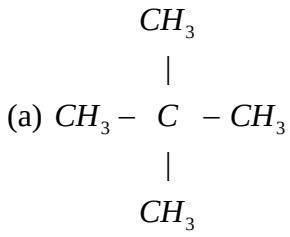
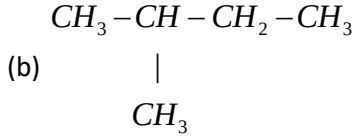
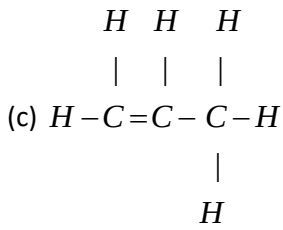
EXERCISE. 12 A

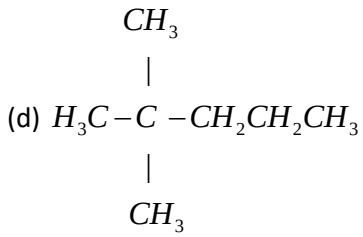
Question 1:

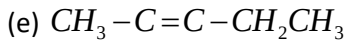
Write the IUPAC name of the following:

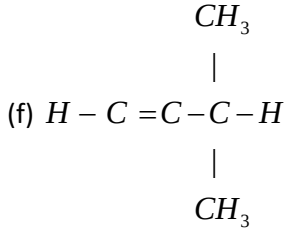
(a)


(b)


(c)


(d)


(e)


(f)


(g) $CH_3-\underset{\displaystyle Cl}{\underset{|}{CH}}-\underset{\displaystyle Cl}{\underset{|}{CH}}-CH_2CH_3$

(h) $CH_2-\underset{\displaystyle CH_3}{\underset{|}{CH}}-\underset{\displaystyle CH_2CH_2CH_3}{\underset{|}{CH_2}}$

(i) $CH_3-\underset{\displaystyle CH_3}{\underset{|}{CH}}-CH_2CH_3$

(j) $CH_3-C=C-CH_2CH_2CH_2CH_3$

(k) $CH_3-\underset{\displaystyle CH_3}{\underset{|}{C}}-CH_2CH_2CH_2CHO$

(l) $CH_3-\underset{\displaystyle OH}{\underset{|}{CH}}-CH_2CH_2CH_3$

(m) $CH_3CH\underset{\displaystyle CH_3}{\underset{|}{CH_2}}CH_2CH_2COOH$

(n) $CH_3-\underset{\displaystyle Br}{\underset{|}{\overset{\displaystyle CH_3}{\overset{|}{C}}}}-CH_2CH_3$

(o) $CH_3 - CH(CH_3) - CH_2 - CH_2Br$

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

Question 2:

Write the structure of the following compounds:
(a) Prop-1-ene, (b) 2, 3 – dimethyl butane,
(c) 2 – methyl propane (d) 3-hexene
(e) prop– 1 – yne (f) 2-methylprop – 1- ene,
(g) Alcohol with molecular formula $C_4H_{10}O$

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 $C_4H_{10}O$
$CH_3 - CH_2 - CH_2 - CH_2 - OH$

Question 3:

Choose the correct answer:

(a) C_5H_{11} is an

(i) alkane (ii) alkene (iii) alkyne (iv) alkyl group

(b) A hydrocarbon of the general C_nH_{2n} is

(i) $C_{15}H_{30}$ (ii) $C_{12}H_{26}$.

(iii) C_8H_{20} (iv) C_6H_{14}

(c) A hydrocarbon with molecular mass 72 is

(i) an alkane (ii) an alkene (iii) an alkyne

(d) The total number of different carbon chains that four carbon atoms form in alkane is

(i) 5 (ii) 4 (iii) 3 (iv) 2

(e) $CH_3 – CH_2 – OH$ and $CH_3 – O – CH_3$ are

(i) position isomers (ii) chain isomers

(iii) homologous (iv) functional – group isomers

(f) The IUPAC name of the compound is

$$CH_3 – CH_2 – CH_2 – \underset{\displaystyle CH_3}{\underset{|}{CH}} – CH_2 – CH_3$$

(i) 3-trimethylhexane (ii) 3- methyl hexane (iii) 4 – methyl hexane

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

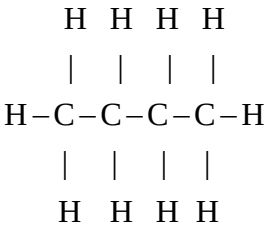
3n = 72

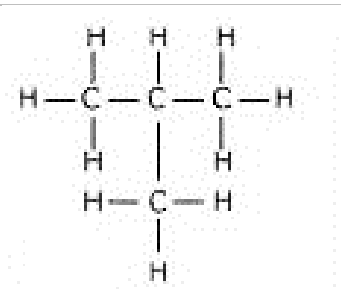
n = 24

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)

$$CH_3-CH_2-\underset{\displaystyle CH_3}{\underset{|}{CH}}-CH_2-CH_2-CH_3$$

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

Question 4:

Fill in the blanks:

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

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

Question 1:
State the sources of Alkanes.

Solution 1:
Sources of alkane:
The principal sources of alkanes are Natural gas and petroleum.

Question 2:
Methane is a greenhouse gas comment.

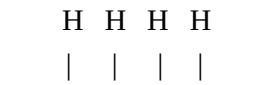
Solution 2:
Methane is a primary constituent of natural gas. It absorbs outgoing heat radiation from the earth, and thus contributes to the green house effect and so it is considered as a green house gas.

