Organic Compounds

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Solution 1:

Urea was the first organic compound synthesized in laboratory by Friedrish Wohler.

Solution 2:

As the general formula of the homologous series is C_nH_{2n-2} so they represent Alkynes.

Third member: C_4H_6

Fifth member: C_6H_{10}

Solution 3:

C_3H_6, C_4H_8 belong to same Homologous series.

Solution 4:

(a) C_3H_8 : Zero isomers. Alkanes with more than three carbon atoms form isomers.

(b) C_4H_{10}:- Two isomer

Solution 5:

Natural gas and Petroleum are one of the major sources of organic compound.

Solution 6:

S.No.	Organic Compounds	Inorganic Compounds
1.	Occurs in living matter i.e. animals and plants	Found from Non-living matter i.e. Minerals.
2.	They have low melting and boiling points.	They have high melting and boiling points.
3.	Insoluble in water	Soluble in water
4.	They are generally volatile and inflammable.	They are generally non-volatile and non-combustible.

Solution 7:

(i) Organic compounds are essentially carbon compounds. They show chemical Reaction and their rates are slow.

(ii) One of the products of combustion of organic compounds is always carbon dioxide.

(iii) More than 90% of the known organic compounds are synthesised.

(iv) Vital force theory was discarded by the synthesis of Urea in laboratory.

Solution 8:

Organic compounds are large in number due to the following unique properties of Carbon atom:

a) Tetra covalency of carbon: Carbon has four valence shell electrons .Thus it always forms covalent bonds by sharing electrons with other atoms.

b) Catenation: It is the property of combining any number of carbon atoms to form straight chains, branched chains and rings of different sizes.

c) Formation of multiple bonds: Due to small size carbon atom can form multiple bonds with not only carbon but with atoms of other elements like oxygen, nitrogen etc.

d) Isomerism: it forms large number of compounds due to isomerism by means of which compounds having same molecular formula can have different structural formula.

Solution 9:

(a) A homologous series is a group of organic compounds having similar structures and similar chemical properties .

(b) The difference in molecular formula of any two adjacent homologues in terms of types of atoms is that that they differ by CH_2 group i.e. by one carbon atom and two hydrogen atom.

The difference in the molecular masses of any two adjacent homologues is 14.

Solution 10:

Carbon has the unique property of combining any number of carbon atoms to form straight chains, branched chains and rings of different sizes.

Carbon show maximum tendency of catenation due to:

(i) Tetra covalency of carbon and
(ii) Great strength of carbon- carbon bonds.

Solution 11:

The name and Formulae of one member of each of following are:

(a) Saturated Hydrocarbons:

Formulae: CH_4
Name: Methane

(b) Unsaturated Hydrocarbons:

Formulae: C_2H_4
Name: Ethene

Solution 12:

(a) The group formed by the removal of one hydrogen atom from an alkane molecule is called an alkyl group.

(b) The three alkyl groups are:

- Methyl
- Ethyl
- Propyl

Formation of alkyl group:

- Methyl:

$$CH_4 \xrightarrow{-H} CH_3 -$$

- Ethyl:

$$C_2H_6 \xrightarrow{-H} C_2H_5 -$$

- Propyl:

$$C_3H_8 \xrightarrow{-H} C_3H_7 -$$

Solution 13:

(i) Pentane
(ii) 2,2-dimethylpropane
(iii) Pent-2-ene
(iv) Propyne

Solution 14:

A functional group may be defined as an atom or group of atoms present in a molecule which largely determines its chemical properties.

For Example: -OH- Alcohol, -CHO- Aldehyde

Functional group of:

(i) Alcohol: -OH
(ii) Ketone: >C=O
(iii) Carboxylic acid: -COOH

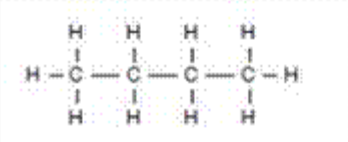
Solution 15:

(i) Molecular formula: The formula of an organic compound which represents kind of atoms and the number of each kind of atoms present in one molecule is called molecular formula.

Molecular formula of butane: C_4H_{10}

(ii) Structural formula: The formula of an organic compound which represents the arrangement of various atoms in one molecule in space is called structural formula.

Structural formula of butane:



(iii) Condensed formula: A kind of structural formula which indicates the group of atoms joined together to each of the carbon atom in straight or branched carbon chain is called condensed formula.

