Book Name: Selina Concise

EXERCISE. 12 A

Solution 1:

(a) 2,2- dimethylpropane
(b) 2-methyl butane
(c) Prop-1-ene
(d) 2,2- dimethyl pentane
(e) Pent-2-yne
(f) 3-methyl but-1-yne
(g) 2,3-dichloropentane
(h) 3-methylheptane
(i) 2-methyl butane
(j) Hept-2-yne
(k) 2,2- dimethyl hexanal
(l) Pentan-2-ol
(m) 4-methylpentanoic acid
(n) 2-bromo2-methyl butane
(o) 1- bromo3-methyl butane

Solution 2:

The structure of the following compounds are:

(a) Prop-1-ene
$CH_3 - CH = CH_2$
(b) 2,3-dimethylbutane
$CH_3 - CH(CH_3) - CH(CH_3) - CH_3$
(c) 2-methylpropane
$CH_3 - CH(CH_3) - CH_3$
(d) 3-hexene
$CH_3 - CH_2 - CH = CH - CH_2 - CH_3$
(e) Prop-1-yne
$CH_3 - C?CH$
(f) 2-methylprop-1-ene
$CH_3 - C(CH_3) = CH_2$
(g) Alcohol with molecular formula $C_4H_{10}O$
$CH_3 - CH_2 - CH_2 - CH_2 - OH$

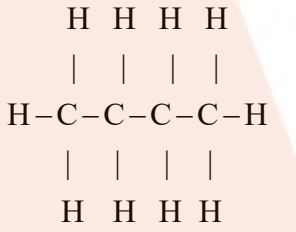
Solution 3:

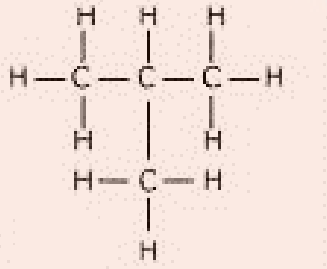
(a) Correct answer: (iv)
C_nH_{2n+1} is the formula for alkyl group. Hence it is C_5H_{11}.

(b) Correct answer: (i)
A hydrocarbon of general C_nH_{2n} is $C_{15}H_{30}$.

(c) Correct answer: (ii)
As the formula of Alkene is C_nH_{2n}. Thus n + 2n = 72
3n = 72
n = 24
By filling value we get the molecular mass 72.

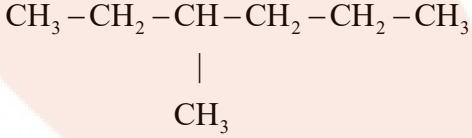
(d) (iv)
The total number of carbon chains that four carbon atoms form in alkane is 2. They are:





(e) Correct answer: (iv)
Alcohol and ether are functional isomers as they have same molecular formula but different functional groups.

(f) Correct answer: (ii)



The IUPAC name of this compound is: 3-methyl hexane.

Solution 4:

(a) Propane and ethane are homologues.
(b) A saturated hydrocarbon does not participate in a/an addition reaction.
(c) Succeeding members of a homologous series differ by CH_2.
(d) As the molecular masses of hydrocarbons increase, their boiling points Increase and melting point increase.
(e) $C_{25}H_{52}$ and $C_{50}H_{102}$ belong to the same homologous series.
(f) CO is an organic Compound.
(g) The physical and chemical properties of an organic compound are largely decided by the Functional group.
(h) CHO is the functional group of an aldehyde.
(i) The root in the IUPAC name of an organic compound depends upon the number of carbon atoms in Principal Chain.
(j) But-1-ene and but-2-ene are examples of position isomerism.

EXERCISE. 12 B

Solution 1:

Sources of alkane:
The principal sources of alkanes are Natural gas and petroleum.

Solution 2:

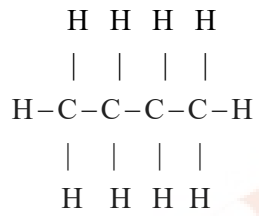
Methane is a primary constituent of natural gas. It absorbs outgoing heat radiation from the earth, and thus contributes to the green house effect and so it is considered as a green house gas.

Solution 3:

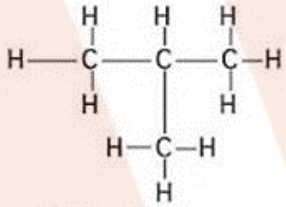
The general formula of alkane is :
C_nH_{2n+2}

Solution 4:

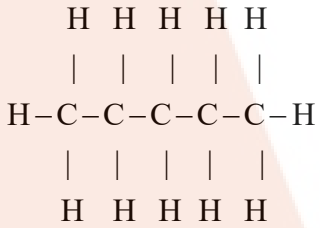
(a)The structures of isomers of butane are:



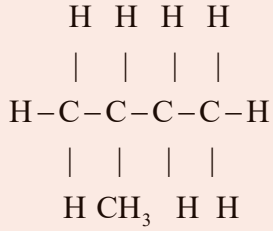
Common name:- n-Butane
IUPAC name:- Butane
(ii)



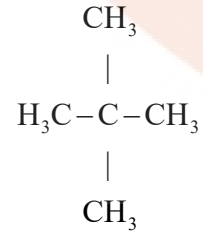
Common name:-iso butane
IUPAC name:- 2-methyl propane
(b) The structures of isomers of Pentane are:
(i)



Common name: n-pentane
IUPAC name:- Pentane
(ii)



Common name:- iso pentane
IUPAC name:- 2-methyl butane
(iii)



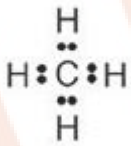
Common name- neo pentane

IUPAC name:- 2,2-dimethyl propane

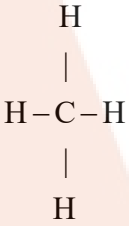
Solution 5:

For methane:

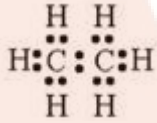
(a) Molecular formula is CH_4
(b) Electron dot formula



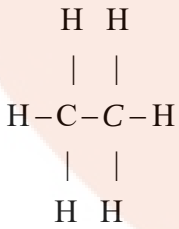
(c) Structural formula



For ethane:
(a) Molecular formula is :- C_2H_6
(b) Electron dot formula:



(a) Structural Formula:



Solution 6:

(a) Laboratory preparation of methane:

When the mixture of sodium ethanoate and soda lime is taken in a hard glass test tube and heated, the gas evolved is methane. It is collected by downward displacement of water.

$CH_3COONa + NaOH \xrightarrow{CaO, 300^0 C} Na_2CO_3 + CH_4$

(b) Laboratory preparation of ethane:

When the mixture of sodium propionate and soda lime is taken in the boiling tube and heated the ethane gas is evolved. It is also collected by downward displacement of water.

$C_2H_5COONa + NaOH \xrightarrow{CaO, 300^0 C} Na_2CO_3 + C_2H_6$

Question 7:

How are methane and ethane prepared from methy1 iodide and ethyl bromide?

Solution 7:

When methyl iodide is reduced by nascent hydrogen at ordinary room temperature then methane is formed.

$CH_3l + 2[H] \longrightarrow CH_4 + Hl$

When bromoethane is reduced by nascent hydrogen at ordinary room temperature then ethane is produced.