Question 3:
Give the general formula of alkanes.

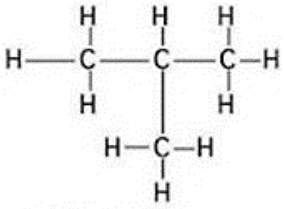
Solution 3:
The general formula of alkane is :
C_nH_{2n+2}

Question 4:
Draw the structures of isomers of:
(a) butane (b) pentane
Write the IUPAC and common names of these isomers

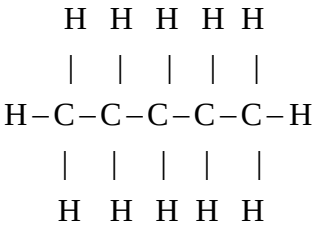
Solution 4:
(a)The structures of isomers of butane are:
(i)



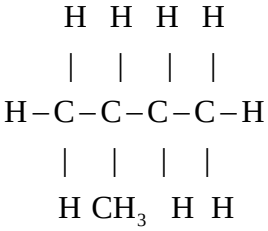
Common name:- n-Butane
IUPAC name:- Butane
(ii)



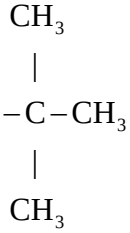
Common name:-iso butane
IUPAC name:- 2-methyl propane
(b) The structures of isomers of Pentane are:
(i)



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

Question 5:

Write the:

(a) molecular formula

(b) electron dot formula and

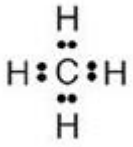
(c) structural formula of methane and ethane.

Solution 5:

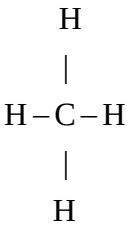
For methane:

(a) Molecular formula is CH_4

(b) Electron dot formula



(c) Structural formula

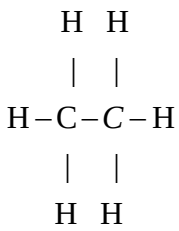


For ethane:

(a) Molecular formula is :- C_2H_6

(b) Electron dot formula:

(a) Structural Formula:



Question 6:

How is:

(a) methane and

(b) ethane prepared in the laboratory?

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.

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

Question 8:

What is a substitution reaction?

Give the reaction of chlorine with ethane and name the product formed.

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

Question 9:

Name the compounds formed when methane burns in:
(a) sufficient air, (b) insufficient air,
Give a balanced equation

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.
$2CH_4 + 3O_2 \longrightarrow 2CO + 4H_2O$

Question 10:

Write the names and the formula of the products formed when:
(a) methane (b) ethane
Reacts with : (i) chlorine (ii) bromine
Write the chemical equations

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

Question 11:

Name the compound prepared from:

(a) sodium propionate, (b) methyl iodide and (c) ethyl bromide

Write a balanced equation for the same

Solution 11:

(a) Ethane is prepared from sodium propionate.

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

(b) Methane is prepared from methyl iodide.

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

(c) Ethane is prepared from ethyl bromide.

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

Question 12:

What is pyrolysis or cracking? Explain with example.

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.

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

Question 13:

Convert:

(a) Methane into chloroform

(b) sodium acetate into methane

(c) Methyl iodide into ethane

(d) Aluminum carbide into methane

Solution 13:

(a) Methane into chloroform

$CH_4 + Cl_2 \rightarrow CH_3Cl + HCl$

$CH_3Cl + Cl_2 \rightarrow CH_2Cl_2 + HCl$

$CH_2Cl_2 + Cl_2 \rightarrow CHCl_3 + HCl$

(b) Sodium acetate into methane

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

(c) Methyl iodide into ethane

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

(d) Aluminium carbide into methane

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

Question 14:

Give three uses of:

(a) methane (b) ethane

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.

Question 15:

Under what conditions does ethane get converted to:

(a) ethyl alcohol (b) acetaldehyde (c) acetic acid

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.

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

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

Question 16:

Give the inter-relationship of methane, methyl alcohol, formaldehyde and formic acid with conditions.

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

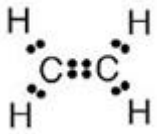
Question 1:

Write: (a) molecular formula, (b) electron dot formula and (c) structural formula of ethane (ethylene)

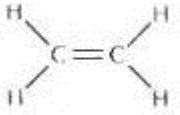
Solution 1:

(a) The molecular formula of ethene is C_2H_4

(b) Electron dot formula of ethene is:



(c) Structural formula of ethene:



Question 2:

The molecules of alkene family are represented by a general formula C_nH_{2n}. Answer the following:

(a) What do n and 2n signify?

(b) what is the name of alkene when n = 4?

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

(d) what is the molecular formula of the alkene if there are ten H atoms in it?

(e) what is the structural formula of the third member of the alkene family?

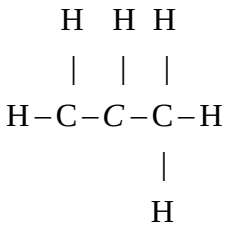
(f) write the molecular formula of lower and higher homologous of an alkene which contains four carbon atoms.

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}.

Question 3:

Discuss isomers in double bond compounds taking example of butane. Draw their structures and write IUPAC names.

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

Question 4:

Give a balanced equation for the lab. Preparation of ethylene. How is the gas collected?

