ORGANIC CHEMISTRY SOLVED EXAMPLE

1. Name the functional group of each of CH_3OH, CH_3COOH, CH_3CHO.

Ans. Alcoholic – OH group present in CH_3OH.

Carboxylic – COOH group present in CH_3COOH.

Aldehydic – CHO group present in CH_3CHO.

2. The melting point of three members X, Y, and Z of a homologous series of hydrocarbons are -180°C, -140°C and -30°C respectively.

(i) Which one of the three would have the lowest number of carbon atoms in its molecule? Justify your answer.

(ii) Which one of the three has the maximum number of carbon atoms in its molecule? Justify your answer.

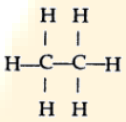
Ans. (i) The homologue with lower number of carbon atoms in its molecule has lower melting point. Therefore, compound X has the lowest number of carbon atoms in its molecule. It is clear from the given values of melting points in which -180°C is lowest.

(ii) The homologue with maximum number of carbon atoms in its molecule has the highest melting point. Therefore, compound Z has the maximum number of carbon atoms in its molecules. It is clear from the given values of melting point in which 30°C is the highest of the three.

3. (i) Alkanes are called saturated hydrocarbons. Give a brief explanation, by taking the example of C_2H_6.

(ii) A compound has number of H atoms just double that of C atoms. What types of hydrocarbon is it?

Ans. (i) Alkane is called saturated hydrocarbons because tetra-valency of each carbon atom is satisfied by single covalent bond.



(iii) The compound is an unsaturated hydrocarbon having general formula C_nH_{2n}. So, this compound is an alkene.

4. The molecules of alkene family are represented by a general formula CnH_{2n}. Now answer the following:

(i) What do n and 2n signify?

(ii) What is the lowest value which can be assigned to n?

(iii) What is the molecular formula of alkene, when n = 4?

Ans. (i) n = Number of C- atoms in a molecule of alkene. 2n = Number of H-atoms in a molecule of alkene.

(ii) The lowest value of n is 2.

(iii) Butene (C_4H_6).

5. Ethane bums completely in air or oxygen to give carbon dioxide and water vapours. With a limited supply of air or oxygen, carbon monoxide is farmed. The same gases are found in automobile exhaust gases. Both gases can be considered as atmospheric pollutants.

(a) Write the equation for the complete combustion of ethane.

(b) What danger is associated with carbon monoxide?

(c) What effect is associated with too much carbon dioxide in the atmosphere?

(d) Burning of acetylene [Ethyne] in oxygen, under appropriate conditions, produces a very hot flame. What is this hot flame used for?

Ans. (a) Ethane bums in atmospheric oxygen to form carbon dioxide and steam [water].

$$2C_2H_6 + 7O_2 \longrightarrow 4CO_2\uparrow + 6H_2O$$

(b) Carbon monoxide is a highly poisonous gas. It readily combines with haemoglobin of blood to form carboxy haemoglobin. Carboxy haemoglobin is a stable compound and is incapable of taking up the oxygen from the inhaled air and as a result, people die due to suffocation.

(c) Greenhouse effect or global warming is associated with too much carbon dioxide in the atmosphere.

(d) This hot flame is used for welding and cutting of steel.

6. (i) Experimentally, how can poly chlorination of methane are minimized?

(ii) What are the conditions required for the addition of hydrogen to ethene?

(iii) Which catalyst is used for the addition of hydrogen to ethene at room temperature?

(iv) Write the names of all the possible organic products in the reaction of methane with chlorine.

Ans. (i) If excess of methane over chlorine is used, the chance of chlorine reacting with methane is greatest than with any other of the formed chloromethane.

(ii) Addition of hydrogen to ethene occurs at 300°C in the presence of nickel (Ni) catalyst.

(iii) Palladiurh (Pd) or Platinum (Pt) is used as catalyst at room temperature for the addition of hydrogen.

(iv) The main products is methyl chloride (CH_3Cl), (CH_2Cl_2) dichloro methane; ($CHCl_3$) trichloro methane, (CCl_4) and tetra chloromethane.

7. (i) The alkenes having how many carbon atoms are in liquid state at normal temperature?

(ii) The alkenes having how many carbon atoms are in solid state at normal temperature?

Ans. (i) The alkenes having six to seventeen carbon atoms are in liquid state at normal temperature.

(ii) The alkenes having eighteen or more carbon atoms are in solid state at normal temperature.

8. (i) What word is used to describe these three compounds taken together?

(ii) What is the special feature of the structure of?