$C_2H_5Br + 2[H] \longrightarrow C_2H_6 + HBr$

Solution 8:

A reaction in which one atom of a molecule is replaced by another atom (or group of atoms) is called a substitution reaction.

When ethane reacts with chlorine

$C_2H_6 + Cl_2 \longrightarrow C_2H_5Cl + HCl$

Chloroethane

$C_2H_5Cl + Cl_2 \longrightarrow C_2H_4Cl_2 + HCl$

Dichloroethane

$C_2H_4Cl_2 + Cl_2 \longrightarrow C_2H_3Cl_3 + HCl$

Trichloroethane

$C_2H_3Cl_3 + Cl_2 \longrightarrow C_2H_2Cl_4 + HCl$
Tetrachloroethane
$C_2H_2Cl_4 + Cl_2 \longrightarrow C_2HCl_5 + HCl$
Pentachloroethane
$C_2HCl_5 + Cl_2 \longrightarrow C_2Cl_6 + HCl$
Hexachloroethane

Solution 9:

(a) Sufficient air: When methane burns in sufficient air, then carbon dioxide and water vapors are formed.
$CH_4 + 2O_2 \longrightarrow CO_2 + 2H_2O$
(b) Insufficient air: When methane burns in insufficient air , then carbon monoxide and water is formed.
$2CH_4 + 3O_2 \longrightarrow 2CO + 4H_2O$

Solution 10:

(a)
(i) When methane reacts with chlorine in the presence of sunlight or UV light, it undergoes substitution reaction to form Tetrachloromethane.

$CH_4 + Cl_2 \xrightarrow{hv} CH_3Cl + HCl$
Chloromethane
$CH_3Cl + Cl_2 \xrightarrow{hv} CH_2Cl_2 + HCl$
Dichloromethane
$CH_2Cl_2 + Cl_2 \xrightarrow{hv} CHCl_3 + HCl$
Trichloromethane
$CHCl_3 + Cl_2 \xrightarrow{hv} CCl_4 + HCl$
Tetrachloromethane

(ii) When it reacts with bromine it forms Tetrabromomethane

$CH_4 + Br_2 \longrightarrow CH_3Br + HCl$

$CH_3Br + Br_2 \longrightarrow CH_2Br_2 + HCl$

Dibromomethane

$CH_2Br_2 + Br_2 \longrightarrow CHBr_3 + HCl$

Tribromo methane

$CHBr_3 + Br_2 \longrightarrow CBr_4 + HCl$

Tetrabromomethane

(b)

(i) When ethane reacts with chlorine it forms hexachoroethane.

$C_2H_6 + Cl_2 \longrightarrow C_2H_5Cl + HCl$

Chloroethane

$C_2H_5Cl + Cl_2 \longrightarrow C_2H_4Cl_2 + HCl$

Dichloroethane

$C_2H_4Cl_2 + Cl_2 \longrightarrow C_2H_3Cl_3 + HCl$

Trichloroethane

$C_2H_3Cl_3 + Cl_2 \longrightarrow C_2H_2Cl_4 + HCl$

Tetrachloroethane

$C_2H_2Cl_4 + Cl_2 \longrightarrow C_2HCl_5 + HCl$

Pentachloroethane

$C_2HCl_5 + Cl_2 \longrightarrow C_2Cl_6 + HCl$

Hexachloroethane

(ii) When ethane reacts with bromine it forms Hexabromoethane

$C_2H_6 + Br_2 \longrightarrow C_2H_5Br + HBr$

Bromoethane

$C_2H_5B_r + Br_2 \longrightarrow C_2H_4Br_2 + HBr$

Dibromoethane

$C_2H_4Br_2 + Br_2 \longrightarrow C_2H_3Br_3 + HBr$

Tribromoethane

$C_2H_3Br_3 + Br_2 \longrightarrow C_2H_2Br_4 + HBr$

Tetrabromoethane

$C_2H_2Br_4 + Br_2 \longrightarrow C_2HBr_5 + HBr$

Pentabromoethane

$C_2HBr_5 + Br_2 \longrightarrow C_2Br_6 + HBr$

HexaBromoethane

Solution 11:

(a) Ethane is prepared from sodium propionate.

$C_2H_5COONa + NaOH \xrightarrow{CaO,300^0C} Na_2CO_3 + C_2H_6$

(b) Methane is prepared from methyl iodide.

$CH_3l + 2[H] \longrightarrow CH_4 + Hl$

(c) Ethane is prepared from ethyl bromide.

$C_2H_5Br + 2[H] \longrightarrow C_2H_6 + HBr$

Solution 12:

The decomposition of a compound by heat in the absence of air is called Pyrolysis. When pyrolysis occurs in alkanes, the process is termed cracking.
For example:

Alkanes on heating under high temperature or in the presence of a catalyst in absence of air broken down into lower alkanes, alkenes and hydrogen.

$2CH_4 \xrightarrow{1500^0C} HC?CH + 3H_2$

Solution 13:

(a) Methane into chloroform

$CH_4 + Cl_2 \rightarrow CH_3Cl + HCl$

$CH_3Cl + Cl_2 \rightarrow CH_2Cl_2 + HCl$

$CH_2Cl_2 + Cl_2 \quad CHCl_3 + HCl$

(b) Sodium acetate into methane

$CH_3COONa + NaOH \xrightarrow{CaO,300^0C} Na_2CO_3 + CH_4$

(c) Methyl iodide into ethane

$2CH_3I + 2Na \xrightarrow{dryether} CH_3 - CH_3 + 2NaI$

(d) Aluminium carbide into methane

$Al_4C_3 + 12H_2O \longrightarrow 3CH_4 + 4Al(OH)_3$

Solution 14:

(a) Methane: Three uses of methane are:
(i) Methane is a source of carbon monoxide and hydrogen
(ii) It is used in the preparation of ethyne, methanal, chloromethane, carbon tetrachloride.
(iii) It is employed as a domestic fuel.

(b) Ethane:
Three uses of ethane are:
(i) It is used in the preparation of ethene, ethanol, and ethanol.
(ii) It forms ethyl chloride, which is used to make tetraethyllead.
(iii) It is also a good fuel.

Solution 15:

(a) When a mixture of ethane and oxygen is compressed to about 120atm pressure and passed over copper tubes at 475K, ethyl alcohol is formed.

$$2C_2H_6 + O_2 \xrightarrow[\text{Cutubes, 475k}]{\text{120 atm}} 2C_2H_5OH$$

(b) When mixture of ethane and oxygen is passed through heated molybdenum oxide, the mixture is oxidized to Acetaldehyde.

$$C_2H_6 + O_2 \xrightarrow{MoO} CH_3CHO + H_2O$$

(c) Ethanol formed from ethane gets oxidized to acetic acid.

$$2C_2H_6 + O_2 \xrightarrow[\text{Cutubes, 475k}]{\text{120 atm}} 2C_2H_5OH$$

$$C_2H_5OH + O_2 \xleftarrow[300^0\,C]{Pt} CH_3COOH + H_2O$$

Solution 16:

(a) Methane to methyl alcohol:
When a mixture of methane and oxygen is compressed to about 120atm pressure and passed over copper tubes at 475K, ethyl alcohol is formed.

$$2CH_4 + O_2 \xrightarrow[\text{Cutubes, 475k}]{\text{120 atm}} 2CH_3OH$$

(b) Methane to formaldehyde:

When mixture of methane and oxygen is passed through heated molybdenum oxide, the mixture is oxidized to Formaldehyde.