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.

Question 5:

How is ethane prepared by:
(a) dehydrohalogenation reaction
(b) dehydration reaction?
Give equations and name the products formed.

Solution 5:

(a) Dehydrohalogenation reaction:

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

Ethene

(b) Dehydration reaction:

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

Ethene

Question 6:

Give the conditions and the main products formed by hydrogenation of ethylene.

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.

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

Question 7:

Ethylene when reacts with halogens (chlorine and bromine) form saturated products. Name them and write balanced equations.

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

Question 8:

How is ethanol converted into ethene using

(i) solid dehydrating agent

(ii) hot conc. H_2SO_4? Give only balanced equations

Solution 8:

(i) Solid dehydrating agent:.

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

Ethene

(ii) Hot conc. H_2SO_4:

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

Question 9:

Write the following properties of ethene:

(a) Physical state (b) Odour

(c) Density as compared to air (d) Solubility

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.

Question 10:

How would you convert:

(a) ethene into 1, 2-dibromoethane?

(b) ethene into ethyl brominde?

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

Question 11:

Give balanced equations when:

(a) ethene is burnt in excess of oxygen

(b) ethene reacts with chlorine

(c) ethene combines with hydrogen chloride

(d) a mixture of ethene and hydrogen is passed over nickel at 200° C.

Solution 11:

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

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

Question 12:

Give the formula and name of A, B C and D in the following equations:

(a) $CH_4 \xrightarrow[-HCl]{cl_2} A \xrightarrow[-HCl]{cl_2} B \xrightarrow[-HCl]{cl_2} C \xrightarrow[-HCl]{cl_2} D$

(b) $C_2H_2 \xrightarrow{H_2} A \xrightarrow{H_2} B \xrightarrow[-HBr]{Br_2} C \xrightarrow[-HBr]{Br_2} D$

(c) $C_2H_4 + Cl_2 \rightarrow A$

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

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

Question 13:

Write the name and formula of the product formed in each case below:

(a) $C_2H_4 + Cl_2 \longrightarrow$ …….

(b) $C_2H_5Br + KOH\ (alc.) \xrightarrow{\Delta}$ …….

(c) $H_2C = CH_2 \xrightarrow{alk.KMnO_4}$ ……

(d) $H_2C = CH_2 + HBr \longrightarrow$ …….

(e) $H_2C = CH_2 + O_3 \longrightarrow$ …….

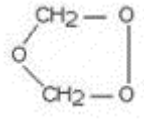
Solution 13:

(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) $CH_2 = CH_2 + O_3 \longrightarrow$



Question 14:

What do you observe when ethylene is passed through alkaline $KMnO_4$ solution?

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

Question 15:

Name three compounds formed by ethylene and give the use of these compounds.

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

Question 1:

What are the sources for alkynes? Give the general formula of alkynes.

Solution 1:

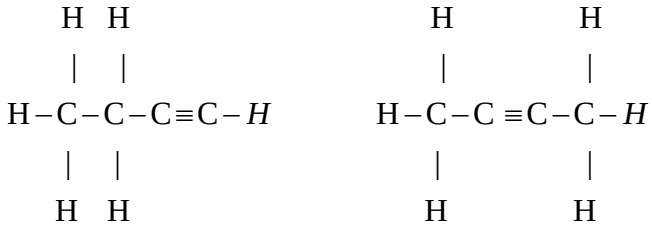
Natural gas and Petroleum are sources for alkynes.
The general formula of alkynes are:
C_nH_{2n-2}

Question 2:

Give an example of isomers shown by triple bond hydrocarbon (alkynes) and write its IUPAC name.

Solution 2:

Butyne is an example, its isomers are:



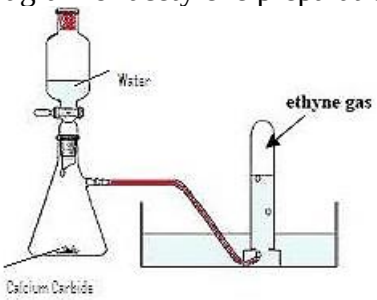
IUPAC name: But-2-yne But-1-yne

Question 3:

How is acetylene prepared in the laboratory?
(a) draw a diagram
(b) Give an equation
(c) How is pure dry gas collected?

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.

Question 4:

Give the method of preparation of ethyne by 1, 2– dibromoethene.

Solution 4:

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

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

Question 5:

Classify the following compounds as alkanes, alkenes and alkynes.
C_3H_4:-
C_3H_8:-
C_5H_8:-
C_3H_6:-

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

Question 6:

Give a chemical test to distinguish between
(a) saturated and unsaturated compounds
(b) ethane and ethene
(c) ethene (ethylene) and ethyne (acetylene)

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.

Question 7:

Name the products formed and write an equation when ethyne is added to the following in an inert solvent:

(a) chlorine

(b) bromine

(c) iodine

(d) hydrogen

(e) excess of hydrochloric acid

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.

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

Question 8:

Name the hydrocarbon which;

(a) is a tetrahedral molecule

(b) is a planar molecule

(c) is a linear molecule

(d) forms a red precipitate with ammoniacal solution of copper (I) chloride

(e) is known as paraffin

(f) is known as olefin

Solution 8:

(a) The hydrocarbon which is tetrahedral is Methane.

(b) The hydrocarbon which is planar molecule is ethene.

(c) The 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) Alkanes are also called as paraffin.
(f) Alkenes are also called olefin.

