13. Carbon and its Compounds

Part-A

1. Question

Assertion: Chemical bonds in organic compounds are covalent in nature.

Reason: Covalent bond is formed by the sharing of electrons in the bonding atoms.

Does the reason satisfy the given assertion?

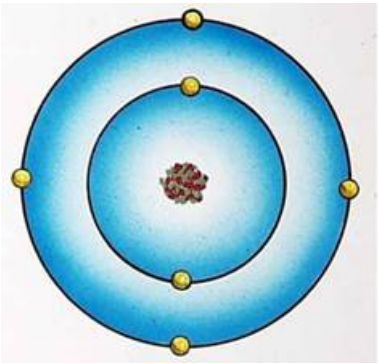
Answer

Yes, the reason satisfies the given assertion.

Explanation: The carbon atom has:

i. Atomic number = 6

ii. Electronic configuration = 2,4

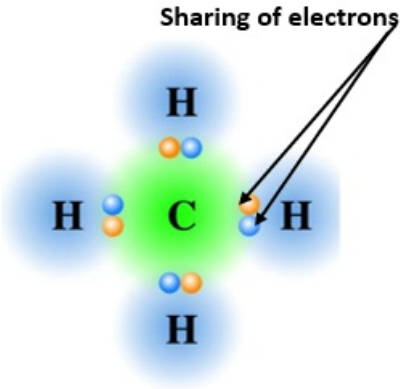


iii. Four electrons in the outermost shell

To achieve noble gas configuration (2,8) carbon atom shares its valence electrons (electrons in the outermost shell) with other atoms of carbon or with atoms of other elements.

In the covalent bond, sharing of electrons takes place. For

example: CH_4



2. Question

Assertion: Diamond is the hardest crystalline form of carbon.

Reason: Carbon atoms in diamond are tetrahedral in nature (Verify the suitability of reason to the given Assertion mentioned above)

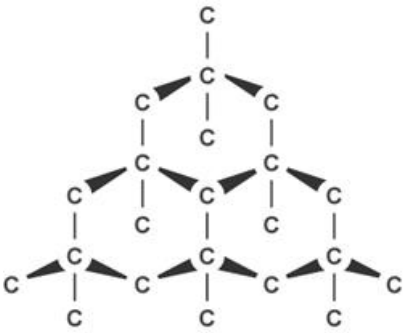
Answer

i. In diamond, every carbon atom is covalently bonded to four

neighbouring atoms in a tetrahedral way.

ii. This leads to a tetrahedral three dimensional structure.

iii. Structure of diamond is given below:



iv. This fact is responsible for its hardness and rigidity.

3. Question

Assertion: Due to catenation a large number of carbon compounds are formed.

Reason: Carbon compounds show the property of allotropy.

Does the reason hold good for the given Assertion?

Answer

Yes, the reason holds good for the given assertion.

Explanation: Carbon compounds show the property of allotropy.

Allotropy is defined as the property by which an element can exist in more than one form.

i. The forms are physically different.

ii. But chemically similar.

Due to catenation, carbons atoms form a large number of compounds (allotropes)

4. Question

Buckminster fullerene is the allotropic form of _____ .(Nitrogen / Carbon / Sulphur)

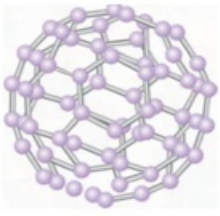
Answer

Carbon

Explanation: Fullerene is an another types of carbon allotropes.

i. The first discovered fullerene contains 60 carbon atoms in the shape of a football. (C-60).

ii. It is named as Buck Minster Fullerene.



Fullerene

It resembles football

5. Question

Even though it is a non-metal, graphite conducts electricity. It is due to the presence of _____ . (free electrons / bonded electrons)

Answer

free electrons

Explanation: Being a non-metal, graphite is a good conductor of electricity due to the following reasons:

i. In graphite, carbon atoms are arranged in different layers.

ii. In each layer, every carbon atom is linked to three

neighbouring carbon atoms.

iii. Thus, the fourth electron of each carbon atom is free to move

continuously within the entire layer.

iv. Because of the presence of these free electrons in different

layers, graphite becomes a god conductor of electricity.

6. Question

The formula of methane is CH_4 and its succeeding member ethane is expressed as

C_2H_6. The common difference of succession between them is _____ .(CH_2 / C_2 H_2)

Answer

CH_2

Explanation: The common difference between CH_4 and C_2H_6 :

$C_2H_6 – CH_4 = CH_2$

A homologous series is a group or a class of organic compounds having same general molecular formula and similar chemical properties in which the successive members differ by a CH2 group.

