

JSUNIL TUTORIAL

PUNJABI COLONY GALI 01

Class X, CARBON AND ITS COMPOUNDS

NCERT Solutions of Exercise Questions

Q.1: Ethane, with the molecular formula C_2H_6 has

- (a) 6 covalent bonds (b) 7 covalent bonds
(c) 8 covalent bonds (d) 9 covalent bonds

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

- (a) carboxylic acid (b) aldehyde (c) ketone (d) alcohol

Q.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

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

Q.5: Draw the electron dot structures for:

- (a) ethanoic acid (b) H_2S (c) propanone (d) F_2

Q.6: What is homologous series? Explain with examples.

Q.7: How can ethanol and ethanoic acid be differentiated on the basis of their physical and chemical properties?

Q.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?

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

Q.10: Explain the formation of scum when hard water is treated with soap.

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

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

Q.13: Which of the following hydrocarbons undergo addition reaction?

C_2H_6 , C_3H_8 , C_3H_6 , C_2H_2 and CH_4 .

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

Q.15: Explain the mechanism of the cleaning action of soaps.

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NCERT Answers of Exercise Questions

Q.1: Ethane, with the molecular formula C_2H_6 has

(a) 6 covalent bonds (b) 7 covalent bonds (c) 8 covalent bonds (d) 9 covalent bonds Answer: (b)

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

(a) carboxylic acid (b) aldehyde (c) ketone (d) alcohol Answer: (c)

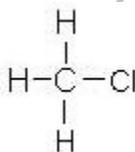
Q.3: While cooking, if the bottom of the vessel is getting blackened on the outside, it means that

(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 Answer: (b)

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

Answer: The bond line structure of CH_3Cl is given as

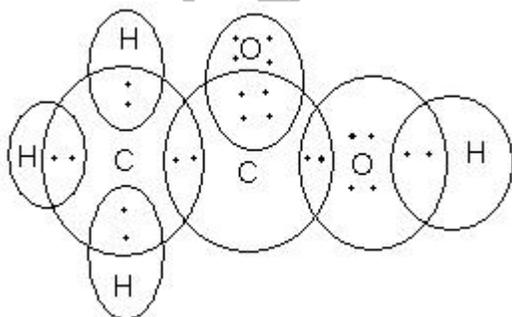


Carbon has four valence electrons. It shares 1 electron each with 3-hydrogen atoms and 1 electron with chlorine. The bond between C and Cl atoms is *covalent* but due to higher value of electro-negativity of Cl, the C-Cl bond is polar in nature.

Q.5: Draw the electron dot structures for: (a) ethanoic acid (b) H_2S (c) propanone (d) F_2

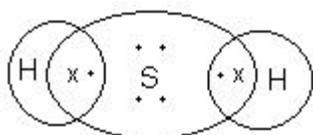
Answer:

(a) Ethanoic Acid



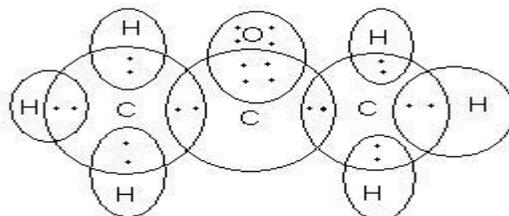
Ethanoic acid

(b) H_2S



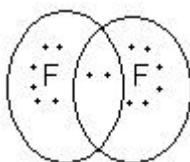
Hydrogen Sulphide (H₂S)

(c) Propanone



Propanone

(d) F₂



Q.6: What is homologous series? Explain with examples.

Answer: A group of compound of carbon having same general formula and same functional group is called 'Homologous Series'. The members of homologous series are called homologue. For example, alcohol.

Methanol – CH₃OH

Ethanol – C₂H₅OH

Propanol – C₃H₇OH

Butanol – C₄H₉OH

Characteristics of Homologous Series

- (a) They have same general formula for all compounds.
- (b) They have same functional group.
- (c) They have same chemical but different physical properties.
- (d) They have difference of –CH₂ between two successive members.
- (e) Difference between masses of two successive members is 14 amu.

Q.7: How can ethanol and ethanoic acid be differentiated on the basis of their physical and chemical properties?