$CH_4 + O_2 \xrightarrow{MoO} HCHO + H_2O$

(c) Methane to Formic acid:

When a manganese based catalyst is used methane is oxidized to formic acid.

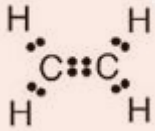
$2CH_4 + 3O_2 \xrightarrow{\text{Min compound}} 2HCOOH + 2H_2O$

EXERCISE. 12 C

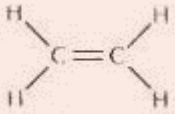
Solution 1:

(a) The molecular formula of ethene is C_2H_4

(b) Electron dot formula of ethene is:



(c) Structural formula of ethene:



Solution 2:

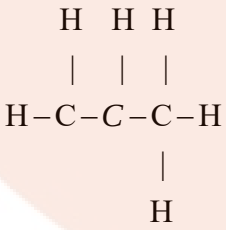
(a) n signifies the number of carbon atoms and 2n signifies the number of hydrogen atoms.

(b) The name of alkene when n = 4 is Butene.

(c) The molecular formula of alkene when n = 4 is C_4H_8.

(d) The molecular formula of alkene when there are 10 H atom in it C_5H_{10}.

(e) The structural formula of the third member of alkene is



(f) Lower homologus of alkene which contain four carbons is C_3H_6.

Higher homologus of alkene which contain four carbons is C_5H_{10}.

Solution 3:

The isomers of Butene are:

(i) $CH_3 - CH_2\text{-}CH = CH_2$,But-1-ene
(ii) $CH_3 - CH = CH - CH_3$, But-2-ene
(iii) $CH_2 = C(CH_3) - CH_3$, 2-methyl propene

Solution 4:

Balanced Equation of ethylene:

$$CH_3 - CH_2OH + H_2SO_4 \longrightarrow CH_3 - CH_2HSO_4 + H_2O$$

$$CH_3 - CH_2HSO_4 \xrightarrow[160^0\,C]{\text{excess } H_2SO_4} CH_2 = CH_2$$

The gas is collected by downward displacement of water.

Solution 5:

(a) Dehydrohalogenation reaction:

$$C_2H_5Cl + KOH(\text{alc.and hot}) \longrightarrow C_2H_4 + KCl + H_2O$$

Ethene

(b) Dehydration reaction:

$$C_2H_5OH \xrightarrow[300^0\,C]{Al_2O_3} C_2H_4 + H_2O$$

Ethene

Solution 6:

When ethene and hydrogen are passed over finely divided catalyst such as platinum or palladium at ordinary temperature or nickel at 200° C, the two atom of hydrogen molecule are added to the unsaturated molecule, which thus becomes a saturated one.

$$C_2H_4 + H_2 \xrightarrow[Ni]{200^0\,C} C_2H_6$$

Solution 7:

Chlorine and bromine are added to the double bond of ethene to form saturated ethylene chloride and ethylene bromide respectively.

$$CH_2 = CH_2 + Cl_2 \longrightarrow CH_2(Cl) - CH_2(Cl)$$

1,2-dichloro ethane

$$CH_2 = CH_2 + Br_2 \longrightarrow CH_2(Br) - CH_2(Br)$$

1,2-dibromo ethane

Solution 8:

(i) Solid dehydrating agent:.

$C_2H_5OH \xrightarrow[300^0C]{Al_2O_3} C_2H_4+H_2O$

Ethene

(ii) Hot conc. H_2SO_4:

$C_2H_5OH \xrightarrow[160–170^0C]{Conc.\ H_2SO_4} C_2H_4 + H_2SO_4$

Solution 9:

(a) Physical state: Ethene is a colourless and inflammable gas.
(b) Odour: It has faint sweetish odour.
(c) Density as compared to air: It has density less than one hence it is lighter than air.
(d) Solubility: It is sparingly soluble in water but highly soluble in organic solvents like alcohol, ether and chloroform.

Solution 10:

(a) Ethene into 1, 2 -dibromoethane: Ethene reacts with bromine at room temperature to form saturated ethylene chloride.

$CH_2 = CH_2 + Br_2 \longrightarrow CH_2(Br) - CH_2(Br)$

1,2-dibromo ethane

(b) Ethene into ethyl bromide: When ethene is treated with HBr bromoethane is formed.

$CH_2 = CH_2 + HBr \longrightarrow CH_3 - CH_2Br$

Ethyl bromide

Solution 11:

(a) $C_2H_4 + 3O_2 \longrightarrow 2CO_2 + 2H_2O + heat$

(b) $CH_2 = CH_2 + Cl_2 \longrightarrow CH_2(Cl) - CH_2(Cl)$

(c) $CH_2 = CH_2 + HCl \longrightarrow CH_3 - CH_2\text{-}Cl$

(d) $C_2H_4 + H_2 \xrightarrow[Ni]{200^0C} C_2H_6$

Solution 12:

(a) $CH_4 \xrightarrow[-HCl]{Cl_2} CH_3Cl \xrightarrow[-HCl]{Cl_2} CH_2Cl_2 \xrightarrow[-HCl]{Cl_2} CHCl_3 \xrightarrow[-HCl]{Cl_2} CCl_4$

A = monochloromethane
B = dichloromethane
C = Trichloromethane
D = Tetrachloromethane

(b) $C_2H_2 \xrightarrow{H_2} C_2H_4 \xrightarrow{H_2} C_2H_6 \xrightarrow[-HBr]{Br_2} C_2H_5Br \xrightarrow[-HBr]{Br_2} C_2H_4Br$

A= Ethene
B = ethane
C = bromoethane
D = dibromoethane

(c) $C_2H_4 + Cl_2 \longrightarrow C_2H_4Cl_2$

A = 1,2-dichloro ethane

(d) $C_2H_4 + H_2 \xrightarrow[Ni]{200^0\,C} C_2H_6$

B = hydrogen

Solution 13:

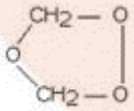
(a) $C_2H_4 + Cl_2 \longrightarrow CH_2(Cl) - CH_2(Cl)$
1,2- dichloro ethane

(b) $C_2H_5Br + KOH\ (alc.) \xrightarrow{\Delta} C_2H_4 + KBr + H_2O$
Ethane

(c) $CH_2 = CH_2 \xrightarrow{alk.KMnO_4} CH_2(OH) - CH_2(OH)$
1,2- Ethanediol

(d) $CH_2 = CH_2 + HBr \longrightarrow CH_3\text{-}CH_2Cl$
Chloroethane

(e) $C_2 = CH_2 + O_3 \longrightarrow$



Solution 14:

When ethylene is passed through alkaline $KMnO_4$ solution 1, 2-Ethanediol is formed. The Purple color of $KMnO_4$ decolorizes.

$CH_2 = CH_2 + H - O - H + [O] \longrightarrow CH_2(OH) - CH_2(OH)$

Cold alkaline

$KMnO_4$ solution

Solution 15:

Three compounds formed by ethylene are:

Polythene

Ethanol

Epoxyethane

Uses of above compounds:

Polythene is used as carry bags.

Ethanol is used as a starting material for other products, mainly cosmetics and toiletry preparation.

Epoxyethane is used in the manufacture of detergents.