7. Question

IUPAC name of the first member of alkyne is _____ . (ethene / ethyne)

Answer

ethyne

Explanation: Alkyne is an unsaturated hydrocarbon.

i. The unsaturated hydrocarbons containing carbon to carbon triple bond are called alkynes.

ii. Alkynes are named by replacing suffix of alkane with “-yne”.

iii. The first member of alkane is ethane.

iv. Thus, the first member of alkyne is named as ethyne.

Note: The unsaturated hydrocarbons are those which contain carbon to carbon double bonds C=C or carbon to carbon triple bonds -CΞC- in their molecules.

8. Question

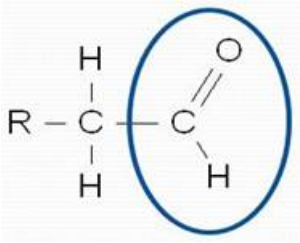
Out of ketonic and aldehydic group, which is the terminal functional group?

Answer

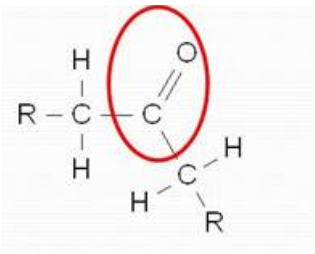
Aldehydic group is the terminal functional group.

i. Terminal functional group is the one that occur at the end of carbon chain.

ii. Aldehyde is a terminal functional group because it occurs at the end of the group.



iii. Ketone is not a terminal functional group because it does not occur at the end of the group. It occurs at the centre.



9. Question

Acetic acid is heated with Na_2CO_3 in a test tube. A colourless and odourless gas (X) is evolved. The gas turns lime water milky. Identify X.

Answer

When acetic acid (CH_3COOH) is heated with Na_2CO_3 , the following reaction takes place:

$$\underset{\text{Acetic acid}}{CH_3COOH} + \underset{\substack{\text{Sodium}\\\text{Carbonate}}}{Na_2CO_3} \rightarrow CH_3COONa + H_2O + CO_2$$

i. In this reaction, when sodium carbonate comes in contact

with the gas released in the form of an effervescence, it turns

milky. This is chemical test for carbon dioxide gas.

ii. Hence, the gas (X) is carbon dioxide.

10. Question

Assertion: Denaturation of ethyl alcohol makes it unfit for drinking purpose.

Reason: Denaturation of ethyl alcohol is carried out by pyridine.

Check whether the reason is correct for assertion.

Answer

Yes, the reason is correct for assertion.

Explanation: Pyridine is a harmful substance. If it is added to ethyl alcohol. It makes ethyl alcohol unfit for drinking purpose

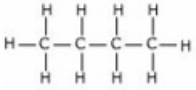
Part-B

1. Question

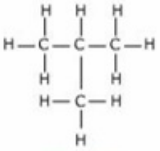
Write down the possible isomers and give their IUPAC names using the formula C_4H_{10}.

Answer

Possible isomers of C_4H_{10} are:



A



B

i. The IUPAC name of isomer A is butane.

ii. The IUPAC name of isomer B is iso-butane.

Note: Isomers are the two or more compounds having same molecular formula but different chemical structures.

2. Question

Diamond is the hardest allotrope of Carbon. Give reason for its hardness.

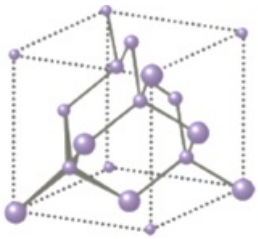
Answer

Diamond is the hardest allotrope of carbon because:

a) In diamond, each carbon atom is covalently bonded to four other carbon atoms in a tetrahedral way.

b) This leads to a tetrahedral three dimensional structure.

c) Three dimensional structure of diamond is:



d) The above reason is responsible for its hardness.

3. Question

An organic compound (A) is widely used as a preservative in pickle and has a molecular formula $C_2H_4O_2$. This compound reacts with ethanol to form a sweet smelling compound

(B).

(i) Identify the compounds A and B.

(ii) Name the process and write the corresponding chemical equation.

Answer

Given:

a) Organic compound has a molecular formula: $C_2H_4O_2$

b) Used as a preservative.

c) Reacts with ethanol to form a sweet smelling substance.

(i) As the organic compound is a preservative, hence it is an acetic acid (ethanoic acid).

Ethanoic acid reacts with ethanol to form a sweet smelling substance called ester(B).

Thus, A is ethanoic acid and B is ester.

