

10th Science Chapter 4 Carbon and Its Compounds

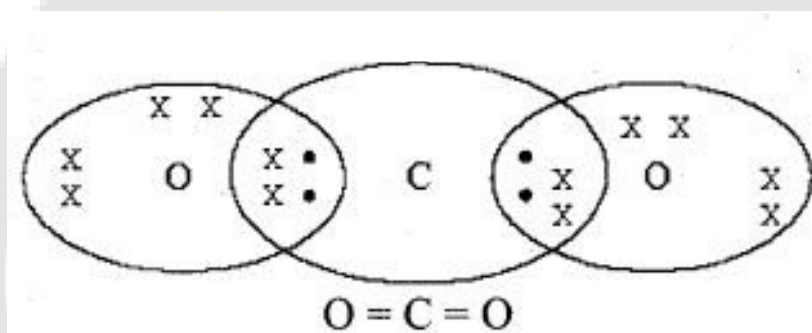
Intext Questions

Intext Questions Page No. 61

Question 1.

What would be the electron dot structure of carbon dioxide which has the formula CO_2 ?

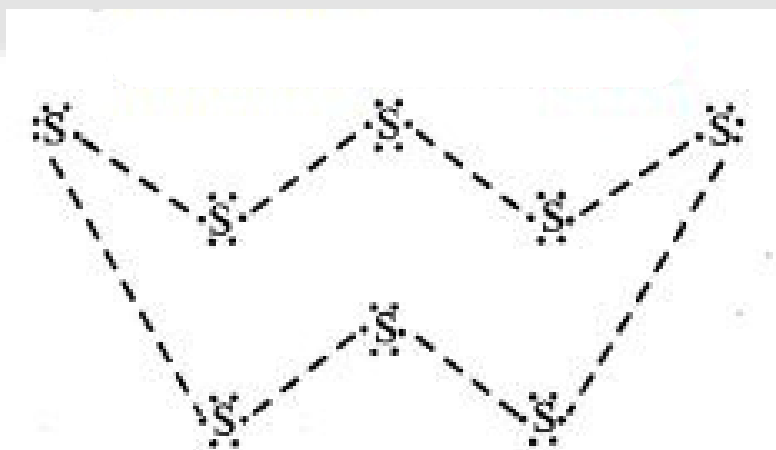
Answer:



Question 2.

What would be the electron dot structure of a molecule of sulphur which is made up of eight atoms of sulphur? (Hint: The eight atoms of sulphur are joined together in the form of a ring).

Answer:



Intext Questions Page No. 68,69

Question 1.

How many structural isomers can you draw for pentane?

Answer:

Three structural isomers are possible for pentane.

Question 2.

What are the two properties of carbon which lead to the huge number of carbon compounds we see around us?

Answer:

The two features of carbon that give rise to a large number of compounds are as follows:

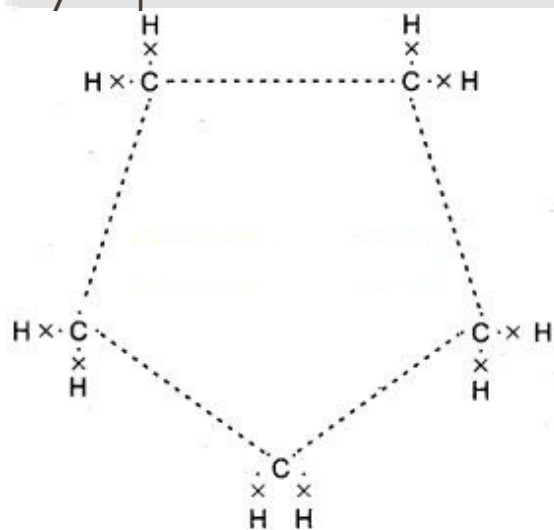
1. Carbon has the unique ability to form bonds with other atoms of carbon, giving rise to large molecules. This property is called catenation.
2. Since carbon has a valency of four, it is capable of bonding with four other atoms of carbon or atoms of some other mono-valent element.

Question 3.

What will be the formula and electron dot structure of cyclopentane?