EXERCISE. 12 D

Solution 1:

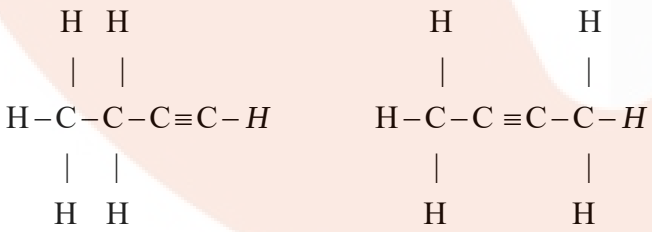
Natural gas and Petroleum are sources for alkynes.

The general formula of alkynes are:

C_nH_{2n-2}

Solution 2:

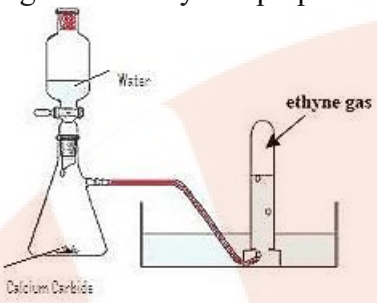
Butyne is an example, its isomers are:



IUPAC name: But-2-yne But-1-yne

Solution 3:

(a) Diagram of acetylene preparation:



(b) $CaC_2 + 2H_2O \longrightarrow Ca(OH)_2 + C_2H_2$

(c) The pure dry gas is collected by downward displacement of water, since it is insoluble in water.

Solution 4:

When 1,2 -dibromoethane is boiled with alcoholic potassium hydroxide, ethyne is formed.

$$CH_2Br - CH_2Br + KOH \xrightarrow{\text{Boiling}} CH \equiv CH + 2KBr + 2H_2O$$

Solution 5:

The following compounds can be classified as:

C_3H_4:- Alkynes
C_3H_8:- Alkanes
C_5H_8:- Alkynes
C_3H_6:- Alkenes

Solution 6:

Chemical test to distinguish :

(b) Ethane and ethene:

Sl. No.	Test	Ethane	Ethene
1.	On adding a few drops of bromine solution in carbon tetrachloride to the hydrocarbon	No change is observed	The reddish brown colour gets decolorized
2.	On adding a few drops of alkaline potassium permanganate (purple colour) to the hydrocarbon	No change is observed	The purple colour fades.

(c) Ethene and ethyne:

Sl. No.	Test	Ethene	Ethyne
1.	On adding a few drops of ammonical cuprous chloride to the hydrocarbon	No change is observed	Red precipitate of copper acetylide is formed

2.	On adding ammonical silver nitrate	No observation	White precipitate of silver acetylide is formed.

Solution 7:

(a) Ethyne in an inert solvent of carbon tetrachloride adds chlorine to change into 1,2-dichloro ethene with carbon-carbon double bond, and then to an 1,1,2,2-tetrachloro ethane with carbon-carbon single bond.

$C_2H_2 \xrightarrow{Cl_2} C_2H_2Cl_2 \xrightarrow{Cl_2} C_2H_2Cl_4$

1,2-dichloro ethene 1,1,2,2 -tetrachloro ethane

(b) Ethyne in an inert solvent of carbon tetrachloride adds bromine to change into 1,2-dibromo ethene and then to 1,1,2,2 -tetrabromo ethane .

$C_2H_2 \xrightarrow{Br_2} C_2H_2Br_2 \xrightarrow{Br_2} C_2H_2Br_4$

(c) Iodine reacts slowly in the presence of alcohol to form di-iodo ethene

$CH \equiv CH + I_2 \longrightarrow ICH = CHI$

1,2-di-iodoethene

(d) In the presence of nickel, platinum or palladium ethyne change to ethene and then to ethane.

$CH \equiv CH \xrightarrow[Ni]{H_2} CH_2 = CH_2 \xrightarrow[Ni]{H_2} CH_3 - CH_3$

Solution 8:

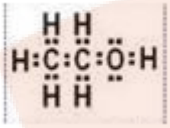
(a) The hydrocarbon which is tetrahedral is Methane.
(b) The hydrocarbon which is planar molecule is ethene.
(c) he hydrocarbon which is a linear molecule is Ethyne.
(d) The hydrocarbon which forms a red precipitate with ammoniacal solution of copper chloride is acetylene.
(e) lkanes are also called as paraffin.
(f) lkenes are also called olefin.

EXERCISE. 12 E

Solution 1:

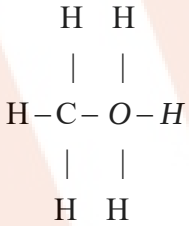
(a) Alcohols are the hydroxyl derivatives of alkanes and are formed by replacing one or more hydrogen atoms of the alkane with OH group.
Methanol is obtained from destructive distillation of wood while ethanol is obtained from fermentation of sugar.
(b) General formula of monohydric alcohol:
$C_nH_{2n+1}OH$

Solution 2:

(a) Dot diagram 

(b) Abbreviated formula C_2H_5OH

(c) Structure:



Solution 3:

(a) By hydrolysis of ethene: When concentrated sulphuric acid is added to ethene at a temperature of 80ºC and pressure of 30 atm. ethyl hydrogen sulphate is produced. Ethyl hydrogen sulphate on hydrolysis with boiling water gives ethanol.

$$C_2H_4 + H_2SO_4 \xrightarrow[30atm]{80^0C} C_2H_5HSO_4$$

$$C_2H_5HSO_4 + H_2O \longrightarrow C_2H_5OH + H_2SO_4$$

(b) By hydrolysis of alkyl halide: Alcohols can be prepared by the hydrolysis of alkyl halide with a hot dilute alkali.

$$C_2H_5Cl + KOH \xrightarrow{boil} C_2H_5OH + KCl$$

Solution 4:

Ethanol is prepared by the fermentation of sugar by the enzymes invertase and zymase.

$$C_{12}H_{22}O_{11} + H_2O \xrightarrow[Fermentation]{Invertase} C_6H_{12}O_6 + C_6H_{12}O_6$$

Glucose Fructose

$$C_6H_{12}O_6 \xrightarrow{Zymase(yeast)} 2C_2H_5OH + 2CO_2$$

Ethanol

Solution 5:

(a) Ethyl alcohol:
Ethyl chloride reacts with aqueous potassium hydroxide to form ethyl alcohol.

$$C_2H_5Cl + KOH \xrightarrow{boil} C_2H_5OH + KCl$$

(b) Methyl alcohol:
Methyl bromide reacts with aqueous potassium hydroxide to form methyl alcohol.

$$CH_3Br + KOH \xrightarrow{boil} CH_3OH$$

Solution 6:

(a) The melting and boiling point of the successive members of the homologous series of alcohols increase with the increase in molecular mass.
(b) When ethanol reacts with acetic acid ethyl acetate is formed.

$$C_2H_5OH + CH_3COOH \xrightarrow{Conc.H_2SO_4} CH_3COOC_2H_5 + H_2O$$

(c) This reaction is known as esterification reaction.

Solution 7:

Ethanol affects that part of the brain which controls our muscular movements and then gives temporary relief from tiredness. But it damages the liver and kidney too.

