounds :

(i) Ethanoic acid (ii) Bromopentane

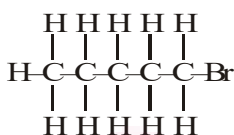
(iii) Butanone (iv) Hexanal

Are structural isomers possible for bromopentane?

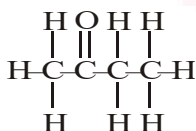
Ans. (i) Ethanoic acid \longrightarrow CH_3COOH



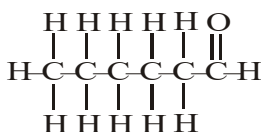
(ii) Bromopentane \longrightarrow $\text{C}_5\text{H}_{11}\text{Br}$



(iii) Butanone \longrightarrow $\text{CH}_3\text{COC}_2\text{H}_5$



(iv) Hexanal $\text{C}_5\text{H}_{11}\text{CHO}$



Q5. How would you name the following compounds?

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

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

(iii) $\begin{array}{ccccccc} \text{H} & \text{H} & \text{H} & \text{H} & & & \\ | & | & | & | & & & \\ \text{H}-\text{C} & -\text{C} & -\text{C} & -\text{C} & -\text{C} & \equiv \text{C}-\text{H} \\ | & | & | & | & & & \\ \text{H} & \text{H} & \text{H} & \text{H} & & & \end{array}$

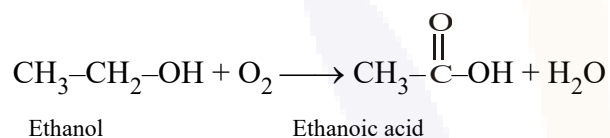
Ans. (i) Bromoethane (ii) Methanal (iii) Hexyne



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Q1. Why is the conversion of ethanol to ethanoic acid an oxidation reaction?

Ans. The reaction showing the conversion of ethanol to ethanoic acid can be shown as :



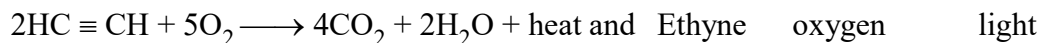
A molecule of ethanol contains one oxygen atom while that of ethanoic acid contains two oxygen atoms.

Since oxidation involves addition of oxygen therefore, conversion of ethanol to ethanoic acid is an oxidation reaction.

Alternatively, a molecule of ethanol contains six hydrogen atoms while that of ethanoic acid contains four hydrogen atoms since oxidation involves removal of hydrogen, therefore conversion of ethanol to ethanoic acid is an oxidation reaction.

Q2. A mixture of oxygen and ethyne is burnt for welding. Can you tell why a mixture of ethyne and air is not used?

Ans. Ethyne is an unsaturated hydrocarbon, therefore, combustion of ethane in air produces a yellow flame with black smoke due to the presence of unburnt carbon in it. Due to this incomplete combustion heat produced is also low and a high temperature usually needed for welding cannot be attained. That is why mixture of ethyne & oxygen is used :





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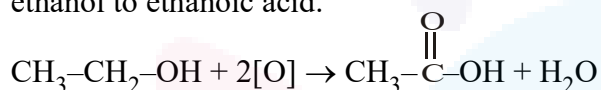
Q1. How would you distinguish experimentally between an alcohol and a carboxylic acid?

Ans. Sodium bicarbonate test

Take a small amount of each compound in a test tube and add to it an aqueous solution of NaHCO_3 . The compound which produces brisk effervescence due to the evolution of CO_2 must be a carboxylic acid

Q2. What are oxidising agents?

Ans. Oxidising agents are substances which are capable of adding oxygen to other substances, for examples, both alkaline potassium permanganate and acidified potassium dichromate can convert ethanol to ethanoic acid.



Ethanol Oxygen from Ethanoic acid
 oxidising agent

e.g. alkaline potassium permanganate KMnO_4 , acidified potassium dichromate $\text{K}_2\text{Cr}_2\text{O}_7$.