Answer:

The formula for cyclopentane is C_5H_{10} . Its electron dot structure is given below:



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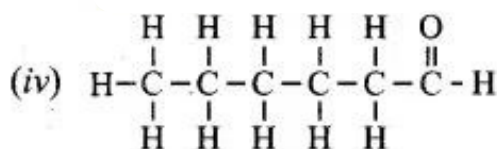
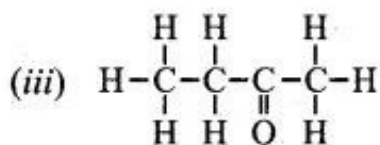
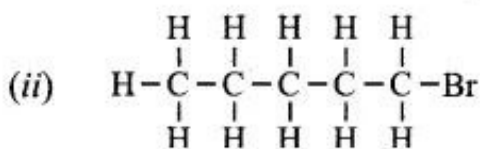
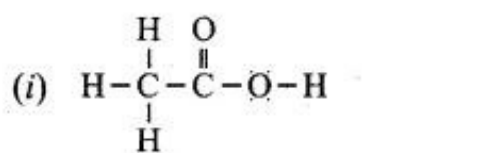
Question 4.

Draw the structures for the following compounds:

- (i) Ethanoic acid
- (ii) Bromopentane
- (iii) Butanone
- (iv) Hexanal

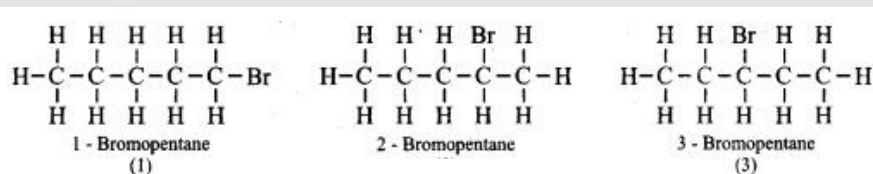
Are structural isomers possible for bromo-pentane?

Answer:

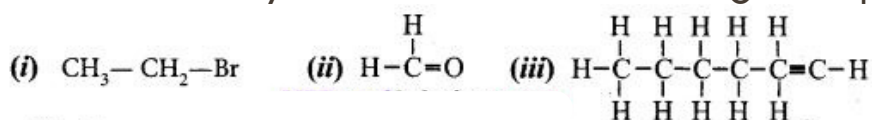


Yes, there are many structural isomers possible for bromo-pentane.

Among them, the structures of the three isomers are given.



Question 5. How would you name the following compounds?



Answer:

- (i) Bromoethane
- (ii) Methanal (formaldehyde)
- (iii) Hexyne.

Intext Questions Page No. 71

Question 1.

Why is the conversion of ethanol to ethanoic acid an oxidation reaction?

Answer:

Addition reaction means adding oxygen. Adding ethanol to potassium permanganate, we get ethanoic acid. Hence this reaction is called oxidation reaction.



Since in this reaction one oxygen is added to ethanol, hence it is an oxidation reaction.

Question 2.

A mixture of oxygen and ethyne is burnt for welding. Can you tell why a mixture of ethyne and air is not used?

Answer:

If a mixture of oxygen and ethyne is burnt, then ethyne burns completely producing a blue flame. The oxygen ethyne flame is extremely hot and produces a very high temperature which is used for welding metals. A mixture of ethyne and air is not used for welding because the burning of ethyne in air produces a sooty flame due to incomplete combination which is not enough to melt metals for welding.

Intext Questions Page No. 74

Question 1.

How would you distinguish experimentally between an alcohol and a carboxylic acid?

Answer:

1. We can distinguish between an alcohol and a carboxylic acid on the basis of their reaction with carbonates and hydrogen carbonates. The acid reacts with carbonate and hydrogen carbonate to evolve CO₂ gas that turns lime-water milky.
2. Metal carbonate/Metal hydrogen carbonate + Carboxylic acid → Salt + Water + Carbon dioxide.
3. In the litmus test, alcohol shows no change in colour whereas carboxylic acid turns blue litmus red.
4. With sodium metal, alcohol gives effervescence but carboxylic acid does not give it. Alcohols, on the other hand, do not react with carbonates and hydrogen carbonates.