(ii) The reaction taking place:

$$\underset{\text{Ethanol}}{C_2H_5OH} + \underset{\substack{\text{Ethanoic acid}\\(A)}}{CH_3COOH} \rightarrow \underset{\substack{\text{Ester}\\(B)}}{CH_3COOC_2H_5} + H_2O$$

The above process is called esterification.

4. Question

An organic compound (A) of molecular formula C_2H_6O on oxidation with alkaline $KMnO_4$ solution gives an acid (B) with the same number of carbon atoms. Compound A is used as an antiseptic to sterilize wounds, in hospitals. Identify A and B. Write the chemical equation involved in the formation of B from A.

Answer

Given:

i. Organic compound has a molecular formula = C_2H_6O

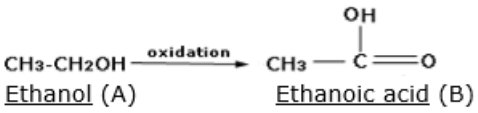
ii. Used as an antiseptic to sterilize wounds.

iii. Oxidation with $KMnO_4$ gives an acid.

As the organic compound is used as an antiseptic to sterilize wounds, it must be an ethanol.

Ethanol (A) undergoes oxidation with $KMnO_4$ to form a carboxylic acid, i.e., ethanoic acid (B)

The reaction takes place is given below:



Thus, A is ethanol and B is ethanoic acid.

5. Question

C_2H_6O is the molecular formula for two compounds A and B. They have different structural formula.

i) What is this phenomenon known as?

ii) Give the structural formula of A and B.

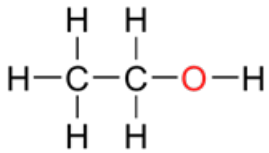
iii) Write down their common and IUPAC names.

iv) Mention the functional groups of A and B.

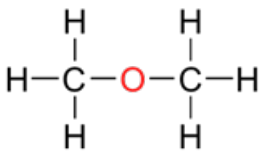
Answer

i) C_2H_6O is the molecular formula for two compounds A and B but have different structural formula. This phenomenon is called isomerism.

ii) The structural formula of A (CH_3CH_2OH) is:



The structural formula of B ($CH_3—O—CH_3$) is:



iii) Structure A

Common name: Ethyl alcohol

IUPAC name: Ethanol

Structure B

Common name: Dimethyl ether

IUPAC name: Methoxymethane

iv) The functional group of A is alcohol

The functional group of B is ether

6. Question

Rewrite the following choosing the correct word from each pair given in brackets:

The hydrocarbons containing at least one carbon to carbon _____ (double/triple) bond are called _____(alkenes/alkynes).They have the general formula C_nH_{2n}.These were previously called _____(olefins/paraffins). When this compound is treated with _____(bromine/lime) water, decolourisation occurs because it is _____(saturated/unsaturated).

Answer

The hydrocarbons containing at least one carbon to carbon double bond are called alkenes. They have the general formula C_nH_{2n}. These were previously called olefins. When this compound is treated with bromine water, decolourisation occurs because it is unsaturated.

Explanation:

The hydrocarbons having general formula C_nH_{2n} are alkenes which contain at least one carbon to carbon double bond (C=C)

In earlier times, alkenes are known as olefins (meaning-oil) because the lower gaseous members of the family form oily products when treated with chlorine.

When alkene is treated with bromine water (Br_2), no change of colour takes place (decolourization) because it is an unsaturated compound (have at least one bond)

7. Question

Identify the compounds using the clues given below:

i) This is a dark coloured syrupy liquid containing 30% of sucrose.

ii) During manufacture of ethanol this is added as food for yeast.

iii)This enzyme converts sucrose into glucose and fructose.

iv) This compound contains 95.5% ethanol and 4.5% water.

v) This compound contains 100% pure alcohol.

Answer

i) Molasses

Explanation: Molasses is a dark coloured syrupy liquid which is used in the manufacture of ethanol.

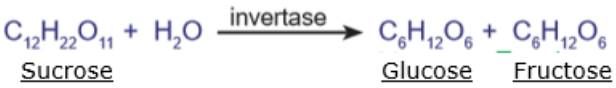
It contains 30% of sucrose which cannot be separated by the crystallization process.

ii) Nitrogenous matter

Explanation: Molasses usually contain nitrogenous matter which act as food for yeast during fermentation.

iii) Invertase

Explanation: The enzyme invertase present in yeast, bring about the conversion of sucrose into glucose and fructose.



iv) Rectified spirit

Explanation: Rectified spirit is an aqueous solution of ethanol which contains 95.5% of ethanol and 4.5% of water.

v) Absolute alcohol

Explanation: The mixture of “rectified spirit” is heated under reflux over quicklime for about 5 to 6 hours. Then it is allowed to stand for 12 hours.