EXERCISE. 12 E

Question 1:

(a) what are alcohols? State their sources
(b) give general formulae of monohydric alcohol

Solution 1:

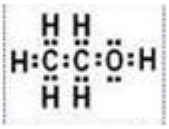
(a) Alcohols are the hydroxyl derivatives of alkanes and are formed by replacing one or more hydrogen atoms of the alkane with OH group.
Methanol is obtained from destructive distillation of wood while ethanol is obtained from fermentation of sugar.
(b) General formula of monohydric alcohol:
$C_nH_{2n+1}OH$

Question 2:

Give the
(a) Dot diagram
(b) Abbreviated formula
(c) Structure of second member of the alcohol group.

Solution 2:

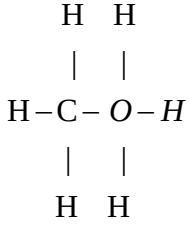
(a) Dot diagram



(b) Abbreviated formula

C_2H_5OH

(c) Structure:



Question 3:

State the method of preparation of ethanol:

(a) by hydrolysis of ethane,

(b) by hydrolysis of alkyl halide

Solution 3:

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

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

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

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

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

Question 4:

How is ethanol prepared by fermentation?

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

Question 5:

Give the lab. Prepared of:

(a) ethyl alcohol

(b) methyl alcohol

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.

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

Question 6:

(a) how do the boiling point and melting point change in the homologous series of alcohols?

(b) Name the product formed when ethanol reacts with acetic acid. Give an equation.

(c) What is the name given to this type of reaction?

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.

Question 7:

What is the effect ethanol on human body.

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.

Question 8:

How are the following obtained

(a) absolute alcohol

(b) spurious alcohol

(c) methylated spirit?

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.

Question 9:

Name the products formed and give appropriate chemical equations for the following:

(a) sodium reacting with ethyl alcohol

(b) Ethanol oxidized by acidified potassium dichromate

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.

Question 10:

Give the trivial (common) names and the IUPAC names of the following:

(a) C_3H_6 (b) C_2H_4 (c) C_2H_2 (d) CH_3OH (e) C_2H_5OH

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

Question 11:

Ethanol can be oxidized to ethanoic acid. Write the equation and name the oxidizing agent.

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.

Question 12:

Complete and balanced the following equations. State the conditions wherever necessary.

(a) CH

||| + $H_2 \rightarrow$ ..... + $H_2 \rightarrow$ .....

CH

(b) $C_2H_4 + Cl_2 \rightarrow$ .....

(c) $C_2H_4 + HCl \rightarrow$.....

(d) $CaC_2 + H_2O \rightarrow$.....

(e) $C_2H_2 + Br_2 \rightarrow$.....

(f) $C_2H_5OH \xrightarrow[K_2Cr_2O_7]{[o]} \rightarrow$.....

Solution 12:

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

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

(c) $C_2H_4 + HCl \longrightarrow CH_3\text{-}CH_2Cl$

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

(e) $C_2H_2 + Br_2 \longrightarrow H(Br)C = C(Br)H$

(f) $C_2H_5OH \xrightarrow[K_2Cr_2O_7]{[o]} CH_3CHO$

Question 13:

Name an organic compound which is:

(a) used for illuminating country houses

(b) Used for making a household plastic material

(c) Called 'wood spirit'

(d) Poisonous and contains OH group

(e) Consumed as a drink

(f) Made from water gas

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

Question 1:

What are carboxylic acids? Give their general formula

Solution 1:

An organic compound containing the carboxyl group(COOH) is known as carboxylic acid.

The general formula: $C_nH_{2n+1}COOH$

Question 2:

Write the common name, IUPAC name and formula of one monocarboxylic acid and one dicarboxylic acid

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

Question 3:

Write the names of:
(a) First three members of carboxylic acids series.
(b) Three compounds that can be oxidized directly or in stages to produce acetic 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

Question 4:

Vinegar in greyish in colour with a particular taste Explain.

Solution 4:

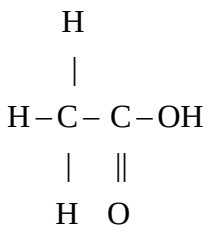
Vinegar commonly called Sirka is a dilute solution of acetic acid. The presence of colouring matter gives it a greyish colour while the presence of some other organic acids and organic compounds impart it the usual taste and flavour.

Question 5:

Give the structural formulae and IUPAC name of acetic acid. What is glacial acetic acid?

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.

Question 6:

Complete:
(a) Vinegar is prepared by the bacterial oxidation of …….
(b) The organic acid present in vinegar is ……..
(c) The next higher homologue of ethanoic acid is ……

Solution 6:

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

Question 7:

How is acetic prepared from
(a) ethanol (b) acetylene?

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.

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

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

Question 8:

What do you notice when acetic acid reacts with
(a) litmus (b) metals

(c) alkalies (d) alcohol

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

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

Question 9:

Acetic acid is a typical acid. Write one equation in each case for its reactions with
(a) a metal (b) a base / alkali
(c) a carbonate (d) a bicarbonate

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

Question 10:

Name:
(a) compound formed when acetic acid and ethanol react together
(b) reducing agent used to convert acetic acid into ethanol
(c) substance used to change acetic acid to acetic anhydride.

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.

Question 11:

Give two tests to show that CH_3COOH is acidic in nature.

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.