Solution 8:

(a) Absolute alcohol: Absolute alcohol may be obtained by distilling moist alcohol with benzene. The mixture of water and benzene distills off and anhydrous alcohol is left behind.
(b) Spurious alcohol: It is made by improper distillation. It contains large portions of methanol in a mixture of alcohols.
(c) Methylated spirit: Methylated spirit or denatured alcohol is ethyl alcohol with 5%methyl alcohol, a coloured dye and some pyridine.

Solution 9:

(a) Sodium reacting with ethyl alcohol:

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

When sodium reacts with ethyl alcohol hydrogen is evolved with formation of sodium ethoxide.

(b) Ethanol oxidized by $K_2Cr_2O_7$:

$C_2H_5OH \xrightarrow{[O]} CH_3CHO + H_2O \xrightarrow{[O]} CH_3COOH$

Alcohols gets oxidized and get converted into ethanal and then into acetic acid.

Solution 10:

Sl. No	Formula	Common Name	IUPAC
1	C_3H_6	Propylene	Propene
2	C_2H_4	Ethylene	Ethene
3	C_2H_2	Acetylene	Ethyne
4	CH_3OH	Methyl alcohol	Methanol
5	C_2H_5OH	Ethyl alcohol	Ethanol

Solution 11:

$C_2H_5OH \xrightarrow{[O]} CH_3CHO + H_2O \xrightarrow{[O]} CH_3COOH$

The oxidizing agents that can be used are potassium dichromate and potassium permanganate.

Solution 12:

(a) $C \equiv CH + H_2 \xrightarrow[200^0C]{Ni} \underline{CH_2 = CH_2} + H_2 \xrightarrow[200^0C]{Ni} \underline{CH_3 - CH_3}$

(b) $C_2H_4 + Cl_2 \longrightarrow CH_2(Cl)\text{-}CH_2(Cl)$

(c) $_2H_4 + HCl \longrightarrow CH_3\text{-}CH_2Cl$

(d) $CaC_2 + 2H_2O \longrightarrow C_2H_2 + Ca(OH)_2$

(e) $_2H_2 + Br_2 \longrightarrow H(Br)C = C(Br)H$

(f) $_2H_5OH \qquad CH_3CHO$

Solution 13:

(a) Used for illuminating country houses : Ethyne
(b) Used for making a household plastic material: ethyne
(c) Called 'wood spirit' : Methanol
(d) Poisonous: Methanol
(e) Consumed as a drink: Ethanol
(f) Made from water gas: Methanol

EXERCISE. 12 F

Solution 1:

An organic compound containing the carboxyl group(COOH) is known as carboxylic acid. The general formula: $C_nH_{2n+1}COOH$

Solution 2:

Monocarboxylic acid:
Formula: HCOOH
Common name: Formic acid
IUPAC name: Methanoic acid
Dicarboxylic acid:
Formula: COOH-COOH
Common name : Oxalic acid
IUPAC name: Ethane-di-oic acid

Solution 3:

(a) First three members of carboxylic acids are:
Methanoic acid
Ethanoic acid
Propanoic acid

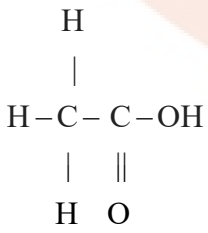
(b) Three compounds that can be oxidized directly or in stages to produce acetic acid are:
Ethanol
Acetylene
Ethanal

Solution 4:

Vinegar commonly called Sirka is a dilute solution of acetic acid. The presence of colouring matter gives it a greyish colour while the presence of some other organic acids and organic compounds impart it the usual taste and flavour.

Solution 5:

Structural formula of acetic acid:



IUPAC name of acetic acid is:
Ethanoic acid
Glacial acetic acid is the pure form of acetic acid. It does not contain water.

Solution 6:

(a) Ethanol
(b) Acetic acid
(c) Propanoic acid

Solution 7:

(a) It is prepared in the lab by the oxidation of ethanol with acidified potassium dichromate.
$C_2H_5OH \xrightarrow{[O]} CH_3CHO \xrightarrow{[O]} CH_3COOH$

(b) Acetylene is first converted to acetaldehyde by passing through 40% H_2SO_4 at 60°C in the presence of 1% $HgSO_4$.
The acetaldehyde is then oxidised to acetic acid in the presence of catalyst manganous acetate at 70°C.

$C_2H_2 + H_2O \xrightarrow[HgSO_4]{H2SO4(dil)} CH_3CHO$

$CH_3CHO + O \xrightarrow[Catalyst]{\Delta} 2CH_3COOH$

Solution 8:

(a) When acetic acid reacts with litmus it turns blue litmus red.
(b) When acetic acid reacts with metals hydrogen is evolved.
$2CH_3COOH + Zn \longrightarrow (CH_3COO)_2Zn + H_2$
(c) When acetic acid reacts with alkalies it forms salt
$CH_3COOH + NaOH \longrightarrow CH_3COONa + H_2O$
(d) Acetic acid reacts with alcohols forming esters
$CH_3COOH + C_2H_5OH \xrightarrow{H_2SO_4} CH_3COOC_2H_5 + H_2O$

Solution 9:

(a) $2CH_3COOH + Zn \longrightarrow (CH_3COO)_2Zn + H_2$
(b) $CH_3COOH + NaOH \longrightarrow CH_3COONa + H_2O$
(c) $2CH_3COOH + Na_2CO_3 \longrightarrow 2CH_3COONa + H_2O + CO_2$
(d) $CH_3COOH + NaHCO_3 \longrightarrow CH_3COONa + H_2O + CO_2$

Solution 10:

(a) When acetic acid and ethanol react it results in the formation of ethyl acetate.
(b) Lithum aluminium hydride($LiAlH_4$) is used to convert acetic acid to ethanol.
(c) Phosphorous pentoxide(P_2O_5) is heated along with acetic acid to form acetic anhydride.

Solution 11:

Test to show that CH_3COOH is acidic are:
When litmus test is done, it turns blue litmus red.

It react with bases to form salt and water.

Solution 12:

(a) When acetic acid is added to sodium bicarbonate, carbondioxide is liberated.

$$CH_3COOH + NaHCO_3 \longrightarrow CH_3COONa + H_2O + CO_2$$

(b) When acetic acid is added to ethyl alcohol in presence of sulphuric acid ester (ethyl acetate) is formed.

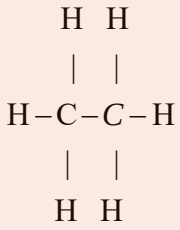
$$CH_3COOH + C_2H_5OH \xrightarrow{H_2SO_4} CH_3COOC_2H_5 + H_2O$$

(c) When acetic acid is added to neutral $FeCl_3$, wine red color is produced.

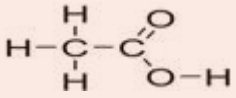
MISCELLANEOUS:

Solution 1:

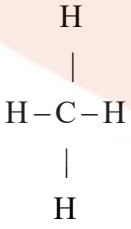
(a) Ethane:



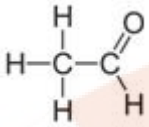
(b) Vinegar



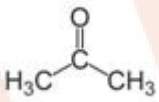
(c) Marsh gas



(d)



(e)

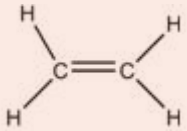


These compounds are called organic compounds.