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Q1. Would you be able to check if water is hard by using a detergents ?

Ans. No, because no scum formation takes place when detergent is added to hard water.

Q2. People use a variety of methods to wash clothes. Usually after adding the 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 ?

Ans. On addition of soap in water, formation of micelle takes place in which soap is attracted both by the oily dirt and water. Due to this, emulsion of oil in water is formed. To wash away the loosened dirt particle in form of micelles from the surface of cloth, agitation is required.



EXERCISES

Q1. Ethane, with the molecular formula C_2H_6 has

- | | |
|----------------------|----------------------|
| (1) 6 covalent bonds | (2) 7 covalent bonds |
| (3) 8 covalent bonds | (4) 9 covalent bonds |

Ans. (2)

Q2. Butanone is a four-carbon compound with the functional group,

- | | |
|---------------------|--------------|
| (1) Carboxylic acid | (2) aldehyde |
| (3) ketone | (4) alcohol |

Ans. (3)

Q3. While cooking, if the bottom of the vessel is getting blackened on the outside, it means that

- (1) the food is not cooked completely
- (2) the fuel is not burning completely
- (3) the fuel is wet
- (4) the fuel is burning completely

Ans. (2)

Q4. Explain the nature of the covalent bond using the bond formation in CH_3Cl .

Ans. Atomic number of C, H & Cl are 6, 1 & 17 respectively.

Their electronic configurations are

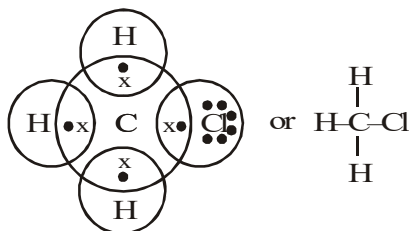
Carbon – 2, 4

Hydrogen – 1

Chlorine – 2, 8, 7

As C need 4 electrons to complete its octet, H needs 1 electron to complete its duplet and Cl needs 1 electron to complete its octet.

So, C share its 4 electron, one electron each with 3 H atom & 1 electron with Cl atom. Thus chloromethane contain 3 C – H and one C–Cl covalent bond

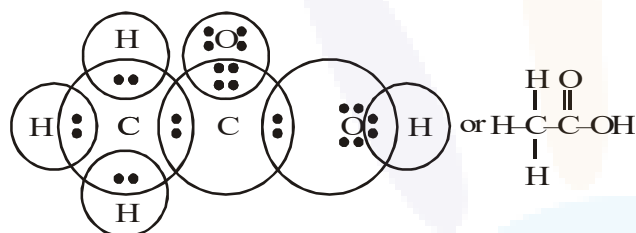




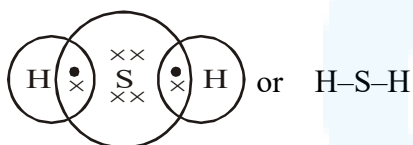
Q5. Draw the electron dot structure of

- (a) Ethanoic acid
- (b) H₂S (Hydrogen sulphide)
- (c) Propanone
- (d) F₂ (Fluorine)

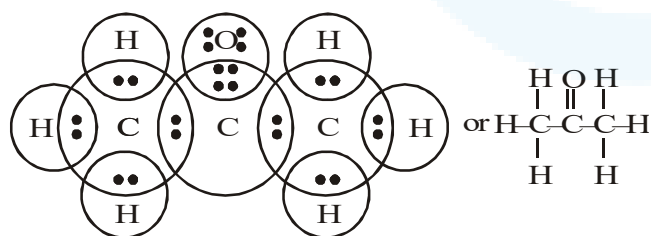
Ans. (a) Ethanoic acid



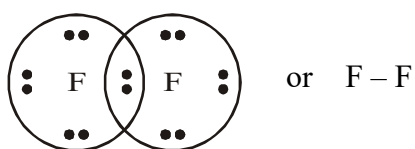
(b) H₂S (Hydrogen sulphide)



(c) Propanone



(d) F₂ (Fluorine)





Q6. What is an homologous series? Explain with an example.

Ans. A family of organic compounds having the same functional group, similar chemical properties and the successive members of which differ by a CH_2 group or 14 mass units.

e.g. CH_3OH (methanol)

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

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

They constitute homologous series of alcohols. Because they have same functional group, differ by $-\text{CH}_2/14$ mass unit and have similar chemical properties.

Q7. How can ethanol and ethanoic acid be differentiated on the basis of their physical and chemical properties?

Ans.	Property	Ethanol	Ethanoic acid
(i)	Melting point	156 K	290 K
(ii)	Action on litmus	No action	Turns blue litmus into red
(iii)	Reaction with NaHCO_3 solution	No reaction	Effervescence due to the formation of CO_2

Q8. Why does micelle formation take place when soap is added to water? Will a micelle be formed in other solvents like ethanol also?

Ans. A molecule of soap has two dissimilar ends. At one end is the hydrocarbon chain which is water repellent. At the other end carboxylate anion is present which is water soluble end. When soap is dissolved in water, many molecules come together and form a group called micelle, these micelles are formed because their hydrocarbon chains come together and the polar ends are projected outward. Micelle formation in ethanol will not occur because the hydrocarbon chain end of the soap will also dissolve in ethanol.

Q9. Why are carbon and its compounds used as fuels for most applications?

Ans. When carbon is heated in presence of excess of air or oxygen, it forms carbon dioxide. During its formation, a large amount of heat and light are released. Further, once ignited, carbon and its compounds keep on burning without needing additional heat energy.



Q10. Explain the formation of scum when hard water is treated with soap.

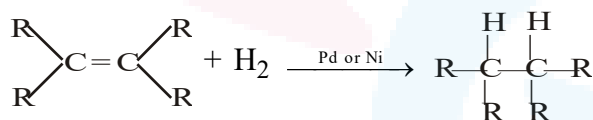
Ans. Hard water contains calcium and magnesium ions. When soap comes in contact with hard water, these ions form calcium and magnesium salts of fatty acids which are insoluble in water. These calcium or magnesium salts precipitate out in the form of scum.

Q11. What change will you observe if you test soap with litmus paper (red and blue)?

Ans. Soap is alkaline in nature therefore turns red litmus blue and no effect on blue litmus.

Q12. What is hydrogenation? What is its industrial application?

Ans. Unsaturated hydrocarbons add hydrogen in the presence of palladium or nickel. This reaction is called hydrogenation.



This reaction is industrially used in the conversion of vegetable oils into vegetable ghee.

Q13. Which of the following hydrocarbons undergo addition reactions?

C_2H_6 , C_3H_8 , C_3H_6 , C_2H_2 and CH_4

Ans. C_3H_6 and C_2H_2 because they are unsaturated hydrocarbons compounds.

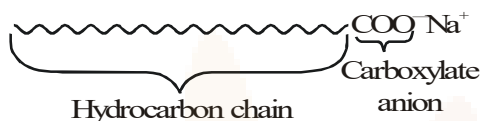
Q14. Give a test that can be used to differentiate between saturated and unsaturated hydrocarbons.

Ans. unsaturated contains unsaturated hydrocarbons it will undergo addition reaction whereas saturated contains hydrocarbons so it will not give addition reaction (hydrogenation) thus hydrogenation reaction can be used.



Q15. Explain the mechanism of the cleansing action of soaps.

Ans. A molecule of soap has two dissimilar ends. At one end is the hydrocarbon chain, which is water repellent and the other end is carboxylate anion which is polar end.



When soap is dissolved in water, many molecules come together and form a group called micelle. These micelles are formed because their hydrocarbon chains come together and the polar ends are projected outward.

When a cloth with a spot of oil is soaked into a soap solution, soap dissolves tiny oil droplets by the hydrophobic end in the middle of the micelle. Due to the outer polar ends, these micelles dissolve in water and are washed away. In this way cloth gets cleaned.