On distillation of the above mixture, pure alcohol (100%) is obtained. This is called absolute alcohol.

8. Question

Read each description given below and say whether it fits for ethanol or ethanoic acid.

i) It is a clear liquid with a burning taste.

ii) It is used to preserve biological specimens in laboratories.

iii) It is used to preserve food and fruit juices.

iv) On cooling, it is frozen to form ice flakes which look like a glacier.

Answer

i) Ethanol is a clear liquid and has a burning taste.

ii) Ethanol is used as a preservative for biological specimens in labs.

Ethanol

iii) Ethanoic acid (acetic acid) is used for making vinegar which is used as a preservative in food and fruit juices.

iv) On cooling, pure ethanoic acid is frozen to form ice like flakes. They look like glaciers, so it is called glacial acetic acid.

9. Question

Match these words /sentences with appropriate statements given below:

(methanol, fermentation, catenation, homologous series, hydrogen gas)

i) The ability of carbon to form large number of compounds through self-linking property.

ii) Alcohols react with sodium to give this element.

iii) This series helps in giving knowledge and enables systematic study of members.

iv) Formation of simple molecules from complex organic compounds using enzymes.

v) Unlike ethanol, the intake of this compound in very small quantities can cause death.

Answer

i) Catenation

Explanation: Carbon has:

a) Ability to form covalent bonds with other atoms of carbon.

b) This gives rise to a larger number of molecules through self-linking property.

c) This property is called catenation.

ii) Hydrogen gas

Explanation: Carbon compounds such as alcohols react with sodium to liberate hydrogen gas.

Example: $2CH_3CH_2OH + 2Na \rightarrow 2CH_3CH_2ONa + H_2\uparrow$

iii) Homologues series

Explanation: Homologues series:

a) All the members are differ by a CH_2 group.

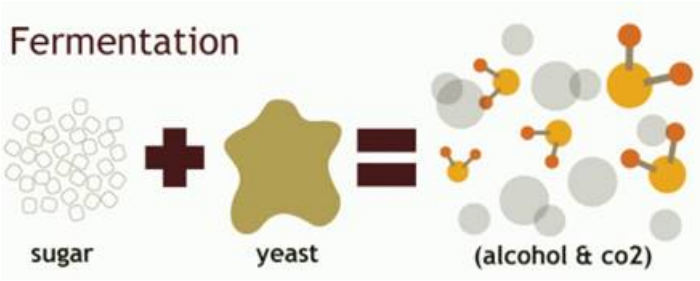
Formula	Common name
CH_4	Methane
CH_3CH_3	Ethane
$CH_3CH_2CH_3$	Propane
$CH_3CH_2CH_2CH_3$	n-Butane

b) It helps to predict the properties of the members of the series that are yet to be prepared.

c) Knowledge of homologous series gives a systematic study of the members.

iv) Fermentation

Explanation: Fermentation is the process of formation of simple molecules from complex organic compounds using enzymes.



v) Methanol

Explanation: Methanol:

a) Intake of methanol is very dangerous and can even cause death.

b) If it is consumed, it gets oxidized into methanal in the liver.

c) It affects the liver and causes death.

Part-C

1. Question

Fill the blanks in the given table using suitable formulae.

No.	Alkane	Alkene	Alkyne
1.	C_2H_6 ethane	_____ ethene	C_2H_2 ethyne
2.	_____Propane	C_3H_6 Propene	_____propyne
3.	C_4H_{10} Butane	_____Butene	_____Butyne

Answer

No.	Alkane	Alkene	Alkyne
1.	C_2H_6 ethane	$\underline{C_2}\underline{H_4}$ ethene	C_2H_2 ethyne
2.	$\underline{C_3}\underline{H_8}$ Propane	C_3H_6 Propene	$\underline{C_3}\underline{H_4}$ propyne
3.	C_4H_{10} Butane	$\underline{C_4}\underline{H_8}$ Butene	$\underline{C_4}\underline{H_6}$ Butyne

Explanation: All the members of homologues series have general formula given below:

Alkane: $C_nH_{2n + 2}$

Alkene: C_nH_{2n}

Alkyne: C_nH_{2n-2}

Value of n	Alkane (C_nH_{2n+2})	Alkene (C_nH_{2n})	Alkyne (C_nH_{2n-2})
n = 2	$C_2H_{2\times2+2}$ = C_2H_6 ethane	$C_2H_{2\times2}$ =$\underline{C_2H_4}$ ethene	$C_2H_{2\times2-2}$ =C_2H_2 ethyne
n = 3	$C_3H_{2\times3+2}$ = C_3H_8 Propane	$C_3H_{2\times3}$ = C_3H_6 Propene	$C_3H_{2\times3-2}$ = C_3H_4 propyne
n = 4	$C_4H_{2\times4+2}$ = C_4H_{10} Butane	$C_4H_{2\times4}$ = C_4H_8 Butene	$C_8H_{2\times4-2}$ = C_4H_6 Butyne

2. Question

Homologous series predict the properties of the members of the series. Justify this statement through its characteristics.