Question 2.

What are oxidising agents?

Answer:

Some substances are capable of adding oxygen to others. These substances are known as oxidising agents.

Intext Questions Page No. 76

Question 1.

Would you be able to check if the water is hard by using a detergent?

Answer:

Detergents are remaining effective in hardwater. Because of this reason, we can check if water is hard by using a detergent.

Question 2.

People use a variety of methods to wash clothes. Usually after adding the soap, they 'beat' the clothes on a stone, or beat it with a paddle, scrub with a brush or the mixture is agitated in a washing machine. Why is agitation necessary to get clean clothes?

Answer:

The soap molecules form structures called micelles in water, where one end of the molecules is towards the oil droplet while the ionic end-faces outside. This forms emulsion in water and we can wash our clothes clean.

MP Board Science Chapter 4

Ncert Textbook Exercises

Question 1.

Ethane, with the molecular formula C_2H_6 has -

- (a) 6 covalent bonds (b) 7 covalent bonds
(c) 8 covalent bonds (d) 9 covalent bonds

Answer: (b) 7 covalent bonds.

Question 2.

Butanone is a four-carbon compound with the functional group.

- (a) Carboxylic acid (b) Aldehyde (c) Ketone (d) Alcohol

Answer: (c) Ketone.

Question 3.

While cooking, if the bottom of the vessel is getting blackened on the outside, it means that.

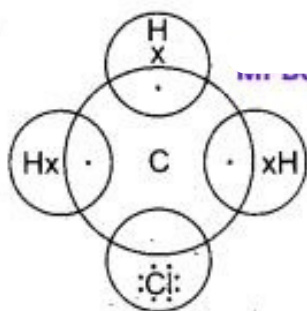
- (a) The food is not cooked completely. (b) The fuel is not burning completely.
(c) The fuel is wet. (d) The fuel is burning.

Answer: (b) the fuel is not burning completely.

Question 4.

Explain the nature of the covalent bond using the bond formation in CH_3Cl .

Answer: The structure of CH_3Cl is given below:



Carbon has four valence electrons. It shares one electron each with three hydrogen atoms and one electron with chlorine. The bond between C and Cl atoms is covalent but due to higher value of electro-negativity of Cl, the C-Cl bond is polar in nature.

MP Board Science Chapter 4

4. Ethanol is oxidized to give ethanoic acid in the presence of acidified KMnO_4 while no reaction takes place with ethanoic acid in the presence of acidified KMnO_4 .

Difference in physical properties:

Ethanol	Ethanoic acid
This is in liquid form at room temperature. Its melting point is 156°K .	Its melting point is 290K and hence it often freezes during winter in cold climates.

Difference in pchemical properties:

Ethanol will not react with metallic carbonates.	Ethanoic acid reacts with carbonates and Hydrogen carbonate and forms salts, carbon dioxide and water.
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Question 8.

Why does micelle formation take place when soap is added to water? Will a micelle be formed in other solvents such as ethanol also?

Answer:

Soaps are molecules in which the two ends have differing properties, one is hydrophilic that is, it interacts with water, while the other end is hydrophobic, that is it interacts with hydrocarbons. When soap is at the surface of water, the hydrophobic tail of soap will not be soluble in water and the soap will align along the surface of water with the ionic end in water and the hydrocarbon tail protruding out of water. Thus, clusters of molecules in which the hydrophobic tails are in the interior of the cluster and the ionic ends are on the surface of the cluster. This formation is called a micelle. Soap in the form of a micelle is able to clean. A micelle will not be formed in other solvents such as ethanol.

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Question 9.

Why are carbon and its compounds used as fuels for most applications?

Answer:

Carbon and its compounds give large amount of heat on combustion due to the high percentage of carbon and hydrogen. Carbon compounds used as fuel have optimum ignition temperature with high calorific values and are easy to handle. Their combustion can be controlled. Therefore, carbon and its compounds are used as fuels.

Question 10.

Explain the formation of scum when hard water is treated with soap.