Answer: Ethanol and Ethanoic acid be differentiated on the basis of their following properties –

- (i) Ethanol is a liquid at room temperature with a pleasant smell. Ethanoic acid has a melting point of 17°C. Since it is below the room temperature so, it freezes during winter. Moreover, ethanoic acid has a smell like vinegar.
- (ii) Ethanol does not react with metal carbonates while, ethanoic acid reacts with metal carbonates to form salt, water and carbon dioxide. For example,
$$2\text{CH}_3\text{COOH} + \text{Na}_2\text{CO}_3 \rightarrow 2\text{CH}_3\text{COONa} + \text{CO}_2 + \text{H}_2\text{O}$$
- (iii) Ethanol does not react with NaOH while ethanoic acid reacts with NaOH to form sodium ethanoate and water. For example,
$$\text{CH}_3\text{COOH} + \text{NaOH} \rightarrow \text{CH}_3\text{COONa} + \text{H}_2\text{O}$$

(iv) Ethanol is oxidized to give ethanoic acid in presence of acidified KMnO_4 while, no reaction takes place with ethanoic acid in presence of acidified KMnO_4 .

Q.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?

Answer: Soap molecule consists of two parts – hydrophobic and hydrophilic. Hydrophilic part is the ionic end of the soap molecule which is soluble in water. Hydrophobic part is the organic end and is insoluble in water. Since dirt contains organic matter so, hydrophobic part entraps dirt and hydrophilic part remains suspended in water. Thus, many more molecules of soap are attached to dirt having their one end suspended in water form clusters. These clusters with entrapped dirt are known as micelle.

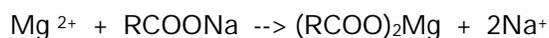
Since ethanol is not as polar as soap, so micelles will not be formed in other solvents such as ethanol.

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

Answer: Carbon and its compounds give large amount of heat on combustion due to high percentage of carbon and hydrogen. Carbon compounds used as fuel have optimum ignition temperature with high calorific values and are easy to handle. Their combustion can be controlled. Therefore, carbon and its compounds are used as fuels.

Q.10: Explain the formation of scum when hard water is treated with soap.

Answer: Soap is a sodium or potassium salt of long chain fatty acids. Hard water contains soluble salts of Ca and Mg. When soap is dissolved in hard water these calcium and magnesium ions displace sodium and potassium ions from soap and thus, insoluble salts of Ca^{+2} and Mg^{+2} are formed which are called scum.



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

Answer: Soap solution will turn red litmus paper blue while there will be no effect on blue litmus paper indicating that soaps are basic in nature.

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

Answer: The addition of hydrogen to an unsaturated hydrocarbon is called *Hydrogenation*. This process takes place in the presence of nickel or palladium metal as catalyst.

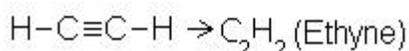
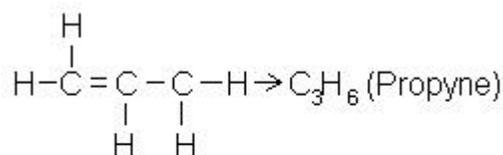
Industrial application of hydrogenation

- (1) It is used to prepare Ghee from vegetable oil.
- (2) Vegetable oil such as ground nut, cotton seed oils are unsaturated and contain double bonds. On hydrogenation in presence of a catalyst, vegetable oil produces vanaspati ghee.

Q.13: Which of the following hydrocarbons undergo addition reaction?

C_2H_6 , C_3H_8 , C_3H_6 , C_2H_2 and CH_4 .

Answer: Among the said hydrocarbons only C_3H_6 and C_2H_2 undergo addition reaction because they are unsaturated hydrocarbons having double and triple bond between two carbon atoms respectively.



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

Answer: If a carbon compound decolorizes bromine water it will be an unsaturated compound. Thus, we can distinguish between a cooking oil and butter by adding Br_2 (aq) to each of them –

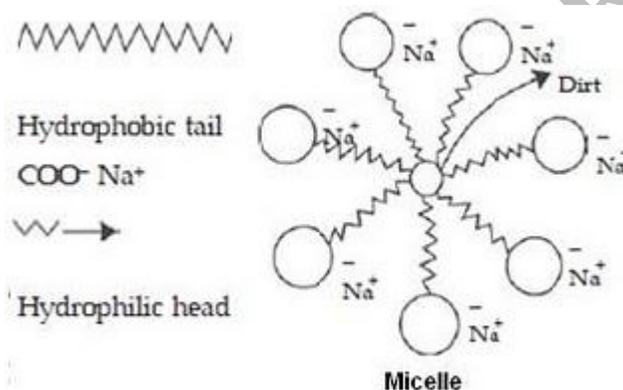
(a) cooking oil decolorizes bromine water, as it is unsaturated compound.