(a) C_2H_4 (b) C_2H_2

(iii) What type of reaction is common in both of these compounds?

(iv) Flow is acetylene filled in commercial gas cylinders?

Ans. (i) Organic compounds.

(ii) (a) C_2H_4 contains a double bond between two carbon atoms.

(b) C_2H_2 contains a triple bond between two carbon atoms.

(iii) Addition reaction.

(iv) The commercial gas cylinders of acetylene contain a solution of acetylene in acetone. The cylinder contains a porous material into which the acetone and acetylene are absorbed. The pressure in a freshly filled cylinder of acetylene is about 15 atmospheres.

9. (i) (a) A compound has triple bond in its molecule and has only two carbon atoms with two hydrogen atoms. Name the compound.

(b) What is hydrogenation?

(c) What is halogenation?

(d) What 'substitution reaction' and 'substitution product'.

(e) What is 'pyrolysis? What is the other term signifying the same?

Ans. (i) (a) Acetylene H-C ≡ C-H. Or Acetylene.

(b) Addition of hydrogen to some unsaturated hydrocarbons is called hydrogenation.

(c) Addition of halogens (Cl, Br, I) to some unsaturated hydrocarbons is called halogenation.

(d) A substitution reaction is one in which one atom in a molecule is replaced by another atom (or group of atoms). The product of a substitution reaction is known as a substitution product.

(e) Decomposition of alkanes by heat is called pyrolysis. Another term signifying the same is cracking.

10. State the conditions required for the following reactions to take place :

(a) Catalytic hydrogenation of ethyne.

(b) Preparation of ethyne from ethylene dibromide.

Ans. (a) In presence of catalyst like finely divided nickel, platinum, heating upto 473 K.

(b) Hot and concentrated alcoholic solution of potassium hydroxide.

11. State two uses of ethane and methane.

Ans. (i) Liquefied ethane is used as a fuel in automobiles.

(ii) It is used in the manufacture of organic compounds such as acetic acid, ethyl alcohol etc.

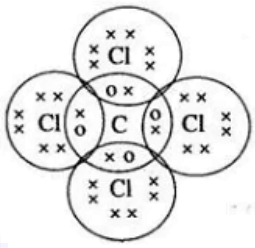
Uses of Methane:

(i) It is used on industrial scale for the preparation of hydrogen by the process of pyrolysis;

(ii) It is used in the manufacture of industrial compounds such as carbon tetrachloride, chloroform, formic acid etc.

12. Methane is the first member of alkane, when it is treated with excess of chlorine in the presence of diffused sunlight forms carbon tetrachloride. Draw the appropriate structural formula of carbon tetrachloride and state the type of bond present in it.

Ans. Structural formula of CCl_4. The type of bond present in CCl_4 is covalent bond.



13. Hydrocarbons are excellent fuels. Give reason.

Ans. Hydrocarbons are excellent fuels because they ignite easily at low temperature and liberate large amount of heat without producing harmful products.

14. Why alkanes are so inert?

Ans. It is because in a molecule, a reactive site has one or more unshared pairs of electrons and a polar bond or an electron deficient atom. Alkanes have none of these.

15. Why alkanes are insoluble in water?

Ans. Alkanes are insoluble in water because alkanes are called hydrophobic hydrocarbons. They have phobia for water. These are insoluble because these cannot make hydrogen bonds with water molecules.

16. Methane is called as marsh gas. Why?

Ans. Because methane is formed by the decomposition of plant and animal matter lying under water in marshy areas.

17. Methane does not undergo addition reactions, but ethene does. Why?

Ans. Because methane is a saturated hydrocarbon while ethene is an unsaturated hydrocarbon. Addition reactions are characteristic properties of unsaturated hydrocarbons.

Why it is dangerous to bum methane in an insufficient supply of air?

Ans. Because it will form carbon monoxide which is poisonous for human beings as it cuts off the oxygen supply by forming carboxy haemoglobin in the blood.

Why light or heat is necessary for chlorination of alkanes?

Ans. The Cl-Cl bond must be broken to form Cl radicals, before the chlorination of alkanes can commence. The breaking of bond requires energy which is supplied either by heat or light.

18. Why ethyne is more reactive than ethane?

Ans. Ethyne is an unsaturated hydrocarbon with a triple covalent bond. Ethane is a saturated hydrocarbon and hence is less reactive than ethyne.

Acetylene bums with sooty flame. Why?

Ans. Acetylene has higher proportion of carbon and all carbon in it does not burn completely. Hence, unburnt carbon particles make the flame sooty.