Answer:

When soap reacts with water, calcium and magnesium salts are formed which causes hardness for water. Ionic ends of soap interacts with water while the carbon chain interacts with oil. The soap molecules, thus form structures called micelles where one end of the molecules is towards the oil droplet while the ionic-end faces outside. This forms an emulsion in water.

Question 11.

What change will you observe if you test soap with litmus paper (red and blue)?

Answer:

Since soap is basic in nature, it will turn red litmus blue. However, the colour of the blue litmus will remain blue.

Question 12.

What is hydrogenation? What is its industrial application?

Answer:

Unsaturated Hydrocarbons react with Hydrogen, in presence of catalysts such as palladium or Nickel and forms saturated Hydrocarbons. This is called Hydrogenation of oils.

This process is useful in hydrogenation of oils derived from plants.

Question 13.

Which of the following hydrocarbons undergo addition reactions:

C_2H_6 , C_3H_8 , C_3H_6 , C_2H_2 and CH_4 .

Answer:

Unsaturated hydrocarbons undergo addition reactions. Being unsaturated hydrocarbons, C_3H_6 and C_2H_2 undergo addition reactions.

Question 14.

Give a test that can be used to differentiate between saturated and unsaturated hydrocarbons.

Answer:

Saturated Hydrocarbons will not react with Bromine, but unsaturated hydrocarbons change the colour of Bromine.

Question 15.

Explain the mechanism of the cleaning action of soaps.

Answer:

The dirt present on clothes is organic in nature and insoluble in water. Therefore, it cannot be removed by washing with water only. When soap is dissolved in water, its hydrophobic ends attach themselves to the dirt and remove it from the cloth. Then, the molecules of soap arrange themselves in micelle formation and trap the dirt at the centre of the cluster. These micelles remain suspended in the water. Hence, the dust particles are easily rinsed away by water.

MP Board Class 10th Science Chapter 4 Additional Questions

Multiple Choice Questions

Question 1.

Which of the following is a three-carbon compound?

- (a) Ethene (b) Ethane (c) Propane (d) Acetylene

Answer: (c) Propane

Question 2.

Which one of the following is an unsaturated hydrocarbon?

- (a) Acetylene (b) Butane (c) Propane (d) Decane

Answer: (a) Acetylene

Question 3.

Two neighbours of homologous series differ by:

- (a) $-CH$ (b) $-CH_2$ (c) $-CH_3$ (d) $-CH_4$

Answer: (b) $-CH_2$

Question 4.

General formula of alkanes is -

- (a) C_nH_{2n+2} (b) C_nH_{2n} (c) C_nH_{2n-2} (d) C_nH_n

Answer: (a) C_nH_{2n+2}

Question 5.

Which of the following represents alkynes?

- (a) $-C - C-$ (b) $-C = C-$ (c) $-C \equiv C-$ (d) None of these

Answer: (c) $-C \equiv C-$

Question 6.

Which of the following represents ketones?

- (a) $-C = O$ (b) $-OH$ (c) $-CHO=$ (d) $COOH$

Answer: (a) $-C = O$

Question 7.

Which of the following is not an aliphatic hydrocarbon?

- (a) ethene (b) ethane (c) propyne (d) benzene

Answer: (d) benzene

Question 8.

Complete combustion of a hydrocarbon gives:

- (a) CO + H₂O (b) CO₂ + H₂O (c) CO + H₂ (d) CO₂ + H₂

Answer: (b) CO₂ + H₂O

Question 9.

Which is NOT correct for isomers of a compound?

- (a) They differ in physical properties.
(b) They differ in chemical properties.
(c) They have the same molecular formula.
(d) They have the same structural formula.

Answer:

- (d) They have the same structural formula.

Question 10.

Buckminsterfullerene is an example of of carbon.

- (a) an isomer (b) an isotope (c) an allotrope (d) a functional group

Answer: (c) an allotrope

Question 11.

Who prepared urea for the first time by heating ammonium cyanate?

- (a) Wohler (b) Lavoisier (c) Fuller (d) Haber

Answer: (a) Wohler

Question 12.