Condensed formula of butane: $CH_3CH_2CH_2CH_3$

Solution 16:

The names of the functional groups are:

-OH : alcohol

$\succ C = O$: Ketone

-CHO : Aldehyde

-COOH : Carboxylic acid

Solution 17:

S.No.	compound	Trivial Name	IUPAC
(a)	C_3H_6	Propylene	Propene
(b)	C_2H_4	Ethylene	Ethene
(c)	C_2H_2	Acetylene	Ethyne
(d)	CH_3OH	methylalcohol	methanol
(e)	CH_3COOH	Acetic Acid	Ethanoic acid

Alkanes

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Solution 1:

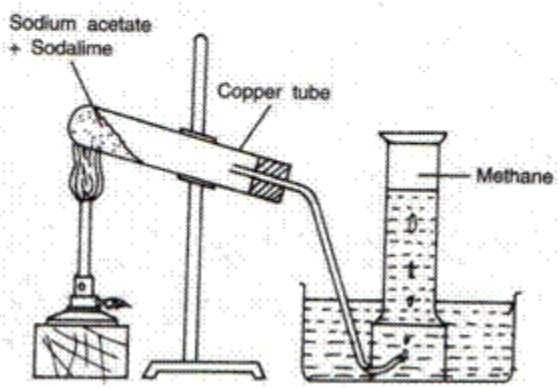
Methane is indicated by marsh gas and fire damp.

Solution 2:

(a) Mixture of sodium ethanoate and soda lime is heated in a hard glass tube.

$$CH_3COONa + NaOH \xrightarrow{CaO} CH_4 + Na_2CO_3$$

(b) Gas is collected by the downward displacement of water, since it is only slightly soluble in water and lighter than air.



(c) Soda lime is used as it is not deliquescent and does not attack glass.

Solution 3:

(a) When methyl bromide or methyl iodide and sodium are heated in presence of dry ether, ethane is formed.

$$CH_3I + 2Na + ICH_3 \xrightarrow{Dryether} CH_3 - CH_3 + 2NaI$$

(b) By reduction of Ethyl iodide using Zn +Cu couple in alcohol, ethane is formed.

$$CH_3CH_2I + 2[H] \rightarrow C_2H_6 + HI$$

Solution 4:

(a) The products obtained when methane reacts with chlorine in diffused sunlight are Chloromethane, Dichloromethane, Trichloromethane and Tetrachloromethane.

(b)

$$CH_4 + Cl_2 \xrightarrow[\text{or } \triangle]{\text{UV light}} CH_3Cl + HCl$$

$$CH_3Cl + Cl_2 \rightarrow CH_2Cl_2 + HCl$$

$$CH_2Cl_2 + Cl_2 \rightarrow CHCl_3 + HCl$$

$$CHCl_3 + Cl_2 \rightarrow CCl_4 + HCl$$

(c) The above reaction is substitution reaction. Here the substitution of alkanes with chlorine takes place hence it is called chlorination.

The reactions in which the hydrogen of the alkane molecule is replaced by another atom or group of atoms resulting in the formation of the derivative of that hydrocarbon are called substitution reactions.

Substitution by halogen atom is called halogenations.

Solution 5:

(i) Uses of Methane

- As a domestic fuel in the form of natural gas
- In the manufacture of methanol and hydrogen.

(ii) Uses of Ethane

- As a fuel, it has high calorific value than methane. Liquefied ethane is also used as a fuel.
- In the preparation of ethanol, acetaldehyde and acetic acid which find use in paints, varnishes, adhesive, plastic etc.

Solution 6:

$$C_2H_6 + Cl_2 \xrightarrow{UV\,light} C_2H_5Cl + HCl$$
$$C_2H_5Cl + Cl_2 \rightarrow C_2H_4Cl_2 + HCl$$
$$C_2H_4Cl_2 + Cl_2 \rightarrow C_2H_3Cl_3 + HCl$$
$$C_2H_3Cl_3 + Cl_2 \rightarrow C_2H_2Cl_4 + HCl$$
$$C_2H_2Cl_4 + Cl_2 \rightarrow C_2HCl_5 + HCl$$
$$C_2HCl_5 + Cl_2 \rightarrow C_2Cl_6 + HCl$$

Solution 7:

(a) Methane to methanol:

$$2CH_4 + O_2 \xrightarrow[200^\circ C]{Cu} 2CH_3OH$$

(b) Ethane to ethanal(acetaldehyde):

$$2C_2H_6 + O_2 \xrightarrow[200^\circ C]{Cu} 2C_2H_5OH$$

$$C_2H_5OH \xrightarrow[acidic]{K_2Cr_2O_7} CH_3CHO$$

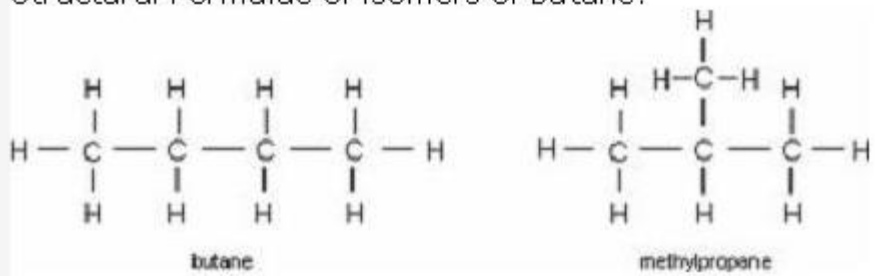
(c) Methane to methanoic acid:

$$2CH_4 + O_2 \xrightarrow[200^\circ C]{Cu} 2CH_3OH$$

$$CH_3OH \xrightarrow[acidic]{K_2Cr_2O_7} HCHO \xrightarrow[acidic]{K_2Cr_2O_7} HCOOH$$