Answer

The characteristics of homologues series are:

i. Each member of the series differs from the preceding or succeeding member by a common difference of CH_2

ii. All members of each homologous series contain same elements and same functional groups.

iii. All members of each homologous series have same general molecular formula.

Alkane: C_nH_{2n+2}

Alkene: C_nH_{2n}

Alkyne: C_nH_{2n-2}

iv. The members in each homologous series show a regular gradation in their physical properties with respect to increase in molecular mass.

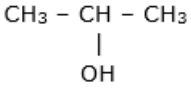
v. The chemical properties of the members of each homologous series are similar.

vi. All members of each homologous series can be prepared by using same general method.

3. Question

Write the common name and IUPAC name of the following:

i) CH_3CH_2CHO ii) CH_3COCH_3

iii)


iv) CH_3COOH v) HCHO

Answer

i) CH_3CH_2CHO

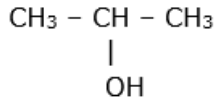
Common name: Propionaldehyde

IUPAC name: Propanal

ii) CH_3COCH_3

Common name: Dimethyl ketone (acetone)

IUPAC name: Propanone

iii)


Common name: Isopropyl alcohol(or) secondary propyl alcohol

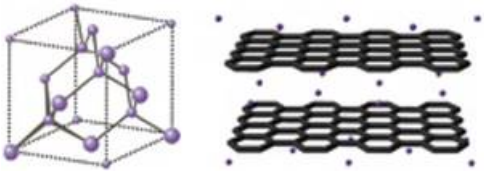
IUPAC name: 2-propanol

iv) HCHO

Common name: Formaldehyde

IUPAC name: Methanal

4. Question



Look at the diagram and answer the following questions:

i) What type of structure do diamond and graphite have?

ii) Why are diamonds used in cutting tools?

iii) Why is graphite used in electrical circuits?

iv) Name the force that accounts for the softness of graphite.

v) Name the precious diamond you know and give its weight in grams.

Answer

i) In diamond:

Diamond exists in tetrahedral three dimensional structure.

In Graphite:

Every carbon atom is bonded to three other carbon atoms by covalent bonds. Graphite exists in hexagonal layer structure.

ii) Diamond is used to cut metals due to the following reasons:

a. Brilliant, pure diamond is an extremely hard substance on the earth.

b. It is really very harder than metals and rocks present in the earth.

iii) Free electrons move continuously within the entire layer of graphite, thus it is a good conductor of electricity and mstly used in electrical circuits.

iv) Graphite is a soft metal due to the following reasons:

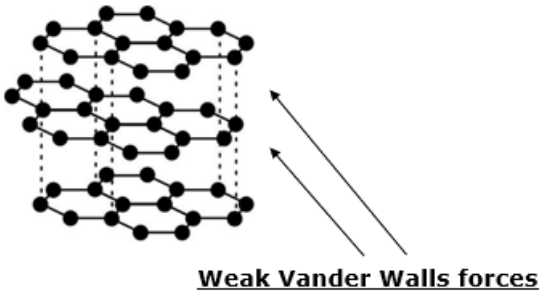
a. A graphite crystal is hexagonal.

b. The regular arrangement of atoms in graphite is in hexagonal layers.

c. The layers are loosely bounded with each other.

d. As there is weak Vander Walls forces present between them, hence the layers slide with each other.

e. This makes the graphite soft.



v) Blue moon diamond si one of three precious diamond.

In carat, its weight is 12.03 carat.

In grams

1 carat = 0.2 grams

12.03 carats =

⇒ 12.03 × 0.2 grams

⇒ 2.406grams

In grams, blue diamond weight is 2.406 grams

5. Question

C_nH_{2n+2} is the general formula of a homologous series of hydrocarbons.

i) Is this series saturated or unsaturated?

ii) Name the series described above. Give the formula and name of the member with two carbon atoms.

iii) Draw the structural formula of the first member of this series.

iv) Define the homologous series and find the common difference between the successive members of this family.

v) Write the formula of n-butane and n-pentane.