Question 12:

What do you observe when acetic acid is added to:
(a) sodium bicarbonate
(b) ethyl alcohol in the presence of sulphuric acid
(c) neutral $FeCl_3$ solution?

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.

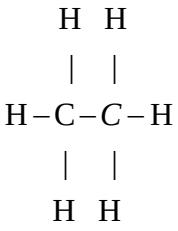
MISCELLANEOUS:

Question 1:

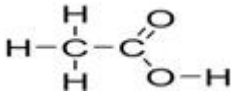
Draw structural formula for each of the following compounds:
(a) isomer of n-butane
(b) vinegar
(c) 2-propanol
(d) ethanal
(e) acetone
(f) diethyl ether
What is used to describe these compounds taken together?

Solution 1:

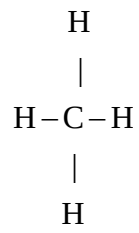
(a) Ethane:



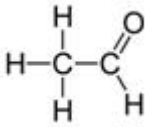
(b) Vinegar



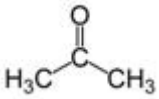
(c) Marsh gas



(d)



(e)



These compounds are called organic compounds.

Question 2:

(a)What is the special feature of the structure of:

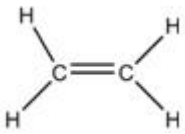
(i) C_2H_4 (ii) C_2H_2

(b) what type of reaction is common to both these compounds? Why methane does not undergo this type of reaction.

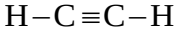
Solution 2:

(a)

(i)



(ii)



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.

Question 3:

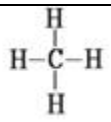
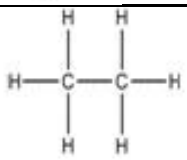
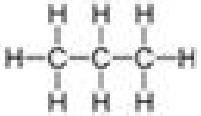
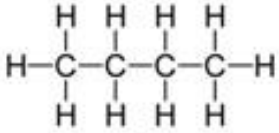
Give the names and structural formula of:

(a) saturated hydrocarbon (b) unsaturated hydrocarbon

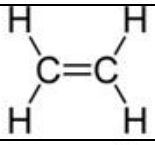
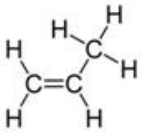
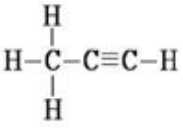
Which type of reaction will they undrgo?

Solution 3:

(a) Saturated 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.

Question 4:

(a) Write an equation for the laboratory preparation of (i) an unsaturated hydrocarbon from calcium carbide. (ii) an alcohol from ethyl bromide.

(b) What would you see, when ethyne is bubbled through a solution of bromine in carbon tetrachloride?

(c) Name the addition product formed between ethene and water.

Solution 4:

(a) $CaC_2 + 2H_2O \longrightarrow Ca(OH)_2 + C_2H_2$
(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) Water reacts with ethene to form ethanol.

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

Question 5:

Choosing only words from the following list, write down appropriate words to fill in the blanks from (a) to (e) given below. Addition, carbohydrates, C_nH_{2n-2}, C_nH_{2n}, C_nH_{2n+2}, electrochemical homologous, hydrocarbon, saturated, substitution, unsaturated.
The alkanes form an (a) _____ series with the general formula (b) _____ The alkanes are (c_____(d)_____ which generally undergo (e) _____ reactions.

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.

Question 6:

Ethanol can be converted into ethene which can be changed into ethane. Choose the correct word or phrase from the brackets to complete the following sentences.
(a) The conversion of ethanol into ethene is an example of _____
(b) Converting ethanol into ethene requires the use of _____
(c) The conversion of ethene into ethane is an example of _____
(d) The catalyst used in the conversion of ethene into ethane is commonly _____

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.

Question 7:

Give reasons:
(a) ethyne is more reactive than ethene
(b) Ethene is more reactive than ethane
(c) Hydrocarbons are excellent fuels

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.

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

Question 1(2004):

Write balanced equation when ethane is burnt in air.

Solution 1(2004):

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

Question 2(2004):

(a) Write the equation for the preparation of ethylene from ethyl alcohol

(b) Write the general formula for a saturated hydrocarbon and give one example of a saturated hydrocarbon with its structural formula

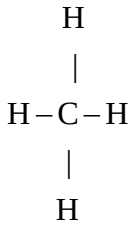
(c) Name a compound which will give acetylene gas when treated with water.

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.

Question 1(2005):

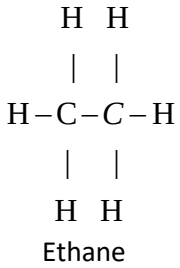
Draw the structural formula of a compound with two carbon atoms in each of the following cases

(a) An alkane with a carbon to carbon single bond

(b) An alcohol containing two carbon atoms
(c) An unsaturated hydrocarbon with a carbon to carbon triple bond.

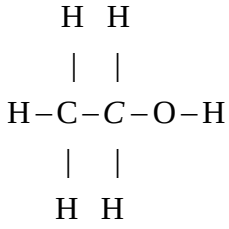
Solution 1(2005):

(a) An alkane is ethane

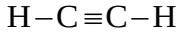


Ethane

(b) The alcohol is ethanol



(c) An unsaturated hydrocarbon is ethyne



Question 2(2005):

Ethane, Ethene, ethanoic acid, Ethyne, Ethanol
From the box, name
(a) The compound with –OH as the part of its structure.
(b) The compound with –COOH as the part of its structure.
(c) Homologue of Homologous series with general formula C_nH_{2n}.