Solution 8:

Structural Formulae of isomers of butane:



Solution 9:

(a) Ethane is mixed with oxygen and is passed through hot copper tube; it gets oxidized to ethyl alcohol.

$$2C_2H_6 + O_2 \xrightarrow[200^\circ C]{Cu} 2C_2H_5OH$$

(b) Ethane is first converted into ethyl alcohol by passing over hot copper tube, then further oxidation with acidified potassium dichromate yield aldehyde and carboxylic acids.

$$2C_2H_6 + O_2 \xrightarrow[200^\circ C]{Cu} 2C_2H_5OH$$

$$C_2H_5OH \xrightarrow[acidic]{K_2Cr_2O_7} CH_3CHO \xrightarrow[acidic]{K_2Cr_2O_7} CH_3COOH$$

Solution 10:

The main sources of alkanes are natural gas and petroleum.

Alkanes are known as saturated hydrocarbons because the carbon atoms in their molecules are bonded to each other by single covalent bond. Each carbon atom is again bonded to hydrogen atom.

Solution 11:

When methane and chlorine are exposed to direct sunlight they give carbon and HCl.

$$CH_4 + 2Cl_2 \xrightarrow{\text{Direct sunlight}} C + 4HCl$$

Solution 12:

(a) Ethane reacts in excess of air to give carbon dioxide and water.

$$2C_2H_6 + 7O_2 \rightarrow 4CO_2 + 6H_2O + \text{Heat}$$

(b) Ethane reacts in absence of air to give carbon black.

$$C_2H_6 + O_2 \rightarrow 2C + 3H_2O$$

(c) Ethane reacts in presence of copper and 120atm pressure to give ethanol

$$2C_2H_6 + O_2 \xrightarrow[200^{\circ}C]{Cu} 2C_2H_5OH$$

(d) Ethane reacts with molybdenum oxide at 100 atm pressure to give ethanal.

$$C_2H_6 + O_2 \xrightarrow[\Delta]{MoO} CH_3CHO + H_2O$$

Solution 13:

Seven covalent bonds are present in Ethane.

Unsaturated Hydrocarbons

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Solution 1:

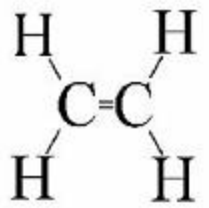
(i) The n signifies Number of carbon atoms where as 2n signifies Number of hydrogen atoms.

(ii) Butene

(iii) C_3H_6

(iv) Molecular formula of first member of alkene is: C_2H_4

Structural formula:



(v) Lower Homologues of alkene which contains four carbon atoms is : C_3H_6

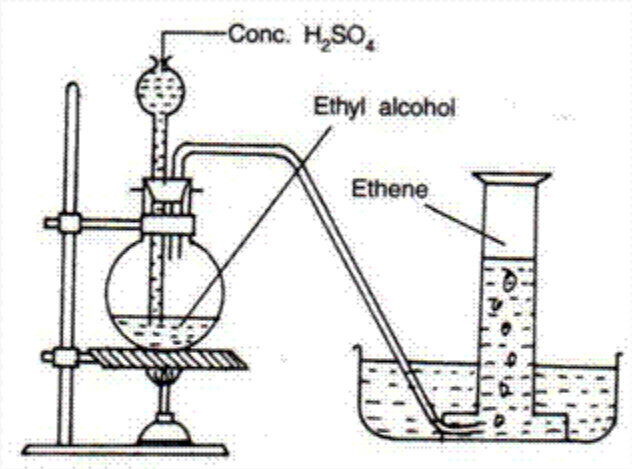
Higher Homologues of alkene which contains four carbon atoms is : C_5H_{10}

Solution 2:

Ethylene is prepared in the laboratory by dehydration of ethyl alcohol.

Reaction:

$$CH_3CH_2OH \xrightarrow[170°C]{conc H_2SO_4} CH_2 = CH_2 + H_2O$$



Procedure:

Take one part of ethyl alcohol in a flask. Add two parts of concentrated sulphuric acid and heat to 170°C.Ethylene is evolved and small amount of aluminium sulphate is also added to the flask to avoid frothing.

Gas is prepared by reacting ethyl alcohol in presence of sulphuric acid and is collected by downward displacement of water.

The gas is dried by passing the gas through sodium hydroxide solution.

Solution 3:

(a) Ethene into 1,2 –dibromoethene:

When bromine gas is passed into inert solvent like CCl_4 containing dissolved ethene at room temperature, one molecule of Br_2 adds across the double bond to give ethylene dibromide.

$$CH_2 = CH_2 + Br_2 \rightarrow CH_2Br - CH_2Br$$

(b) Ethene to bromoethane:

Ethene reacts with halogen acids to form alkyl halides.