Hexanone is a four-carbon compound with the functional group:

- (a) Carboxylic acid (b) Aldehyde (c) Ketone (d) Alcohol

Answer: (c) Ketone

Question 13.

Major constituent of LPG is

- (a) Ethene (b) Butane (c) Propane (d) Pentane

Answer: (b) Butane

Question 14.

The gas used in welding and cutting metals is:

- (a) Ethyne (b) Ethene (c) Ethane (d) Propane

Answer: (a) Ethyne

Question 15.

How is carbon atoms arranged in Buckminsterfullerenes?

- (a) Triangle shape (b) Hexagonal array (c) Football shape (d) None

Answer: (c) Football shape

Question 16.

Vinegar is a solution of -

- (a) 40%-45% acetic acid. (b) 90%-95% acetic acid. (c) 5-20% acetic acid and water. (d) 35-40% acetic acid and water.

Answer: (c) 5-20% acetic acid and water.

Question 17.

How many covalent bonds are there in Bromoethane?

- (a) 4 (b) 6 (c) 10 (d) 7

Answer: (d) 7

Question 18.

Which functional group is present in propane?

- (a) Aldehyde (b) No group (c) Ketone (d) Alcohol

Answer: (b) No group

Question 19.

Which compound/molecule is being presented by the following formula: H:

C:: C: H (a) Ethane (b) Ethene (c) Ethyne (d) None of these

Answer: (b) Ethene

Question 20.

Next homologous to C₂H₅OH will be:

(a) CH₄ (b) C₂H₆ (c) C₃H₅ (d) C₃H₇OH

Answer: (d) C₃H₇OH

Question 21.

When we burn naphthalene it produces:

(a) Smoky flame (b) Non-sooty flame (c) Colourless flame (d) No flame

Answer: (a) Smoky flame

Question 22.

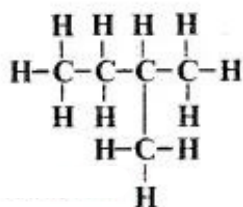
Bunsen burner is used for:

(a) making food. (b) study flames type. (c) low heating work. (d) all the above.

Answer: (c) low heating work.

Question 23.

See the figure carefully.



Choose the suitable name of isomer:

(a) Neo-pentane

(b) n-pentane

(c) Iso-pentane

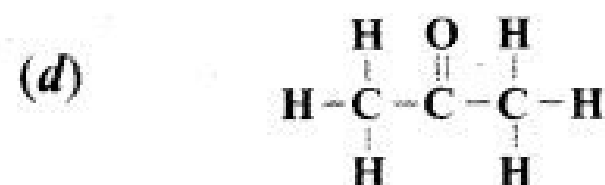
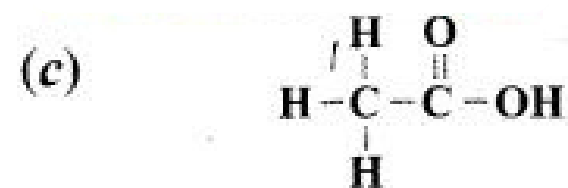
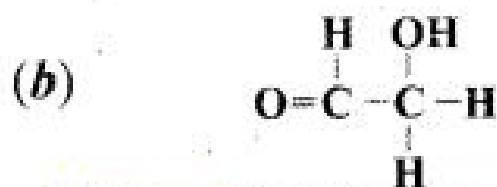
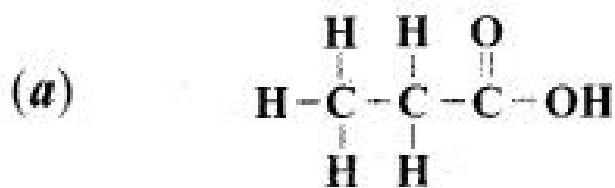
(d) All

Answer:

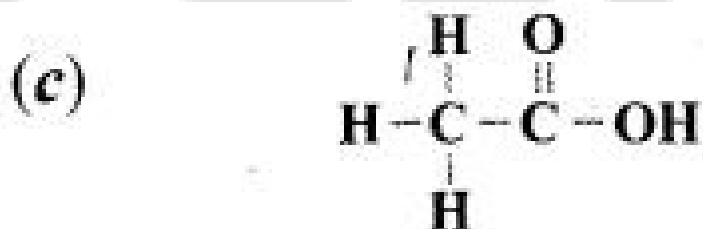
(c) Iso-pentane

Question 24.