Solution 2:

(a)

(i)



(ii)

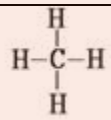
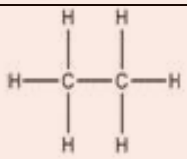
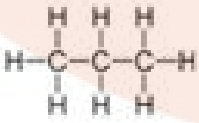
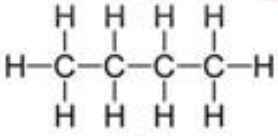
$H-C\equiv C-H$

They both are unsaturated compound. The structure (i) contains double bond where as structure (ii) contains triple bond.

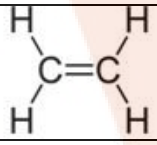
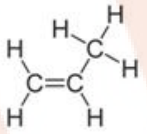
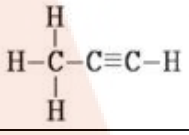
(b) Both the compounds undergo addition reactions.

Solution 3:

(a) Satu ated hydrocarbon

Name	Structural formula
Methane	
Ethane	
Propane	
Butane	

(b) Unsaturated hydrocarbon:

Name	Structural formula
Ethene	
Propene	
Ethyne	
Propyne	

The Saturated hydrocarbons undergo substitution reactions whereas unsaturated hydrocarbons undergo addition reactions.

Solution 4:

(a) C $C_2 + 2H_2O \longrightarrow Ca(OH)_2 + C_2H_2$

(b) When bromine in carbon tetrachloride is added to ethyne, the orange colour of the bromine disappears due to the formation of the colourless ethylene bromide.

(c) ater reacts with ethene to form ethanol.

$CH_2{=}CH_2 + H_2O \xrightarrow{H^+} C_2H_5OH$

Solution 5:

The alkanes form an (a) Homologous series with the general formula (b) C_nH_{2n+2}. The alkanes are (c) saturated (d) hydrocarbon which generally undergo (e) substitution reactions.

Solution 6:

(a) The conversion of ethanol into ethene is an example of Dehydration.

(b) Converting ethanol into ethene requires the use of Conc. H_2SO_4.

(c) The conversion of ethene into ethane is an example of hydrogenation.

(d) The catalyst used in the conversion of ethene into ethane is commonly nickel.

Solution 7:

(a) Ethyne is a highly reactive compound than ethene because of the presence of a triple bond between its two carbon atoms.

(b) Ethene is a highly reactive compound than ethane because of the presence of a double bond between its two carbon atoms.

(c) Hydrocarbons such as alkanes undergo combustion reactions with oxygen to produce carbon dioxide and water vapour. Alkanes are flammable which makes them excellent fuels. Methane for example is the principal component of natural gas.

$CH_4 + 2O_2 \rightarrow CO_2 + 2H_2O$

Solution 1(2004):

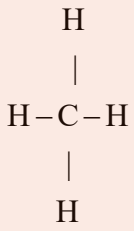
$2C_2H_6 + 7O_2 \longrightarrow 4CO_2 + 6H_2O$

Solution 2(2004):

(a) $C_2H_5OH \xrightarrow[170^{O}C]{Conc.H_2SO_4} CH_2 = CH_2 + H_2O$

(b) General formula of saturated hydrocarbon is: C_nH_{2n+2}

Example: CH_4



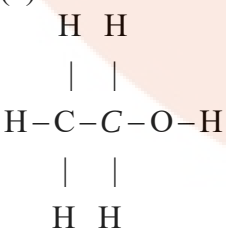
(c) Calcium carbide reacts with water to give acetylene gas.

Solution 1(2005):

(a) An alkane is ethane

Ethane

(b) The alcohol is ethanol



(c) An unsaturated hydrocarbon is ethyne

$H-C\equiv C-H$

Solution 2(2005):

(a) Ethanol
(b) Ethanoic acid
(c) Ethene

Solution 3(2005):

(a) Ethane from sodium propionate

$$C_2H_5COONa + NaOH \xrightarrow[300^\circ C]{CaO} Na_2CO_3 + C_2H_6$$

(b) Ethene from iodoethane

$$C_2H_5I + KOH(\text{alcoholic}) \rightarrow C_2H_4 + KI + H_2O$$

(c) Ethyne from calcium carbide

$$CaC_2 + 2H_2O \rightarrow Ca(OH)_2 + C_2H_2$$

(d) Methanol from iodoethane

$$CH_3I + NaOH \rightarrow CH_3OH + NaI$$

Solution 1(2006):

(a) IUPAC name: Propanal
Functional group: -CHO
(b) IUPAC name: Propanol
Functional group: -OH

Solution 2(2006):

(a) Preparation of carbon tetrachloride from methane:

$$CH_4 + Cl_2 \xrightarrow[\text{Or } 600k]{\text{Difused sunlight}} CH_3Cl + HCl$$

$$CH_3Cl + Cl_2 \longrightarrow CH_2Cl_2 + HCl$$

$$CH_2Cl_2 + Cl_2 \longrightarrow CHCl_3 + HCl$$

$$CHCl_3 + Cl_2 \longrightarrow CCl_4 + HCl$$

(b) Structural formula of ethyne:

$$H-C\equiv C-H$$

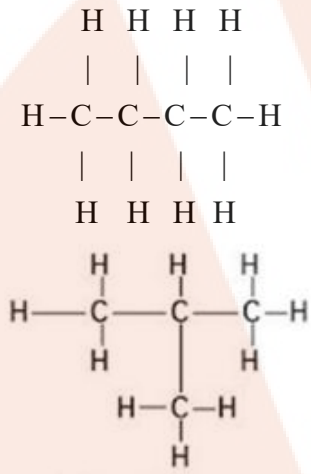
(c) Alkynes contain triple bond where as alkenes contain double bond.

Solution 3(2006):

Alkenes are the (a) homologous series of (b) unsaturated hydrocarbons. They differ from alkanes due to presence of (c) single bonds. Alkenes mainly undergo (d) addition reactions.

Solution 4(2006):

(a) Structural formulae of isomers of Butane are:

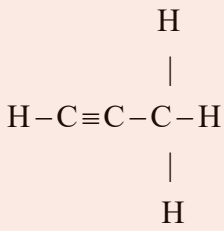


Butane 2-methyl propane

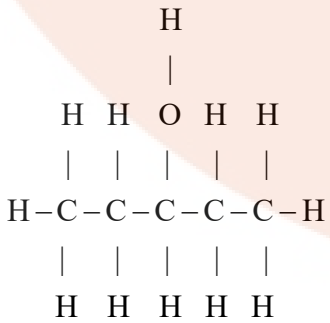
(b) Use of acetylene:

For Oxy-acetylene welding at very high temperatures.