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

Solution 4:

Physical properties:

- State: colourless gas, neutral to litmus, faint sweet odour
- Solubility: slightly soluble in water, highly soluble in organic solvents.
- Density: slightly lighter than air
- Melting point: -169°C
- Boiling point: -104°C

Solution 5:

(a) Ethanol to ethene:

$$CH_3CH_2OH \xrightarrow[170^\circ C]{conc\ H_2SO_4} CH_2 = CH_2 + H_2O$$

(b) Ethene to ethanol:

$$CH_2 = CH_2 + H_2O \xrightarrow{H^+} CH_3 - CH_2OH$$

Solution 6:

When bromine solution is added to ethane and ethene, In case of ethene the orange colour of bromine disappears where as in case of ethane colour does not disappear.

Solution 7:

The addition of hydrogen across the double bond is called hydrogenation.

Ethene reacts with hydrogen gas when heated in presence of catalyst like nickel, to give ethane.

$$CH_2 = CH_2 + H_2 \xrightarrow[300^\circ C]{Ni} CH_3 - CH_3$$

Use of hydrogenation:

Hydrogenation of Oils: The oils can be converted into ghee which are semi solid at room temperature.

Solution 8:

Two equations:

(i) $CH_2 = CH_2 + H_2 \xrightarrow[300^\circ C]{Ni} CH_3 - CH_3$

(ii) $CH_2 = CH_2 + H_2O \xrightarrow{H^+} CH_3 - CH_2OH$

Solution 9:

Addition Reaction: The reactions in which molecules of the attacking reagent add across the double or triple bond of an unsaturated compound to yield saturated compound.
Ethene is a reactive compound due to presence of double bond. Hence undergo addition reactions.
Two examples:

(i) Addition of hydrogen: $CH_2 = CH_2 + H_2 \xrightarrow[300^\circ C]{Ni} CH_3 - CH_3$

(ii) Addition of halogens: $CH_2 = CH_2 + Br_2 \rightarrow CH_2Br - CH_2Br$

Solution 10:

Three uses of ethene are:

1. It is used for the manufacture of polythene
2. For the artificial ripening of fruits.
3. As a general anaesthetic.

Solution 11:

(i) When ethene is passed in bromine solution in CCl_4, the orange colour of bromine disappears due to formation of colourless ethylene bromide.

$$CH_2 = CH_2 + Br_2 \rightarrow CH_2Br - CH_2Br$$

(ii) When Baeyer's reagent reacts with ethene, colour of potassium permanganate gets discharged in this reaction.

$$CH_2 = CH_2 + H_2O + O \xrightarrow[KMnO_4]{25^\circ C - 30^\circ C} CH_2OH - CH_2OH$$

Alkynes

PAGE NO : 260

Solution 1:

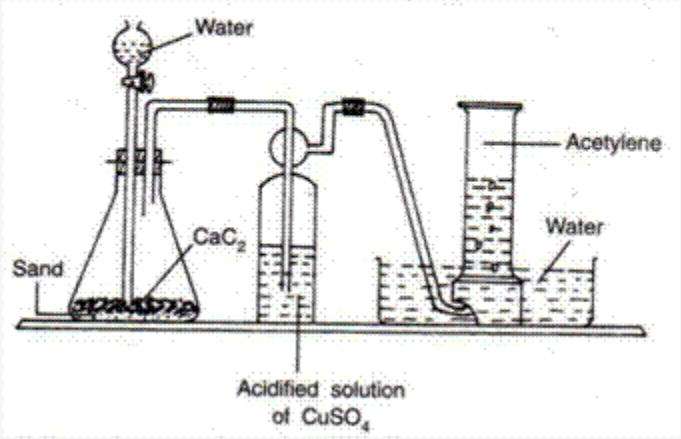
First four members of the homologus series of alkynes are:

- Ethyne
- Propyne
- Butyne
- Pentyne

Solution 2:

Ethyne is prepared by the reaction of calcium carbide with water

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



Solution 3:

Addition Reactions: The reactions in which molecules of the attacking reagent add across the double or triple bond of an unsaturated compound to yield saturated compound.

In case of ethene the addition occurs due to presence of double bond hence one molecule of the compound is added whereas in case of alkynes there is presence of triple bond hence two molecules of the compound is added.