(b) butter does not decolorize bromine water, as it is saturated compound.

Moreover, butter does not undergo catalytic hydrogenation which shows it is saturated fat while, oil being unsaturated hydrocarbon can be hydrogenated in presence of a catalyst (Ni / Pd).

Q.15: Explain the mechanism of the cleaning action of soaps.

Answer: A soap molecule is a sodium or potassium salt of long chain carboxylic acid. It consists of two parts, *i.e.*, a long hydrocarbon tail and a negatively charged head. The hydrocarbon tail is hydrophobic, *i.e.*, insoluble in water and repelled by water while the polar end is soluble in water and hydrophilic in nature. When soap is applied on a wet dirty surface, the polar end of the soap molecule dissolves in water while the non-polar tail attaches it to dirt molecule, as dirt is non-polar in nature.

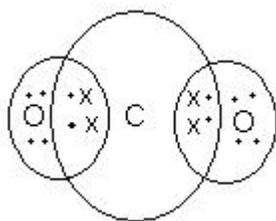


This results into the formation of spherical clusters called **Micelle**. In the micelle the hydrophobic tails are in the interior of the cluster while the ionic ends are on the surface of cluster. Due to ion-ion repulsion the micelle stay in the solution as a colloid and do not come together to precipitate. Thus, an emulsion is formed which helps to dissolve dirt in water and it is finally washed with running water.

Solutions of NCERT In-text Questions

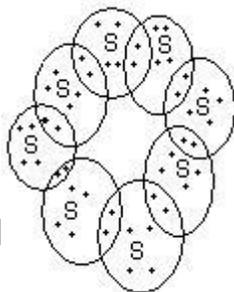
Q.1: What would be the electron dot structure of carbon dioxide which has the formula CO_2 ?

Answer: The electron dot structure of Carbon dioxide (CO_2) is given below:



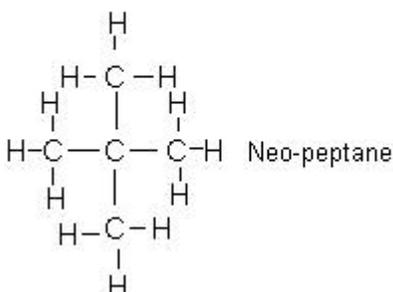
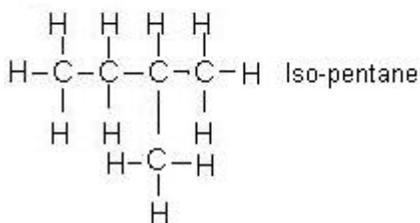
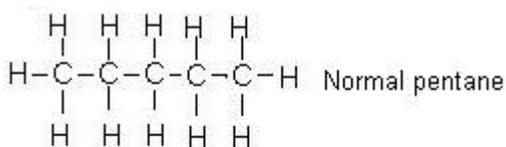
Q.2: What would be the electron dot structure of a molecule of sulphur which is made up of eight atoms of sulphur?

Answer: The 8 atoms of sulphur molecule (S_8) are joined together in the form of a ring as shown below:



Q.3: How many structural isomers can you draw for pentane?

Answer: There are three structural isomers of pentane as given below:



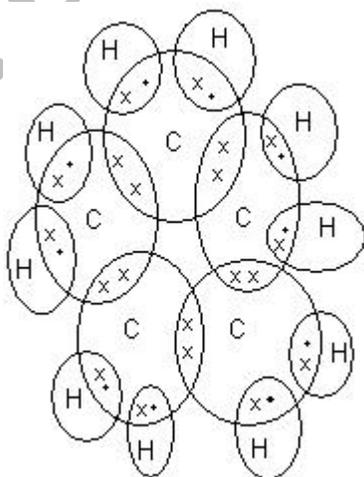
Q.4: What are the two properties of carbon which lead to the huge number of carbon compound we see around us ?