Which of the following is a structure of ethanoic acid?



Answer:



Question 25.

What is the name of $\text{CH}_3\text{-CH}_2\text{-Br}$? Choose from the following:

- (a) Hex-1-one (b) Hexanal (c) Ethanoic acid (d) None

Answer: (d) None

Question 26.

What happens on the litmus test of soap?

- (a) No change (b) Red litmus turns blue (c) Red litmus turn purple
(d) Red litmus turn green

Answer:

- (b) Red litmus turns blue

Very Short Answer Type Questions

Question 1.

Name two groups which can have the same general formula.

Answer:

Both alkenes and cyclo-alkanes can be represented by the same general formula.

Question 2.

Which group of compounds have general formula C_nH_{2n} ?

Answer:

The general formula C_nH_{2n} represents alkenes group of compounds.

Question 3.

What is the common name and IUPAC name for CH_3COCH_3 ?

Answer:

Acetone is the common name and propanone is the IUPAC name for CH_3COCH_3 .

Question 4.

Do isomers always show same chemical properties?

Answer:

No, isomers always do not show the same chemical properties.

Question 5.

What is the common name and formula for ethanol?

Answer:

Alcohol, CH_3CH_2OH .

Question 6.

What are the products of complete combustion of a hydrocarbon?

Answer:

Carbon dioxide and water.

Question 7.

What is next homologue of C_3H_7OH is called?

Answer:

The next homologue of C_3H_7OH is called butanol C_4H_9OH .

Question 8.

What are isomers?

Answer:

The compounds which have the same molecular formula but different structures and chemical properties are called isomers.

Question 9.

Which one are more reactive unsaturated hydrocarbons or saturated hydrocarbons? Give reason.

Answer:

Unsaturated hydrocarbons: The Presence of double and triple covalent bonds make them more reactive.

Question 10.

Discuss the general nature of covalent compounds in water.

Answer: Generally, they are insoluble in water.

Question 11.

What type of hydrocarbons takes part in an addition reaction?

Answer: Unsaturated hydrocarbons.

Question 12.

Which carboxylic acid freezes during winter or under cold climate conditions?

Answer: Acetic acid and hence, known as glacial acetic acid.

Question 13.

What is the difference in molecular masses of any two successive homologous alkanes?

Answer: 14 units.

Question 14.

What is the molecular formula of the alcohol which can be derived from propane?

Answer:

Alcohol obtained from propane is propanol -1 and the molecular formula is C_3H_7OH .

Question 15.

Give the names of the functional groups: (CBSE 2007)

1. -CHO
2. -COOH

Answer:

1. Aldehydic group.
2. Carboxylic acid group.

Question 16.

Give the names of the following functional groups: (CBSE 2007)

1. -OH
2. -CO

Answer:

1. Alcoholic.
2. Ketonic.

Short Answer Type Questions

Question 1.

What is meant by the term functional group?

Answer:

An atom or a group of atoms, which makes a carbon compound reactive and decides its properties, is called a functional group.

For example aldehyde, ketone etc.

Question 2.

Which R functional groups always occur at the terminal position of a carbon chain?

Answer:

Aldehydic Group, R-CHO (R is the alkyl group),

Carboxyl Group, R-COOH (R is the alkyl group)

Question 3.

Why a candle flame burns yellow, while a highly-oxygenated gas fuel flame burns blue?

Answer:

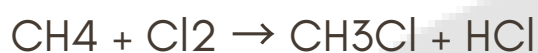
The most important factor determining the colour of the flame is oxygen supply and the extent of fuel-oxygen, which determines the rate of combustion and thus, the temperature and reaction paths, thereby producing different colour hues. In case of a candle, it is incomplete combustion and the flame temperature is not high. This gives a yellow flame, while a highly-oxygenated gas (e.g., ethyne) flame burns blue because of complete combustion raising a very high temperature.