Answer

i) The series is saturated.

Explanation: C_nH_{2n+2} is the general formula of a homologous series of alkane which is a saturated hydrocarbon.

Note: Saturated hydrocarbons are those organic compounds which contain carbon–carbon single bond. These were earlier named as paraffins.

ii) The given is homologues series of alkane hydrocarbons.

The formula and name of the member with two carbon atoms:

n=2

$C_2H_{2\times2+2} = C_2H_6$ (ethane)

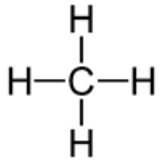
Thus, formula is C_2H_6 and name is ethane

iii) The first member of the series is:

n=1

$C_1H_{2\times1+2}$ = CH_4 (methane)

The structural formula of methane is:



iv) Homologues series: A homologous series is a group or a class of organic compounds having same general molecular formula and similar chemical properties in which the successive members differ by a CH_2 group.

v) In butane, there are four carbon atoms and in pentane there are five carbon atoms.

Value of n	Alkane (C_nH_{2n+2})
n = 4	$C_4H_{2\times4+2} = C_4H_{10}$ Butane
n = 5	$C_5H_{2\times5+2} = C_5H_{12}$ Pentane

6. Question

Ethanol is heated with excess concentrated H_2SO_4 at 443K.

i) Name the reaction that occurs and explain it.

ii) Write the equation for the above reaction.

iii) What is the product formed? What happens when this gas is passed through bromine water?

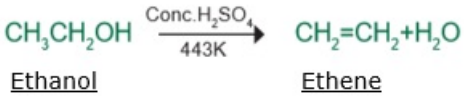
iv) When ethanol vapour is passed through bromine water, why does no change occur?

Answer

i) When ethanol is heated with excess conc. H_2SO_4 at 443K, it undergoes intra molecular dehydration (i.e. removal of water within a molecule of ethanol) to give ethene.

The reaction is intra molecular dehydration reaction.

ii) The equation for the above reaction is:



iii) The product formed is ethane (alkene), an unsaturated hydrocarbon which contains a double bond.

When this is passed through bromine water, it decolourises the water. It means decolourisation occurs.

iv) When ethanol vapour is passed through bromine water, no changes occur because it is neither a saturated nor an unsaturated hydrocarbon.

Ethanol is a functional group, hence no changes occur.

7. Question

Complete the following table:

Molecular Formula	Common Name	IUPAC Name
$CH_3CH_2CH_2CH_2OH$		
	Dimethyl ketone	
		Propanal
HCOOH		
		Butanone

Answer

Molecular Formula	Common Name	IUPAC Name
$CH_3CH_2CH_2CH_2OH$	n-Butyl alcohol	1-Butanol
CH_3COCH_3	Dimethyl ketone	Propanone
CH_3CH_2CHO	Propionaldehyde	Propanal
HCOOH	Formic acid	Methanoic acid
$CH_3CO\ CH_2CH_3$	Ethyl methyl ketone	Butanone

8. Question

Ethanoic acid is a member of Homologous series with general formula

C_nH_{2n+1} COOH.

i) Name the series and give its functional group.

ii) Give the molecular formula and the common name of ethanoic acid.

iii) If this compound is mixed with ethanol in the presence of Conc.H_2SO_4, a sweet smelling compound is formed. Give the equation and name the compound.

iv) Ethanoic acid reacts with carbonates. Which gas is liberated during this reaction?

v) Write the balanced equation for the reaction of ethanoic acid with carbonate.

vi) Your grandmother has prepared mango pickle. What has she added to preserve it for a long time?

Answer

i) The given is a member of homologues series of carboxylic acid.

Its functional group is carboxylic.

ii) Ethanoic acid:

Molecular formula: CH_3COOH

Common name: Acetic acid

iii) Ethanoic acid reacts with ethanol in the presence of concentrated H_2SO_4, a sweet smelling compound "ester" is formed. The reaction taking place:

$$\underset{\text{Ethanol}}{C_2H_5OH} + \underset{\text{Ethanoic acid (A)}}{CH_3COOH} \rightarrow \underset{\text{Ester (B)}}{CH_3COOC_2H_5} + H_2O$$

The above process is called esterification.

iv) Ethanoic acid reacts with carbonates and bicarbonates and produces brisk effervescence due to the evolution of carbon dioxide.