Solution 2(2005):

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

Question 3(2005):

Write the equations for the following lab. Preparations:
(a) Ethane from sodium propionate,
(b) Ethene from Iodoethane
(c) ethyne from calcium carbide

(d) Methanol from Iodomethane.

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

$$C_2H_5\,I + KOH(alcoholic) \rightarrow C_2H_4 + KI + H_2O$$

(c) Ethyne from calcium carbide

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

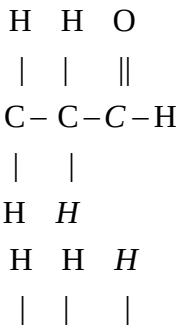
(d) Methanol from iodoethane

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

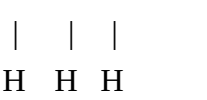
Question 1(2006):

Give the correct IUPAC name and the functional group for each of the compounds whose structural formulae are given below:

(a)



(b)



Solution 1(2006):

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

Question 2(2006):

(a) write the equation for the preparation of carbon tetrachloride from methane .
(b) draw the structural formula of ethyne
(c) How is the structure of alkynes different from that of alkenes?

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.

Question 3(2006):

Fill in the blanks with the correct words from the brackets:

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

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.

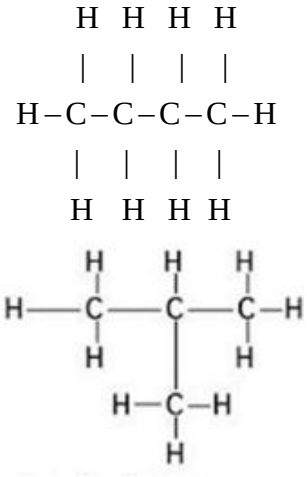
Question 4(2006):

(a) draw the structural formulae of the two isomers of Butane. Give the correct IUPAC name of each isomer.

(b) State one use of acetylene.

Solution 4(2006):

(a) Structural formulae of isomers of Butane are:



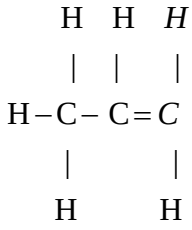
Butane 2-methyl propane

(b) Use of acetylene:

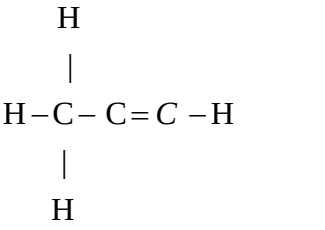
For Oxy-acetylene welding at very high temperatures.

Question 1(2007):

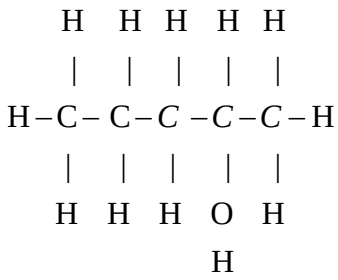
Give the IUPAC names of the following compounds numbered (i) to (v). The IUPAC names of the compounds on the left are to guide you for giving the correct IUPAC names of the compounds on the right.



Propene



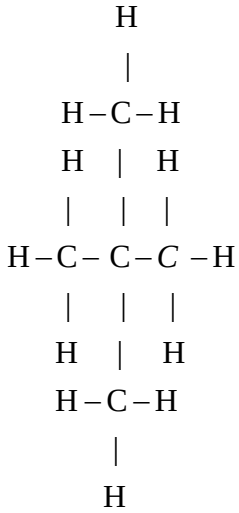
(i) _____



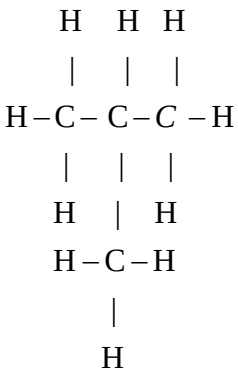
Pentan – 2 – ol

(ii)

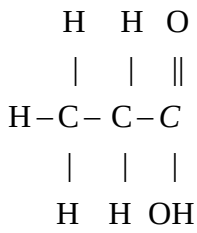
_____



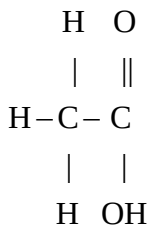
2, 2-dimethylpropane



(iii) _____

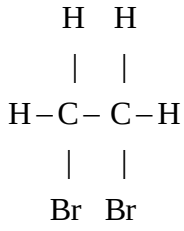


Propanoic acid

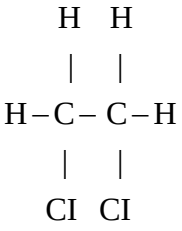


(iv)

_____

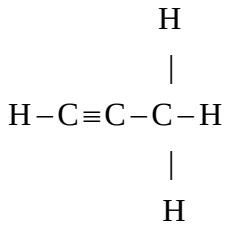


1, 20dibromoethane

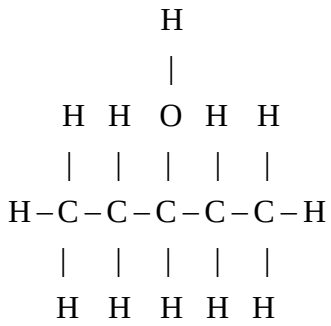


(v) _____

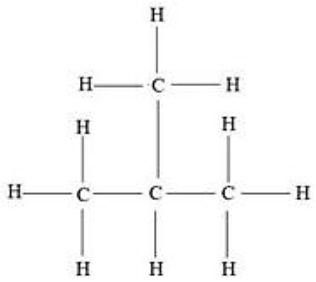
Solution 1 (2007):