Question 4.

Why is the reaction between methane and chlorine considered a substitution reaction? (CBSE 2008)

Answer:

Methane reacts with chlorine in the presence of sunlight to form chloromethane and hydrogen chloride. Since chlorine substitutes or replaces hydrogen of methane to form chloromethane, it is considered as substitution reaction.



With the excess of chlorine, four hydrogen atoms of methane are replaced by chlorine atoms to form carbon tetrachloride (CCl_4).

Question 5.

Why does carbon form compounds mainly by covalent bonding?

Answer:

Being tetravalent carbon atom, it is neither capable of losing all of its four valence electrons nor it can easily accept four electrons to complete its octet. Both of these are requirements of ionic bond formation and are energetically less favourable. Carbon completes its octet by sharing electrons and hence, covalent bonding is preferred.

Question 6.

What do you mean by Octane rating?

Answer:

Gasoline is rated on a scale known as octane rating, which is based on the way they burn in an engine. The higher the octane rating, the greater the percentage of complex-structured hydrocarbons that are present in the mixture, the more uniformly the gasoline burns, and the less knocking there is in the automobile engine. Thus, a gasoline rated 92 octane will burn more smoothly than one rated 87 octanes.

Question 7.

What is covalent bonding?

Answer:

The chemical bonding that takes place due to the mutual sharing of electron pairs of two or more atoms of different elements is called covalent bonding. By mutual sharing of electron pairs, atom attains noble gas configuration, e.g., hydrogen molecule (H_2), the two H-atoms combine by covalent bonding (H-H).

Question 8.

What are hydrocarbons? Give examples.

Answer:

Compounds of carbon and hydrogen are called hydrocarbons. Methane, ethane, butane, ethyne, propane, benzene, petroleum products – all are examples of hydrocarbons.

Question 9.

What are saturated hydrocarbons? (CBSE 2011)

Answer:

The hydrocarbons in which valency of carbon is satisfied by a single covalent bond are called saturated hydrocarbons. Alkanes like methane (CH_4), ethane (C_2H_6), propane (C_3H_8) etc. are examples of saturated hydrocarbons. Saturated hydrocarbons will generally give a clean flame.

Question 10.

Why do ionic compounds have high melting points? (HOTS)

Answer:

Ions have strong electrostatic forces of attraction among them forming ionic compounds. It requires a lot of energy to break these ionic bonds or forces. That's why ionic bonds have high melting points.

Question 11.

What are homologous series? (HOTS)

Answer:

Homologous series are:

1. Compounds with the same formula.
2. Belong to the same functional group.
3. Have general methods of separation.
4. Have similar chemical properties.

Show similar gradation of physical properties, e.g., boiling points of alcohol increase with an increase in their molecular weights. Similarly, solubility decreases with increase in molecular weights.

Question 12.

What is a heteroatom? What is the heteroatom in the alcohol functional group? (HOTS)

Answer:

In a hydrocarbon chain, one or more hydrogen atoms can be replaced by other atoms according to their valencies. The element which replaces hydrogen in the chain is called a heteroatom, e.g., in alcohol (-OH) functional group, oxygen is the heteroatom.

Long Answer Type Questions

Question 1.

Distinguish between saturated and unsaturated hydrocarbons by the way of their burning in air and bromine test inferences.

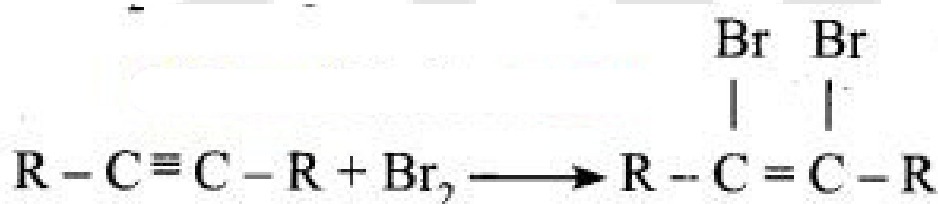
Answer:

1. Saturated compounds are burnt in air, to give a clear (blue) flame but the burning of unsaturated compounds (alkenes and alkynes) give a sooty (yellowish) flame because saturated compounds contain comparatively less percentage of carbon which is completely oxidized by the oxygen present in the air.