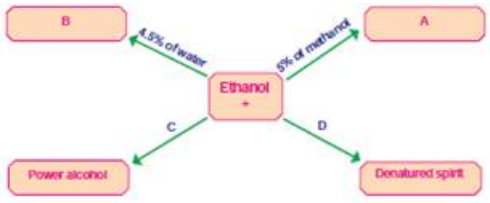
v) The reaction of ethanoic acid with a carbonate (Na_2CO_3) is:

$2CH_3COOH + Na_2CO_3 \rightarrow 2CH_3COONa + CO_2\uparrow + H_2O$

vi) She has added vinegar to preserve it for long time. Acetic acid is used for making vinegar.

9. Question

i) Identify A & B.



ii) Convert ethanol into power alcohol. Mention one of its uses.

iii) What should be added to obtain denatured spirit?

iv) Give one use of denatured spirit.

Answer

i) A is methylated spirit which is a mixture of 95% of ethanol and 5% of methanol.

B is rectified spirit which is a mixture of 95.5% of ethanol and 4.5% of water.

ii) By adding petrol to ethanol, we can get power alcohol.

Power alcohol is used in automobiles. It acts as best fuel for automobiles.

iii) Pyridine should be added to obtained denatured spirit. This makes alcohol unfit for drinking.

iv) Denatured spirit is used as a solvent and a fuel.

10. Question

Write a balanced equation using the correct symbols for these chemical reactions:

i) Action of hydrogen on ethene in the presence of nickel catalyst.

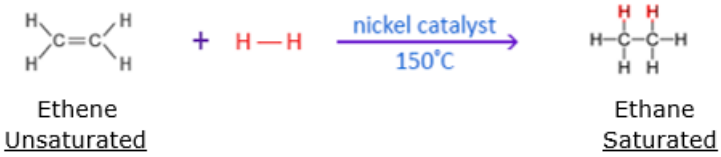
ii) Combustion of methane evolving carbondioxide and water.

iii) Dehydrogenation of ethanol.

iv) Decarboxylation of Sodium salt of ethanoic acid.

Answer

i) When hydrogen reacts with ethene (unsaturated hydrocarbon) in the presence of nickel catalyst, it gives ethane (saturated hydrocarbon). The reaction takes place given below:



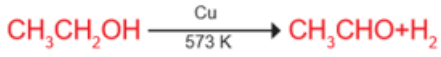
Ethene
Unsaturated

Ethane
Saturated

ii) Combustion of methane evolving carbon dioxide and water:

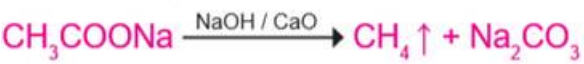
$CH_4 + 2O_2 \rightarrow CO_2 + 2H_2O$

iii) When the vapour of ethanol is passed over heated copper catalyst at 573 K, it is dehydrogenated to acetaldehyde. This reaction is called dehydrogenation reaction.



Ethanol Acetaldehyde

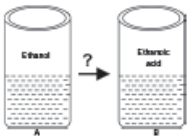
iv) Decarboxylation (Removal of CO_2) : When sodium salt of ethanoic acid is heated with soda lime (solid mixure of 3 parts of NaOH and 1 part of CaO), methane gas is formed.



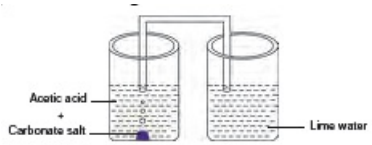
11. Question

Look at the picture and identify what happens. Support your answer with equations.

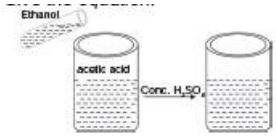
i) How is B formed from A?



ii) What happens when acetic acid is treated with carbonate salt. Name the gas produced. What happens when this gas is treated with lime water?



iii) What happens when acetic acid is treated with ethanol in the presence of concentrated H_2SO_4? Give the equation.

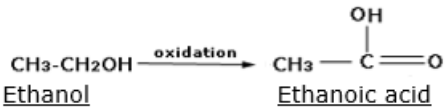


Answer

i. Preparation of ethanoic acid from ethanol:

Ethanol undergoes oxidation with $KMnO_4$ to form a carboxylic acid, i.e., ethanoic acid.

The reaction takes place is given below:



ii. Ethanoic acid reacts with sodium bicarbonate, it gives brisk effervescence of carbon dioxide.

The reaction of ethanoic acid with a carbonate (Na_2CO_3) is:

$2CH_3COOH + Na_2CO_3 \rightarrow 2CH_3COONa + CO_2 \uparrow + H_2O$

Ethanoic acid — Sodium salt of ethanoic acid

When the released gas is treated with limewater, it turns

milky.

iii. When acetic acid is treated with ethanol in the presence of concentrated H_2SO_4, it forms a sweet smelling substance called ester. This reaction is called esterification.