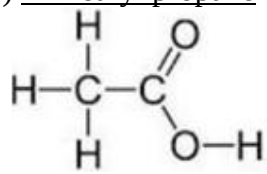
(i) Propyne



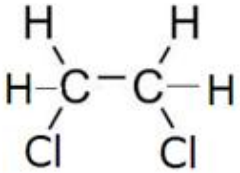
(ii) Pentan-3-ol



(iii) 2- methyl propane



(iv) Ethanoic acid



(v) 1,2-dichloroethane

Question 2(2007):

Copy and complete the following table which relates to three homologous series of hydrocarbons:

General Formula	C_nH_{2n}	C_nH_{2n-2}	C_nH_{2n+2}
IUPAC name of the homologous series			
Characteristic bond type			Single Bond
IUPAC name of the first member of the series			
Type of reaction with chlorine		Addition	

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

Question 1a(2008):

(a) Name the organic compound prepared by each of the following reactions:

(i) $C_2H_5COONa + NaOH \rightarrow$

(ii) $CH_3I + 2[H] \rightarrow$

(iii) $C_2H_5Br + KOH$ (alcoholic solution) $\rightarrow$

(iv) $CO + 2H_2$ (zinc oxide catalyst) $\rightarrow$

(v) $CaC_2 + 2H_2O \rightarrow$

Solution 1a(2008):

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

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

Question 1b(2008):

Write the equations for the following reactions:

(i) calcium carbide and water

(ii) ethene and water (steam)

(iii) Bromoethane and an aqueous solution of sodium hydroxide.

Solution 1b(2008):

(i) Calcium carbide and water:

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

(ii) Ethene and water:

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

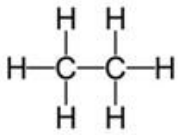
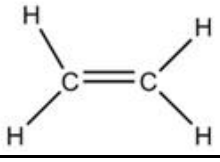
(iii) Bromoethane and aqueous solution of sodium hydroxide

$C_2H_5Br + NaOH \longrightarrow C_2H_5OH + NaBr$

Question 1c(2008):

Distinguish between the saturated hydrocarbon ethane and the unsaturated hydrocarbon ethene by drawing their structural formulae.

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.

Question 1d(2008):

Addition reactions and substitution reactions are types of organic reactions. Which type of reaction is shown by:

(i) ethane

(ii) ethane?

Solution 1d(2008):

(i) Ethane undergoes substitution reaction.

(ii) Ethene undergoes addition reactions.

Question 1e(2008):

(i) write the equation for the complete combustion of ethane

(ii) Using appropriate catalysts, ethane can be oxidized to an alcohol, an aldehyde and an acid. Name the alcohol, aldehyde and acid formed when ethane is oxidized.

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.

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

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.

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

Question 1f(2008):

(i) Why is pure acetic acid known as glacial acetic acid?

(ii) what type of compound is formed by the reaction between acetic acid and an alcohol?

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

Question 1:

(a) What do you understand by organic chemistry?

(b) What is vital force theory? Why was it discarded?

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.

Question 2:

(a) Name a few sources of organic chemistry

(b) give the various applications of organic chemistry

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.

Question 3:

Organic chemistry plays a key role in all walks of life. Discuss

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.

Question 4:

Carbon shows some unique properties, name them

Solution 4:

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

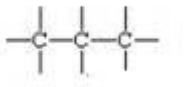
Question 5:

Explain the following:
(a) Tetravalency
(b) Catenation

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.



Question 6:

Write any four properties of organic compounds that distinguish them from inorganic compounds.

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.

Question 7:

Why are organic compounds studies as a separate branch of chemistry?

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.

Question 8:

What are hydrocarbons? Compare saturated and unsaturated hydrocarbons?

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.

Question 9:

Give reason for the existence of the large number of organic compounds.

Solution 9:

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

Question 10:

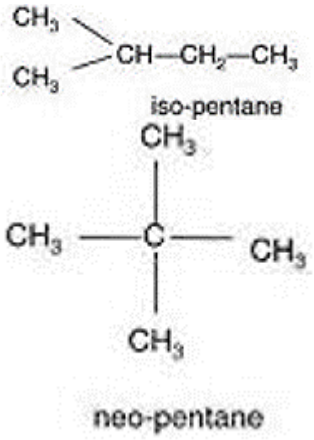
Give at least one example in each case to show structure of isomers of:
(a) single bond compound
(b) double bond compound
(c) triple bond compound

Solution 10:

(a) Single Bond compound: For example: In pentane

$CH_3 - CH_2 - CH_2 - CH_2 - CH_3$

n – pen tan *e*



(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*

$CH_2 \equiv C - CH_2 - CH_3$

$|$

CH_3

isopentene

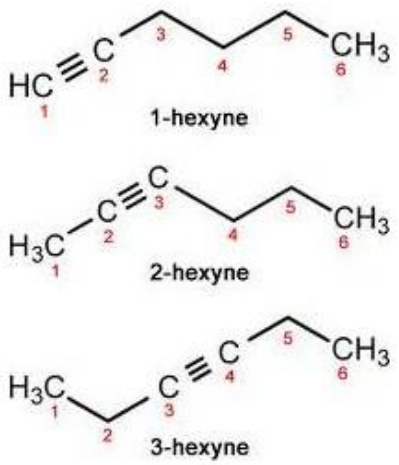
$CH_2 - C \equiv CH_2 - CH_3$

$|$

CH_3

isopentene

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

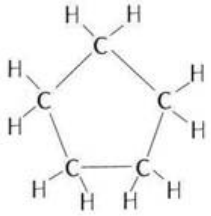


Question 11:

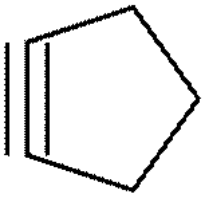
Name a compound of each type and draw the figure.
(a) Cyclic compound with single bond
(b) Cyclic compound with triple bond.

Solution 11:

(a) Cyclic compound with single bond: cyclopentane
Structure:



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



Question 12:

Give the name of one member of each of the following:
(a) saturated hydrocarbons
(b) unsaturated hydrocarbons

Solution 12:

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

Question 13:

Define substitution and addition reaction.

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.

Question 14:

Define or explain chain isomerism and position isomerism with examples in each case.

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

Question 15:

(a) Define the term isomerism. State two main causes of isomerism.

(b) draw the chain isomers of hexane (C_6H_{12})

(c) Draw position isomers of butane (C_4H_8)

Solution 15:

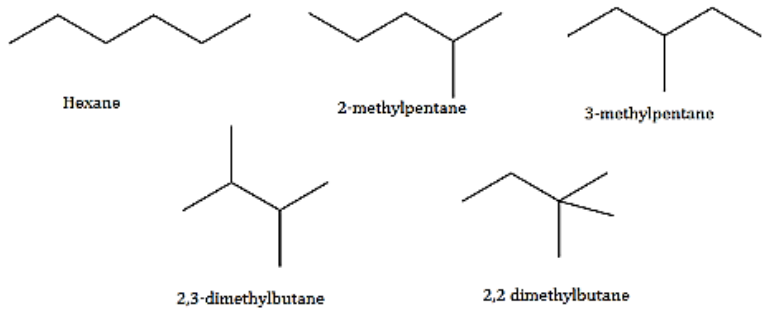
(a)Isomerism: Compounds having the same molecular formula but different structural formula are known as isomers and the phenomenon as isomerism.

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)

$CH_2=CHCH_2CH_3$ $H_3C-CH=CHCH_3$

1-butene 2-butene

Question 16:

Define a functional group and give the structural formula of the following:

(a) Ketone, (b) alcohols (c) aldehydes.

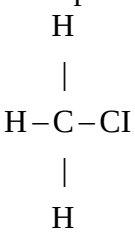
Solution 16:

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

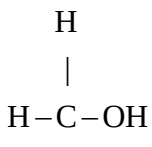
(a) Halides :- R-X

Example:

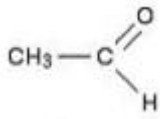


(b) Alcohols:- R-OH

Example:



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



Question 17:

Identify the functional groups of the following:
(a) CH_3OH (b) HCHO (c) CH_3COOH

Solution 17:

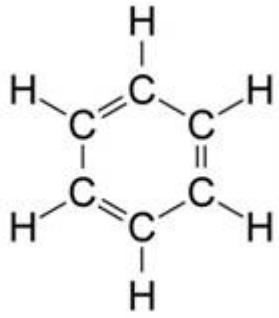
The functional group present in the following compounds are:
(a) CH_3OH :- Alcohol
(b) HCHO:- Aldehyde
(c) CH_3COOH:- Carboxyl

Question 18:

What will be the formula and structure of benzene?

Solution 18:

Formula of benzene :C_6H_6
Structure of benzene:



Question 19:

Which part of an organic compound determines

(i) physical properties (ii) chemical properties?

Solution 19:

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

Question 20:

Name the alkyl radical and the functional group of the following organic compounds:

(a) CH_3OH (b) C_2H_5OH (c) C_3H_7CHO (d) C_4H_9COOH

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

Question 21:

(a) What is an alkyl group?
(b) Give the names of any three alkyl radicals. How are they formed?

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

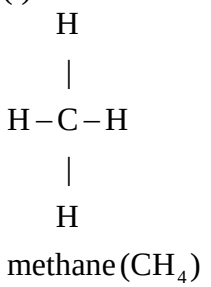
Question 22:

Give the names and the structural formula of the first three members of the homologous series of alkanes.

Solution 22:

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

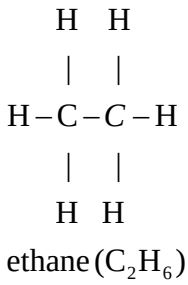
(i)



methane (CH_4)

(ii)

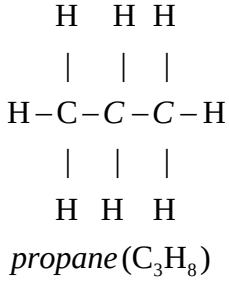
C_2H_6 Ethane



ethane (C_2H_6)

(iii)

C_3H_8 Propane



propane (C_3H_8)

Question 23:

(a) What is homologous series?

(b) What is the difference in the molecular formula of any two adjacent homologues:

(i) in terms of molecular mass,

(ii) in terms of number and kind of atoms per molecule?

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.