Solution 4:

Equations:

(i) Bromine water:

$$CH \equiv CH + Br - Br \xrightarrow{CCl_4} CHBr = CHBr$$
$$CHBr = CHBr + Br - Br \xrightarrow{CCl_4} CHBr_2 - CHBr_2$$

(ii) Excess of Hydrochloric acid:

$$CH \equiv CH \xrightarrow{HCl} CH_2 = CHCl$$
$$CH_2 = CHCl \xrightarrow{HCl} CH_3 - CHCl_2$$

Solution 5:

(i) Ethyne to ethane:

$$CH \equiv CH + H_2 \xrightarrow{Ni,300^\circ C} CH_2 = CH_2$$
$$CH_2 = CH_2 + H_2 \xrightarrow{Ni} CH_3 - CH_3$$

(ii) Ethyne to acetaldehyde:

$$CH \equiv CH + H_2O + [O] \xrightarrow[H_2SO_4]{HgSO_4} CH_3CHO$$

Solution 6:

Two chemical tests to distinguish between ethane and ethyne are:

(i) Bromine water test
(ii) Baeyers test

Solution 7:

S.No.	Saturated organic compound	Unsaturated organic compound
1.	All the four valencies of each carbon atom are satisfied by forming single covalent bonds with carbon and with hydrogen atoms	The valencies of at least two carbon atoms are not fully satisfied by the hydrogen atoms
2.	Carbon atoms are joined only by a single covalent bond	Carbon atoms are joined by double covalent bonds or by triple covalent bonds.
3.	Less reactive	More reactive

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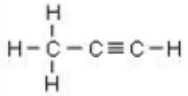
Solution 8:

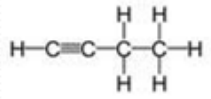
Structural formulae and IUPAC name of Second Homologues:

Propyne



Structural formulae and IUPAC name of third homologues:

Butyne



Solution 9:

(a) Hydrogen:

$$CH \equiv CH + H_2 \xrightarrow{Ni,300^\circ C} CH_2 = CH_2$$
$$CH_2 = CH_2 + H_2 \xrightarrow{Ni} CH_3 - CH_3$$

(b) Water:

$$CH \equiv CH + H_2O + [O] \xrightarrow[H_2SO_4]{HgSO_4} CH_3CHO$$

(c) Bromine:

$$CH \equiv CH + Br - Br \xrightarrow{CCl_4} CHBr = CHBr$$
$$CHBr = CHBr + Br - Br \xrightarrow{CCl_4} CHBr_2 - CHBr_2$$

Solution 10:

(i) Ethene and ethyne burns with a sooty luminous flame as all the carbon atoms do not get oxidized.

(ii) Ethane does not undergo addition reaction due to absence of double and triple bond.

(iii) Ethyne is used for welding and cutting metals as ethylene produce high temperature.

Solution 11:

Uses of ethyne:

(i) For welding and cutting metals

(ii) For artificial ripening of fruits

(iii) As a general anaesthetic under the name Naracylene.

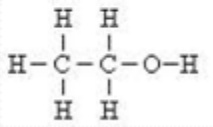
Alcohols

PAGE NO : 264

Solution 1:

Molecular formula of Ethanol: C_2H_5OH

Structural formula of Ethanol:



Solution 2:

Necessary conditions and equations of getting ethanol from the following are:

(a) Alkyl halide: alkyl halide on hydrolysis with dilute alkali give alcohol

$$C_2H_5Br + KOH(aq) \rightarrow C_2H_5OH + KBr$$

(b) An ethene: Ethene is first treated with concentrated sulphuric acid at 80°C when ethyl hydrogen sulphate is formed. Ethyl hydrogen sulphate on hydrolysis with boiling water or steam yield ethanol.

$$CH_2 = CH_2 + H_2SO_4 \xrightarrow[30atm]{80^\circ c} CH_3CH_2HSO_4$$
$$CH_3CH_2HSO_4 + HOH \xrightarrow{boiling} CH_3CH_2OH + H_2SO_4$$

Solution 3:

(i) Potassium dichromate and potassium permanganate in the presence of acid .
(ii) Conc.H_2SO_4
(iii) Methanol
(iv) Ethyl alcohol

Solution 4:

Ethanol reacts as follows

(a) Metallic sodium:

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

(b) Acetic acid:

$$C_2H_5OH + CH_3COOH \underset{}{\overset{conc.H_2SO_4}{\rightleftharpoons}} CH_3COOC_2H_5 + H_2O$$

(c) Conc.H_2SO_4:

$$C_2H_5OH \xrightarrow[170^\circ C]{conc.H_2SO_4} CH_2 = CH_2 + H_2O$$

Solution 5:

(i) Methylated spirit:- Ethyl alcohol mixed with certain percentage of methyl alcohol.

(ii) Power alcohol:-Petrol:Alcohol in 4:1

(iii) Spurious alcohol:- Ethyl alcohol mixed with higher percentage of methyl alcohol

Solution 6:

Uses of ethanol:

(i) In the manufacture of alcoholic beverages
(ii) As a solvent for paint, oils, perfumes
(iii) As an antifreeze in automobile radiators

Solution 7:

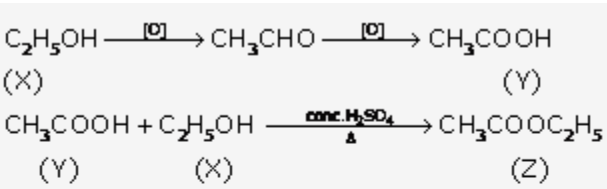
(i) Ethanol to ethene:

$$C_2H_5OH \xrightarrow[170^\circ C]{conc.H_2SO_4} CH_2 = CH_2 + H_2O$$

(ii) Bromoethane to ethanol:

$$C_2H_5Br + KOH(aq) \rightarrow C_2H_5OH + KBr$$

Solution 8:



'X'=Ethyl alcohol

'Y'=Ethanoic acid

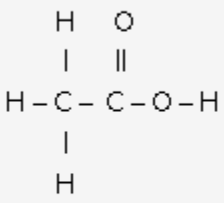
'Z'=Ethyl ethanoate

Carboxylic acid

PAGE NO : 269

Solution 1:

Structure formula of Ethanoic acid:



Molecular formula of Ethanoic acid:

CH_3COOH

Solution 2:

Vinegar: Vinegar is 4 to 6 % acetic acid (Ethanoic Acid).

Glacial acetic acid: Pure acetic acid is called glacial acetic acid.

Solution 3:

Three physical properties of acetic acid:

- State: Liquid
- Odour : Pleasant smell- smell of vinegar
- Taste: Sour taste

Solution 4:

Uses of acetic acid:

- As a solvent for gums, resin, cellulose etc
- As a laboratory reagent
- In medicines
- As a vinegar for table purpose and for manufacturing pickels
- For making rubber, rayon, plastic, varnishes etc.
- For the manufacture of dyes, perfumes, pigments.

Solution 5:

Acetic acid is the main constituent of vinegar.

Solution 6:

Oxidation of ethyl alcohol gives acetic acid.

$$C_2H_5OH + [O] \xrightarrow[H_2SO_4]{K_2Cr_2O_7} CH_3CHO + H_2O$$

$$CH_3CHO + [O] \xrightarrow[H_2SO_4]{K_2Cr_2O_7} CH_3COOH$$

Solution 7:

Acetic acid turns blue litmus red. It proves that it is acidic in nature.

Solution 8:

Boiling Point: 118^0C

Solution 9:

Pure acetic acid is called Glacial acetic acid because it forms an ice-like solid when cooled.

Solution 10:

The first four members of aliphatic carboxylic acid are:

- Methanoic acid
- Ethanoic acid
- Propanoic acid
- Butanoic acid

Solution 11:

i) Ethene to Acetic acid

$$C_2H_4 + H_2 \xrightarrow{Pt} C_2H_6$$
$$C_2H_6 + O_2 \xrightarrow[350^0C]{MoO} CH_3CHO + H_2O$$
$$CH_3CHO + [O] \xrightarrow[Conc.H_2SO_4]{K_2Cr_2O_7} CH_3COOH$$

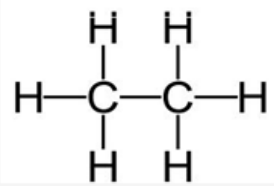
ii) Ethane to acetic acid

$$C_2H_6 + O_2 \xrightarrow[350^0C]{MoO} CH_3CHO + H_2O$$
$$CH_3CHO + [O] \xrightarrow[Conc.H_2SO_4]{K_2Cr_2O_7} CH_3COOH$$

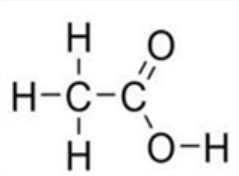
Solution 1999-1:

(i) Structural formula are as under:

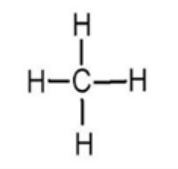
(a) Ethane



(b) Vinegar



(c) Marsh Gas



(ii) The three compounds taken together are known as Organic compounds.

Solution 1999-2:

(i). (a) The special feature of the structure of C_2H_2 is that there is presence of triple bond in the molecule.

(b) The special feature of the structure of C_2H_4 is that there is presence of double bond.

(ii) Addition reaction is common to both of these compounds.

Solution 2000-1:

(i) The name of saturated Hydrocarbon is called Alkane and the formula is C_nH_{2n+2} where n=1,2,3.....

(ii) The name of unsaturated hydrocarbon with double bond is called alkene and the formula is C_nH_{2n} , where n=1,2,3,4.....

Solution 2000-2:

A saturated hydrocarbon will undergo Substitution reactions, whereas the typical reaction of an unsaturated hydrocarbon is Addition .

Solution 2000-2:

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

(ii) Special feature of the structure of Ethyne is that there is presence of triple bond.

(iii) When Ethyne is bubbled through a solution of bromine in carbon tetrachloride, the orange colour of bromine disappears due to formation of colourless product.

(iv) Ethyl alcohol is formed when the addition reaction takes place between ethene and water.

$$CH_2 = CH_2 + H_2O \xrightarrow{H^+} CH_3 - CH_2OH$$

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Solution 2001-1:

When ethene is bubbled through a solution of bromine in tetrachloromethane, the orange colour of bromine disappears due to the formation of colourless ethylene bromide.