$C_2H_5OH + CH_3COOH \rightarrow CH_3COOC_2H_5 + H_2O$

Ethanol Ethanoic acid Ester

12. Question

Organic compounds ‘A’ and ‘B’ are the isomers with the molecular formula C_2H_6O.

Compound ‘A’ produces hydrogen gas with sodium metal, whereas compound ‘B’ does not. Compound ‘A’ reacts with acetic acid in the presence of concentrated H_2SO_4 bto form compound ‘C’ with a fruity flavour. What are the isomers ‘A’, ‘B’ and the compound ‘C’?

Answer

It is given that C_2H_6O has two isomers A and B.

Compound A produces hydrogen gas with sodium metal,

i. Compound A must be an ethanol. Ethanol reacts with sodium metal to produce hydrogen gas.

Whereas compound B does not react with sodium metal.

ii. Ethanol reacts with acetic acid in the presence of concentrated H_2SO_4, a sweet smelling compound “ester” is formed. The reaction taking place:

$C_2H_5OH + CH_3COOH \rightarrow CH_3COOC_2H_5 + H_2O$

Ethanol Ethanoic acid Ester

(A) (C)

The above process is called esterification.

Thus, A is CH_3CH_2OH (ethanol)

B is $CH_3—O—CH_3$ (diethyl ether)

C is ester

13. Question

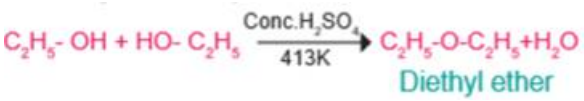
Organic compound ‘A’ of molecular formula C_2H_6O liberates hydrogen gas with sodium metal. ‘A’ gives ‘B’ of formula C4H10O, when it reacts with concentrated H_2SO_4 at 413K. At 443K with concentrated H_2SO_4 ‘A’ gives compound ‘C’ of formula C_2H_4. This compound ‘C’ decolourises bromine water. What are ‘A’, ‘B’ and ‘C’?

Answer

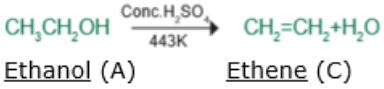
It is given that organic compound liberates hydrogen gas with sodium metal.

i. It must be an ethanol. Ethanol reacts with sodium metal to form sodium ethoxide and hydrogen gas.

ii. When ethanol (A) reacts with concentrated H_2SO_4 at 413K, it gives diethylether (B).



iii. When ethanol (A) reacts with concentrated H_2SO_4 at 413K, it gives ethene (C)



Ethene (C) when reacts with bromine water, it delcolourises it.

Thus, A is ethanol.

B is diethyl ether.

C is ethene.

14. Question

Organic compound ‘A’ of molecular formula $C_2H_4O_2$ gives brisk effervescence with sodium bicarbonate solution. Sodium salt of A on treatment with soda lime gives a hydrocarbon ‘B’ of molecular mass 16. It belongs to the first member of the alkane family. What are ‘A’ and ‘B’ and how will you prepare ‘A’ from ethanol?

Answer

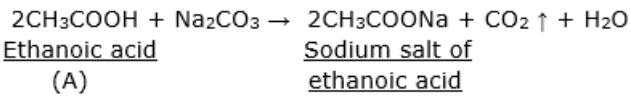
It is given that organic compound gives brisk effervescence with sodium bicarbonate solution.

i. As we know that when ethanoic acid reacts with sodium bicarbonate, it gives brisk effervescence of carbon dioxide.

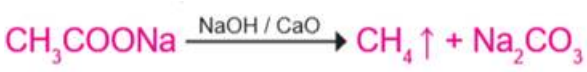
Hence, the organic compound “A” must be ethanoic acid

(CH_3COOH)

The reaction of ethanoic acid with a carbonate (Na_2CO_3) is:



ii. When sodium salt of ethanoic acid is heated with soda lime, methane (alkane) gas is formed.

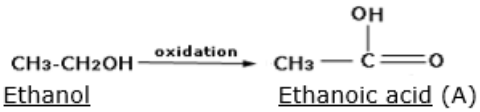


Methane (B) formed belongs to the first member of the alkane family

iii. Preparation of ethanoic acid (A) from ethanol:

Ethanol undergoes oxidation with $KMnO_4$ to form a carboxylic acid, i.e., ethanoic acid (A)

The reaction takes place is given below:



Ethanol Ethanoic acid (A)

Thus, A is ethanoic acid and B is methane.