On the other hand, the percentage of carbon in unsaturated compounds is more and it requires more oxygen to get completely oxidized that is not fulfilled by air. So, due to incomplete oxidation, they burn with a sooty flame.

2. Bromine-water test: Br₂ water is a brown coloured liquid:

1. Unsaturated hydrocarbons give addition reaction with Br₂. So, the colour of Br₂ water gets decolourised.



2. Saturated hydrocarbons do not react with Br₂ water, so the colour of Br₂-ater does not get decolourised.

Question 2.

Two compounds A and B react with each other in the presence of a dehydrating agent to produce an ester. Both react with Na to evolve hydrogen gas. On reaction with Na_2CO_3 , only A evolves CO_2 . Identify the functional groups present in A and B giving the reason for your answer.

Answer:

Compound A contains $-\text{COOH}$ group while compound B contains $-\text{OH}$ group. Since, carboxylic acids and alcohols react with each other to form an ester, out of A and B, one is an alcohol and the other is a carboxylic acid. This is further strengthened by the reaction of both with Na to evolve hydrogen gas. Only carboxylic acids react with Na_2CO_3 to evolve CO_2 , A contains $-\text{COOH}$ group while B contains $-\text{OH}$ group.

Question 3.

An organic compound 'X' is widely used as a preservative in pickles and has a molecular formula $\text{C}_2\text{H}_4\text{O}_2$. This compound reacts with ethanol to form a sweet-smelling compound 'Y'.

1. Identify the compound 'X'.
2. Write the chemical equation for its reaction with ethanol to form compound 'Y'.
3. How can we get compound 'X' back from 'Y'?
4. Name the process and write a corresponding chemical equation.
5. Which gas is produced when compound 'X' reacts with washing soda?
Write the chemical equation.

Answer:

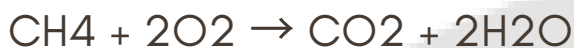
1. Compound X is ethanoic acid which gives an ester (Y) when reacts with ethanol. $\text{CH}_3\text{COOH} + \text{CH}_3\text{CH}_2\text{OH} \rightarrow \text{CH}_3\text{COOC}_2\text{H}_5$.
2. Esters give back alcohol and carboxylic acid in the presence of acid or base.
3. Saponification reaction: $\text{CH}_3\text{COOC}_2\text{H}_5 + \text{NaOH} \rightarrow \text{C}_2\text{H}_5\text{OH} + \text{CH}_3\text{COOH} + \text{Na}$.
4. CO_2 gas is released,
5. $\text{CH}_3\text{COOH} + \text{Na}_2\text{CO}_3 \rightarrow 2\text{CH}_3\text{COONa} + \text{H}_2\text{O} + \text{CO}_2$.

Question 4.

“Saturated hydrocarbons burn with a blue flame while unsaturated hydrocarbons burn with a sooty flame.” Why?

Answer:

Saturated hydrocarbons have only C-C and C-H single bonds and thus, contain the maximum possible number of hydrogen atoms per carbon atom. With sufficient oxygen, saturated hydrocarbons burn completely and give blue flame,



Unsaturated hydrocarbons contain a carbon-carbon double bond (C=C) or triple bond (C≡C). Hence, they contain less number of hydrogen than carbon. Unsaturated hydrocarbons undergo incomplete combustion and give yellow flame along with black sooty carbon.



Question 5.

What makes some molecular formula compound different? (HOTS)

Answer:

The arrangement makes them different compounds with identical molecular formula but different structures are called structural isomers. Organic compounds show a great level of isomerism. Isomers may be structural (due to difference in the arrangement of C atoms forming chain) or stereo (due to arrangement of bonds in a chain). With the increase in the number of carbon atoms in molecular formula, it leads to an increase in the number of isomers.

For example:

