Carboxylic acid

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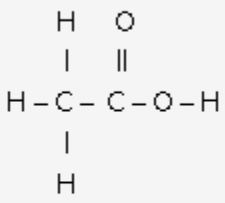
Solution 1:

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

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

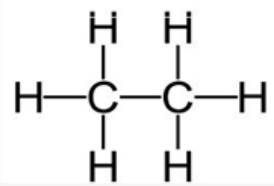
ii) Ethane to acetic acid

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

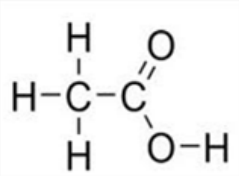
Solution 1999-1:

(i) Structural formula are as under:

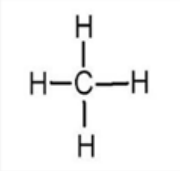
(a) Ethane



(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:

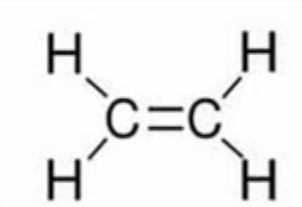
$$CaC_2 + 2H_2O \rightarrow C_2H_2 + Ca(OH)_2$$

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

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

(iii) Ethyne from Calcium carbide

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

(iv) Ethanoic acid from ethane

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

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

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

(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:

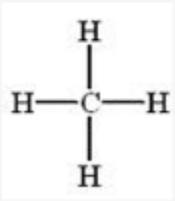
Ethane is burnt in air

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

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

(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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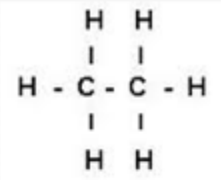
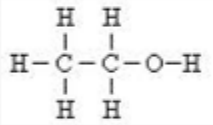
Solution 2005-1:

(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:

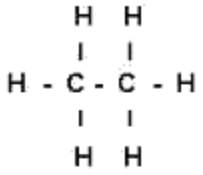
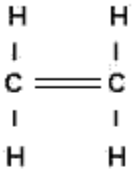
(i) $C_2H_5Br + KOH \rightarrow C_2H_5OH + KBr$

(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 $\rightarrow$ Alcohol

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

The alcohol is ethanol.

Ethane $\rightarrow$ Aldehyde

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

The Aldehyde formed is Ethanol.

Ethane $\rightarrow$ 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:

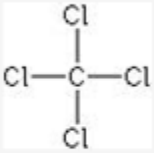
$$CH_3COOH + C_2H_5OH \rightleftharpoons CH_3COOC_2H_5 + H_2O$$

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.