Answer: The two properties of carbon are – (a) *Catenation* and (b) *Tetra Covalency or Tetravalency* of carbon atom.

Catenation is the unique property of carbon due to which carbon atoms can link among themselves to form a straight, branched or close chain. Due to tetravalency, the carbon atoms can form single, double or triple covalent bond. This is why carbon leads to form a huge number of carbon compounds.

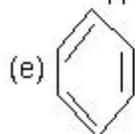
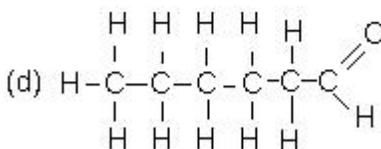
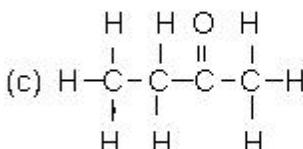
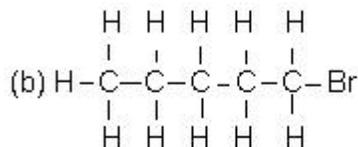
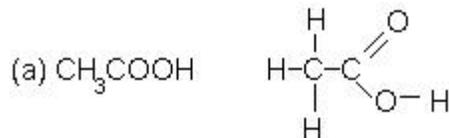
Q.5: What will be the formula and electron dot structure of cyclopentane ?

Answer: The formula of cyclopentane is C_5H_{10} .

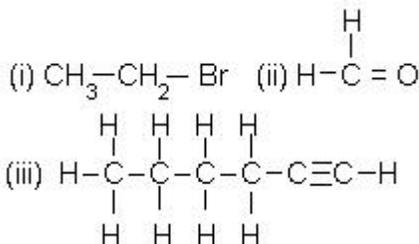


Q.6: Draw the structure for following compounds: (a) Ethanoic acid (b) Bromopentane (c) Butanone (d) Hexanal.

Answer:



Q.7: How would name the following compounds ?



Answer: (i) Bromo-ethane (ii) Methanal (iii) Hex 1-yne.

Q.8: Why is the conversion of ethanol to ethanoic acid an oxidation reaction ?



Here, in this reaction there is a decrease in the number of hydrogen along with increase in number of oxygen atoms in compound. Therefore, it is an oxidation reaction.

Q.9: A mixture of oxygen and ethyne is burnt for welding. Can you tell why a mixture of ethyne and air is not taken ?

Answer: Air contains nitrogen and other inactive gaseous contents which resist the adequate supply of oxygen for burning of ethyne. Ethyne is an unsaturated hydrocarbon. If we use a mixture of ethyne and air then incomplete combustion of ethyne takes place with a sooty flame and also high temperature required for welding is not achieved. But if it is burnt with oxygen it produces clean flame with very high temperature due to complete combustion.

Therefore, air is taken for burning of ethyne for welding.

Q.10: How can you distinguish experimentally between an alcohol and a carboxylic acid ?

Answer: We can distinguish experimentally between an alcohol and a carboxylic acid by using laboratory reagent Na_2CO_3 solution as follows:

(i) When Na_2CO_3 is added to the test tube containing CH_3COOH , CO_2 gas evolves which turn the lime water milky.

(ii) When Na_2CO_3 is added to the test tube containing CH_3COOH , no gas is evolved.

Q.11: Would you be able to check if water is hard by using a detergent ?

Answer: No, it is impossible because detergent is effective in both hard water and soft water.

Q.12: 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 ?

Answer: A soap molecule has two parts:

(i) Hydrophobic part i.e. the hydrocarbon tail which is insoluble in water and repelled by water.

(ii) Hydrophilic part i.e. negatively charged end which is soluble in water.

With the help of these parts, soap can attach grease and dirt particles and form spherical clusters known as "micelle". Due to ion-ion repulsion these micelles remain suspended as a colloid in the water. In order to remove these micelles containing the dirt, it is necessary to scrub or agitate the clothes.

Q.13: Why is detergent a better cleansing agent than soap ?

Answer: Detergent a better cleansing agent than soap because detergent acts better even in hard water.

Q.14: Which causes water pollution, detergent or soap ?

Answer: Detergent causes water pollution as detergents are non-biodegradable.

Q.15: Why does not soap form lather with hard water ?

Answer: Soap reacts with hard water to form scum and acts to remove the hardness of water. So, lather is not formed by soap with hard water.