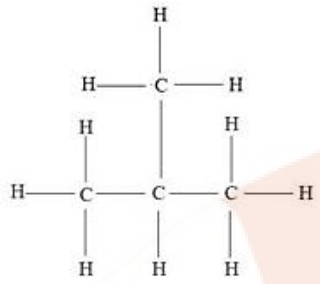
Solution 1 (2007):



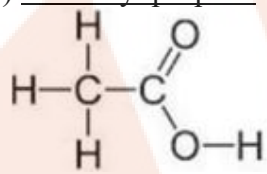
(i) Propyne



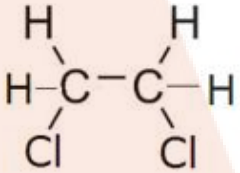
(ii) Pentan-3-ol



(iii) 2- methyl propane



(iv) Ethanoic acid



(v) 1,2-dichloroethane

Solution 2(2007):

The homologous series of hydrocarbons are:

General Formula	C_nH_{2n}	C_nH_{2n-2}	C_nH_{2n+2}
IUPAC name of the homologous series	Alkenes	Alkynes	Alkanes
Characteristics bond type	Double bond	Triple Bond	Single Bond
IUPAC name of the first member of the series	Ethene	Ethyne	Methane
Type of reaction with chlorine	Addition	Addition	Substitution

Solution 1a(2008):

(i) $C_2H_5COONa + NaOH \xrightarrow[300^0\,C]{CaO} Na_2CO_3 + C_2H_6$

(ii) $CH_3I + 2[H] \longrightarrow CH_4 + HI$

(iii) $C_2H_5Br + KOH \longrightarrow C_2H_4 + KBr + H_2O$

(iv) $CO + 2H_2 \longrightarrow CH_3OH$

(v) $CaC_2 + 2H_2O \longrightarrow Ca(OH)_2 + C_2H_2$

Solution 1b(2008):

(i) Calcium carbide and water:

$CaC_2 + 2H_2O \rightarrow Ca(OH)_2 + C_2H_2$

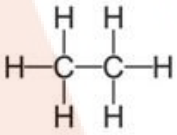
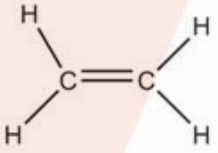
(ii) Ethene and water:

$CH_2 = CH_2 + H_2O \xrightarrow{H^+} C_2H_5OH$

(iii) Bromoethane and aqueous solution of sodium hydroxide

$C_2H_5Br + NaOH \longrightarrow C_2H_5OH + NaBr$

Solution 1c(2008):

Ethane	Ethene
	
It has carbon -carbon single bond.	It has carbon-carbon double bond
It is saturated.	It is unsaturated
Alkanes undergo substitution reaction.	Alkenes undergo addition reaction.

Solution 1d(2008):

(i) Ethane undergoes substitution reaction.

(ii) Ethene undergoes addition reactions.

Solution 1e(2008):

(i) $2C_2H_6 + 7O_2 \longrightarrow 4CO_2 + 6H_2O$

(ii) Ethane can be oxidized as follows:

When a mixture of ethane and oxygen in the ratio 9:1 by volume is compressed to about 120 atm pressure and passed over copper tubes at 475K, ethyl alcohol is formed.

$2C_2H_6 + O_2 \xrightarrow[\text{Cutubes 475k}]{120\,\text{atm}} 2C_2H_5OH$

When a mixture of ethane and oxygen is passed through heated MoO, the mixture is oxidized to ethanal.

$C_2H_6 + O_2 \xrightarrow{MoO} CH_3CHO + H_2O$

When a manganese based catalyst is used 100°C, ethane can be oxidized to ethanoic acid.

$2C_2H_6 + 3O_2 \xrightarrow{\text{Mn Compound}} 2CH_3COOH + 2H_2O$

Solution 1f(2008):

(i) Pure acetic acid on cooling forms crystalline mass resembling ice and for this reason it is called glacial acetic acid.
(ii) When acetic acid reacts with alcohol, ester is formed.

$$CH_3COOH + C_2H_5OH \xrightarrow{Conc.H_2SO_4} CH_3COOC_2H_5 + H_2O$$

INTEXT 1

Solution 1:

(a) Organic chemistry may be defined as the chemistry of hydrocarbons and its derivatives.
(b) Vital Force Theory is a theory made by the Scientist Berzelius in 1809 which assumed that organic compounds are only formed in living cells and it is impossible to prepare them in laboratories.
It was discarded because Friedrich Wohler showed that it was possible to obtain an organic compound (urea) in the laboratory.

Solution 2:

(a) Few sources of organic compounds are:
Plants
Animals
Coal
Petroleum
Wood
(b) The various applications of organic chemistry is:
It is used in the production of soaps, shampoos, powders and perfumes.
Various fuels like natural gas, petroleum are also organic compounds.
The fabrics that we use to make various dresses are also made from organic compounds.

Solution 3:

Organic compounds are present everywhere. They are present in:
It is present in the production of soaps, shampoos, powders and perfumes.
It is present in the food we eat like carbohydrates, proteins, fats, vitamins
etc. Fuel like natural gas, petroleum are also organic compounds.

Medicines, explosives, dyes, insecticides are all organic compounds.
Thus we can say that organic compounds play a key role in all walks of life.

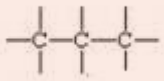
Solution 4:

The unique properties shown by carbon are:
Tetravalency of carbon
Catenation
Isomerism

Solution 5:

(a) Tetravalency: Carbon can neither lose nor gain electrons to attain octet. Thus it shares four electrons with other atoms. This characteristics of carbon by virtue of which it forms four covalent bonds, is called Tetravalency of carbon.
In structural form :

(b) Catenation: The property of self -linking of atoms of an element through covalent bonds in order to form straight chains, branched chains and cyclic chains of different sizes is known as catenation.
Carbon- carbon bond is strong so carbon can combine with other carbon atoms to form chains or rings and can involve single, double and triple bonds.



Solution 6:

Four properties of organic compound that distinguish them from inorganic compounds are:

(i) Presence of carbon.
(ii) Solubility in the organic solvents.
(iii) Forming of covalent bonds.
(iv) Having low melting and boiling points.

Solution 7:

Due to the unique nature of carbon atom, it gives rise to formation of large number of compounds. Thus this demands a separate branch of chemistry.

Solution 8:

Hydrocarbons are compounds that are made up of only carbon and hydrogen.
Comparison of saturated and Unsaturated hydrocarbons:

Saturated Hydrocarbon	Unsaturated Hydrocarbon
1. Carbon atoms are joined only by single bonds.	Carbon atoms are joined by double or by triple bonds.
2. They are less reactive due to the non-availability of electrons in the single covalent bond.	They are more reactive due to presence of electrons in the double or the triple bond.
3. They undergo substitution reaction.	They undergo addition reaction.

Solution 9:

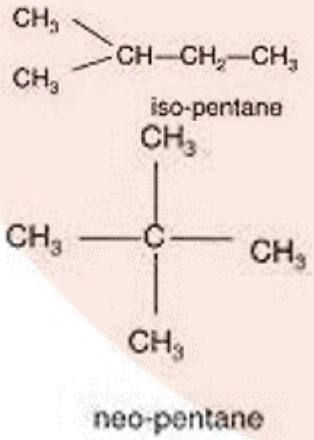
Due to presence of unique properties of carbon like Tetravalency, catenation and Isomerism large number of organic compounds are formed.