$CH_2 = CH_2 + Br_2 \rightarrow CH_2Br - CH_2Br$

Solution 2001-2:

The alkanes form a homologus series with general formula C_nH_{2n-2} .The alkanes are saturated, which generally undergo substitution reactions.

Solution 2001-3:

(i) The conversion of ethanol to ethene is an example of dehydration (dehydration, dehydrogenation)

(ii) Converting ethanol to ethene requires the use of concentrated sulphuric acid (Concentrated hydrochloric acid, concentrated nitric acid and concentrated sulphuric acid).

(iii) The conversion of ethene to ethane is an example of hydrogenation (hydration, hydrogenation).

(iv) The catalyst used in the conversion of ethene to ethane is commonly nickel (iron, cobalt, nickel).

Solution 2001-4:

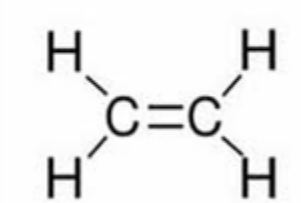
$CaC_2 + 2H_2O \rightarrow C_2H_2 + Ca(OH)_2$

Solution 2002-1:

(i) Substitution reaction takes between ethane and chlorine to form monochloroethane.This reaction is called chlorination.

(ii) Addition reaction takes place between ethene and chlorine and it is called halogenations.

(iii) (a) Structural formula of Ethene:



(b)Ethene can react with chlorine because there is presence of double bond which can result in the addition reaction.

Solution 2002-2:

(i) Ethene
(ii) Methane.
(iii) Ethene
(iv) Methane
(v) Ethyne, Ethene

Solution 2002-3:

(i) Ethane from sodium propionate:

$$CH_3CH_2COONa + NaOH \xrightarrow[\Delta]{CaO} CH_3 - CH_3 + Na_2CO_3$$

(ii) Ethene from Ethanol

$$C_2H_5OH \xrightarrow[170^\circ C]{Conc.H_2SO_4} CH_2 = CH_2 + H_2O$$

(iii) Ethyne from Calcium carbide

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

(iv) Ethanoic acid from ethane

$$2C_2H_6 + O_2 \xrightarrow[200^\circ C]{Cu} 2C_2H_5OH$$

$$C_2H_5OH \xrightarrow{K_2Cr_2O_7\ acidic} CH_3CHO \xrightarrow{K_2Cr_2O_7\ acidic} CH_3COOH$$

Solution 2003-1:

(i) Sodium propionate is heated with soda lime to obtain ethane gas in the laboratory.

(ii) $CH_3CH_2COONa + NaOH \xrightarrow[\Delta]{CaO} CH_3 - CH_3 + Na_2CO_3$

(iii) $2C_2H_6 + 7O_2 \rightarrow 4CO_2 + 6H_2O + heat$

(iv) Al_2O_3 can be used instead of sulphuric acid to prepare ethylene by dehydration of alcohol.

(v) Bromine solution can be used to distinguish between ethane and ethene.

(vi) Ethylene reacts with chlorine to form a product called as 1,2-dichloroethane. This reaction is known as Halogenation.

$CH_2 = CH_2 + Cl_2 \rightarrow CH_2Cl - CH_2Cl$

1,2-dichloroethane

Solution 2004-1:

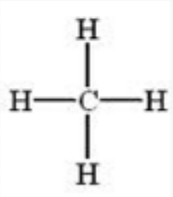
Ethane is burnt in air

$2C_2H_6 + 7O_2 \rightarrow 4CO_2 + 6H_2O + heat$

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

(b) General formula of saturated hydrocarbon: C_nH_{2n+2}. For Example: Methane.

Structural Formula of methane is:



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

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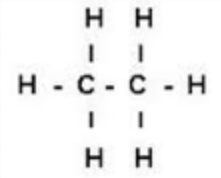
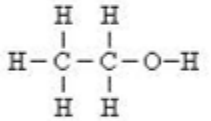
Solution 2005-1:

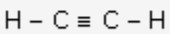
(a) (i) Ethane



(ii) Ethanol



(iii) Ethyne



(b) (i) Ethanol

(ii) Ethanoic acid

(iii) Ethene

Solution 2005-2:

(i) Ethane from sodium propionate

$$CH_3CH_2COONa + NaOH \xrightarrow[\Delta]{CaO} CH_3 - CH_3 + Na_2CO_3$$

(ii) Ethene from iodoethane

$$CH_3 - CH_2I + KOH \rightarrow CH_2 = CH_2 + KI + H_2O$$

(iii) Ethyne from calcium Carbide

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

Solution 2005-3:

Carbon has the unique property of combining any number of carbon atoms to form straight chains, branched chains and rings of different sizes. This property is called catenation.

Solution 2006-1:

(i) IUPAC Name: Propanal

Functional group: Aldehyde

(i) IUPAC Name: Propan-1-ol

Functional group: Alcohol

Solution 2006-2:

(i) $CH_4 + 4Cl_2 \xrightarrow{h\nu} CCl_4 + 4HCl$

(ii) $H - C \equiv C - H$

(iii) Alkynes contain triple bond between carbon atoms where as alkenes contain double bond.