Solution 10:

(a) S ngle Bond compound: For example: In pentane

$CH_3 - CH_2 - CH_2 - CH_2 - CH_3$

$n - pentane$



(b) Double bond compound: For example:- In pentene

$CH_2 \equiv CH - CH_2 - CH_2 - CH_3$

1– *pentene*

$CH_3 - CH \equiv CH - CH_2 - CH_3$

2 – *pentene*

$CH_2 \equiv C(CH_3) - CH_2 - CH_3$

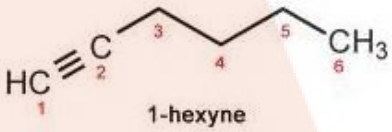
isopentene

$CH_2 - C \equiv CH_2 - CH_3$

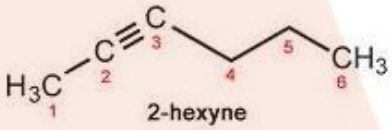
CH_3

isopentene

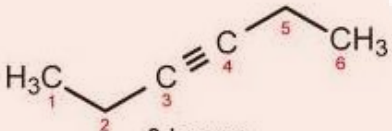
(c) Triple bond compound: In case of Hexyne:



1-hexyne



2-hexyne

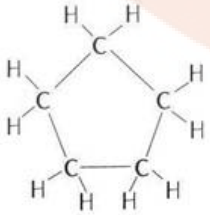


3-hexyne

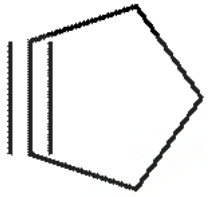
Solution 11:

(a) Cyclic compound with single bond: cyclopentane

Structure:



(b) Cyclic compound with triple bond: cyclopentyne
Structure:



Solution 12:

The member of each of the following is:
(a) Saturated Hydrocarbon: Hexane (C_6H_{14})
(b) Unsaturated Hydrocarbon: Hexene (C_6H_{12})

Solution 13:

Substitution reaction: A reaction in which one atom of a molecule is replaced by another atom (or group of atoms) is called a substitution reaction.
Addition reaction: A reaction involving addition of atom(s) or molecules(s) to the double or the triple bond of an unsaturated compound so as to yield a saturated product is known as addition reaction.

Solution 14:

Chain isomerism
Chain isomerism arises due to the difference in arrangement of C atoms in the chain. For example, there are two isomers of butane, C_4H_{10}. In one of them, the carbon atoms lie in a "straight chain" whereas in the other the chain is branched.

$CH_3 - CH_2 - CH_2 - CH_3$

$$CH_3 - \underset{\displaystyle CH_3}{\underset{|}{CH}} - CH_3$$

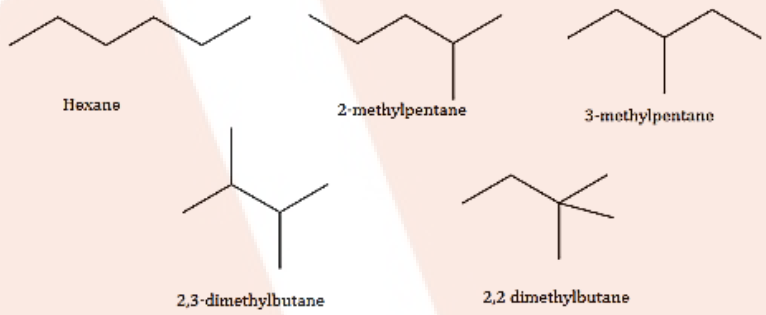
Position isomerism
It is due to the difference in position of functional groups.
For example, there are two structural isomers with the molecular formula C_3H_7Br. In one of them, the bromine atom is on the end of the chain, whereas in the other it is attached in the middle.

$CH_3 - CH_2 - CH_2 - Br$
1- bromopropane

$$CH_3 - \underset{\displaystyle Br}{\underset{|}{CH}} - CH_3$$
2 – bromopropane

Solution 15:

(a)Isomerism: Compounds having the same molecular formula but different structural formula are known as isomers and the phenomenon as isomerism.
Two main causes of isomerism are:
Difference in mode of linking of atoms.
Difference in the arrangement of atoms or groups in space.
(b)



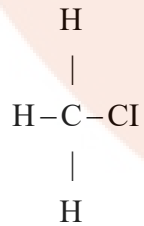
(c)

$CH_2=CHCH_2CH_3$ $H_3C\text{-}CH=CHCH_3$

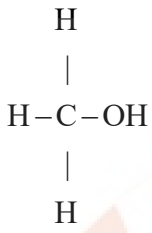
1-butene 2-butene

Solution 16:

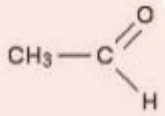
A functional group is an atom or a group of atoms that defines the structure (or the properties of a particular family) of organic compounds.
The structural formula of
(a) Halides :- R-X
Example:



(b) Alcohols:- R-OH
Example:



(c) Aldehydes:- R-CH=O
Example:



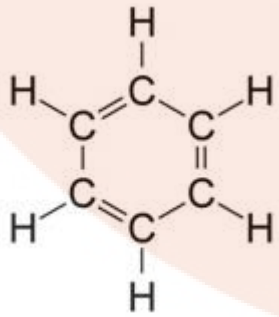
Solution 17:

The functional group present in the following compounds are:

(a) CH_3OH :- Alcohol
(b) HCHO:- Aldehyde
(c) CH_3COOH:- Carboxyl

Solution 18:

Formula of benzene :C_6H_6
Structure of benzene:



Solution 19:

(i) Physical properties: The alkyl group determines the physical properties.
(ii) Chemical properties: The functional group is responsible for the chemical properties.

Solution 20:

The alkyl radical and the functional group are:

Sl. No	Formula	Name of alkyl radical	Name of Functional group
a	CH_3OH	Methyl	Alcohol
b	C_2H_5OH	Ethyl	Alcohol
c	C_3H_7CHO	Propyl	Aldehyde
d	C_4H_9COOH	Butyl	Carboxyl

Solution 21:

(a) An alkyl group is obtained by removing one atom of hydrogen from an alkane molecule. Alkyl group is named by replacing the suffix 'ane' of the alkane with the suffix -yl.
(b) The name of three alkyl radicals are:
Methyl
Ethyl
Propyl
They are formed by removing 1 hydrogen from an alkane.

$CH_4 \longrightarrow -CH_3 + H^+$

Methyl

$CH_3 - CH_3 \longrightarrow CH_3 - CH_2 - + H^+$

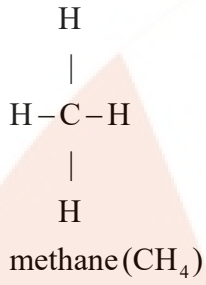
Ethyl

$CH_3 - CH_2 - CH_3 \longrightarrow CH_3 - CH_2 - CH_2 - + H^+$

Propyl

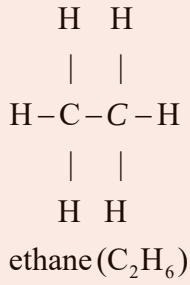
Solution 22:

The names and the structural formula of first three members of the homologous series of alkane are:



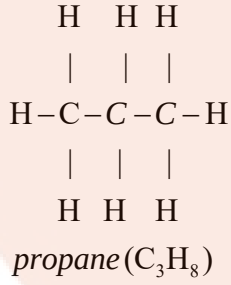
methane (CH_4)

(ii)
C_2H_6 Ethane



ethane (C_2H_6)

(iii)
C_3H_8 Propane



propane (C_3H_8)

Solution 23:

(a) A homologous series is a group of organic compounds having a similar structure and similar chemical properties in which the successive compounds differ by a CH_2 group.
(b) The difference in molecular formula of any two adjacent homologues is
(i) It differs by 14 a.m.u in terms of molecular mass.
(ii) It differs by three atoms. The kind of atoms it differs is one carbon and two hydrogen.