Solution 2006-3:

(i) Homologous

(ii) Unsaturated

(iii) Double

(iv) Addition

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Solution 2007-1:

(i) Propyne
(ii) Pentan-3-ol
(iii) 2-methylpropane
(iv) Ethanoic acid
(v) 1,2-dichloroethane

Solution 2007-2:

General formula	C_nH_{2n}	C_nH_{2n-2}	C_nH_{2n+2}
IUPAC name of the homologus series	Alkenes	Alkynes	Alkanes
Characteristic 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

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Solution 2008-1:

(d)Addition

Solution 2008-2:

(i) Ethane

$$C_2H_5COONa + NaOH \rightarrow C_2H_6 + Na_2CO_3$$

(ii) Methane

$$CH_3I + 2H^- \rightarrow CH_4 + HI$$

(iii) Alkenes

$$C_2H_5Br + KOH(\text{alcoholicsolution}) \rightarrow C_2H_4 + KBr + H_2O$$

(iv) Ethyne

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

Solution 2008-3:

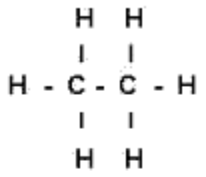
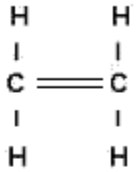
(i) $C_2H_5Br + KOH \rightarrow C_2H_5OH + KBr$

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

(iii) $CH_2 = CH_2 + H_2O \xrightarrow{H^+} CH_2 - CH_2 - OH$

Solution 2008-4:

(a)

Ethane	Ethene
	

(b) (i) Ethane shows Substitution Reaction.

(ii) Ethene shows Addition Reaction.

(c) (i) $2C_2H_6 + 7O_2 \rightarrow 4CO_2 + 6H_2O + \text{Heat}$

(ii) Ethane → Alcohol

$$2C_2H_6 + O_2 \xrightarrow[200^oC]{Cu} 2C_2H_5OH$$

The alcohol is ethanol.

Ethane → Aldehyde

$$C_2H_6 + O_2 \xrightarrow[350^oC]{MoO} CH_3CHO + H_2O$$

The Aldehyde formed is Ethanol.

Ethane → Acid

$$C_2H_6 + O_2 \xrightarrow[350^oC]{MoO} CH_3CHO + H_2O$$

$$CH_3CHO + [O] \xrightarrow[\text{conc. } H_2SO_4]{K_2Cr_2O_7} CH_3COOH$$

The acid formed is Ethanoic acid.

Solution 2009-1:

(i) (b) Statement is wrong. They can undergo addition as well as substitution reaction.

(ii) Acetic acid contains four hydrogen atoms in it.

Solution 2009-2:

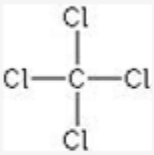
$$CH_3COOH + C_2H_5OH \rightleftharpoons CH_3COOC_2H_5 + H_2O$$

Solution 2009-3:

C_5H_{10} is odd one out as it is an alkene whereas rests of organic compounds are Alkanes.

Solution 2009-4:

Structural Formula of carbon tetrachloride:



The bond is Covalent Bond.

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Solution 2009-5:

(a) $CH_3COONa + NaOH \xrightarrow[\Delta]{CaO} CH_4 + Na_2CO_3$

(b) $CH_2 = CH_2 + Cl_2 \rightarrow CH_2Cl - CH_2Cl$

(c) $CH_2Br - CH_2Br + 2KOH(alc.) \rightarrow CH \equiv CH + 2KBr + 2H_2O$

Solution 2009-6:

(a) Ethyl chloride on hydrolysis with dilute alkali gives ethyl alcohol.

$$C_2H_5Cl + KOH \rightarrow C_2H_5OH + KCl$$

(b) Ethyl chloride by treating with alcoholic KOH gives Ethene.

$$CH_3 - CH_2Cl + KOH \rightarrow CH_2 = CH_2 + KBr + H_2O$$

(c) Ethene adds molecule of water in presence of mineral acids to form Ethyl alcohol.

$$CH_2 = CH_2 + H_2O \xrightarrow{H^+} CH_3 - CH_2 - OH$$

(d) When concentrated sulphuric acid is added to ethyl alcohol, it causes dehydration to give ethene. Ethene reacts with hydrogen in presence of Ni to give ethane.

$$C_2H_5OH \xrightarrow[170^\circ C]{Conc.H_2SO_4} CH_2 = CH_2 + H_2O$$

$$CH_2 = CH_2 + H_2 \xrightarrow[300^\circ C]{Ni} CH_3 - CH_3$$

Solution 2009-7:

(a) Compounds having the same molecular formula, but different structural formula are called isomers and the phenomenon is called isomerism.

(b) IUPAC name of branched chain isomer of C_4H_{10} is 2-methyl propane.