Carbon and its Compounds

4

Objective Section (1 mark each)

Note: Two statements are given-one labelled Assertion (A) and the other labelled Reason (R). Select the correct answer to these questions from the codes (a), (b), (c) and (d) as given below:

(a) Both (A) and (R) are true and (R) is correct explanation of the assertion.

(b) Both (A) and (R) are true but (R) is not the correct explanation of the assertion.

(c) (A) is true but (R) is false.

(d) (A) is false buy (R) is true.

Q. 1. Assertion (A): Esterification is a process in which a sweet smelling substance is produced.

Reason (R): When ester react with sodium hydroxide an alcohol and sodium salt of carboxylic acid are obtained. [CBSE Delhi, Set 1, 2020]

Ans. **(b)** Both A and R are true but R is not the correct explanation of the Assertion.

Q. 2. Assertion (A): In a homologous series of alcohols, the formula for the second member is C_2H_5OH and the third member is C_3H_7OH.

Reason (R): The difference between the molecular masses of the two consecutive members of a homologous series is 144. [CBSE Delhi, Set 2, 2020]

Ans. **(c)** In homologous series two consecutive members differ by – CH_2 and differ in molecular masses by 14. Thus, A is true, but R is false.

Very Short Answer Type Questions (1 mark each)

Q. 1. Name the functional group present in propanone. [CBSE Delhi, Set 2, 2020]

Ans. Ketone group is present in propanone.

Q. 2. Name cyclic unsaturated carbon compound. [CBSE Delhi, Set 1, 2020]

Ans. Cyclopentane C_5H_{10} or Cyclopropane C_3H_6.

Q. 3. Write the molecular formula of the 2^{nd} and the 3^{rd} member of the homologous series whose first member is methane. [CBSE OD, Term 2, Set 1, 2017]

Ans. Ethane: C_2H_6
Propane: C_3H_8

Q. 4. While studying the saponification reaction, what do you observe when you mix an equal amount of colourless vegetable oil and 20% aqueous solution of NaOH in a beaker?

(a) The colour of the mixture has become dark brown.

(b) A brisk effervescence is taking place in the beaker.

(c) The outer surface of the beaker has become hot.

(d) The outer surface of the beaker has become cold. [CBSE OD, Term 2, Set 1, 2017]

Ans. **(c)** The outer surface of the beaker has become hot.

Q. 5. A student requires hard water for an experiment in his laboratory which is not available in the neighbouring area. In the laboratory there are some salts, which when dissolved in distilled water can convert it into hard water. Select from the following groups of salts, a group, each salt of which when dissolved in distilled water will make it hard.

(a) Sodium chloride, Potassium chloride
(b) Sodium sulphate, Potassium sulphate
(c) Sodium sulphate, Calcium sulphate
(d) Calcium sulphate, Calcium chloride
[CBSE OD, Term 2, Set 1, 2017]

Ans. **(d)** Calcium sulphate, Calcium chloride

Q. 6. Write the molecular formula of the 2nd and 3rd member of the homologous series whose first member is ethene.
[CBSE OD, Term 2, Set 2, 2017]

Ans. **(i)** Propene: C_3H_6
(ii) Butene: C_4H_8

Q. 7. Write the molecular formula of the 2nd and 3rd member of the homologous series where the first member is ethyne.
[CBSE OD, Term 2, Set 3, 2017]

Ans. **(i)** $CH_3C \equiv CH$ (propyne), n = 3
(ii) $CH_3CH_2C \equiv CH$ (Butyne), n = 4

Q. 8. Write the molecular formula of first two members of homologous series having functional group –Cl.
[CBSE Delhi, Term 2, Set 1, 2017]

Ans. The general formula for the homologous series of functional group –Cl is $C_nH_{2n+1}Cl$.

(i) CH_3Cl **(ii)** CH_3CH_2Cl

Q. 9. For demonstrating the preparation of soap in the laboratory which of the following combination of an oil and a base would be most suitable?
(a) Mustard oil and calcium hydroxide
(b) Castor oil and calcium hydroxide
(c) Turpentine oil and sodium hydroxide
(d) Mustard oil and sodium hydroxide.
[CBSE Delhi, Term 2, Set 1, 2017]

Ans. **(d)** Mustard oil and sodium hydroxide.

Q. 10. A student took four test tubes P, Q, R and S and filled about 8 ml. of distilled water in each. After that he dissolved an equal amount of Na_2SO_4 in P, K_2SO_4 in Q, $CaSO_4$ in R and $MgSO_4$ in S. On adding an equal amount of soap solution and shaking each test tube well, a good amount of lather will be obtained in the test tubes:
(a) P and Q (b) P and R
(c) P, Q and S (d) Q, R and S
[CBSE Delhi, Term 2, Set 1, 2017]

Ans. **(a)** P and Q

Q. 11. Write the molecular formula of first two members of homologous series having functional group –Br
[CBSE Delhi, Term 2, Set 2, 2017]

Ans. General formula for the homologous series of Br group is $C_nH_{2n+1}Br$.
(i) CH_3Br (Bromomethane)
(ii) CH_3CH_2Br (Bromoethane)

Q. 12. Write the molecular formula of first two members of homologous series having functional group –OH.
[CBSE Delhi, Term 2, Set 3, 2017]

Ans. The general formula for the homologous series of functional group –OH is $C_nH_{2n+1}OH$.
(i) CH_3OH (Methanol)
(ii) CH_3CH_2OH (Ethanol)

Q. 13. Which of the following sets of materials can be used for conducting a saponification reaction for the preparation of soap?
(a) $Ca(OH)_2$ and neem oil
(b) NaOH and neem oil
(c) NaOH and mineral oil
(d) $Ca(OH)_2$ and mineral oil
[CBSE Delhi, Term 2, Set 1, 2016]

Ans. **(b)** NaOH and neem oil

Q. 14. Write the name and structure of an alcohol with three carbon atoms in its molecule.
[CBSE OD, Term 2, Set 1, 2016]

Ans. The compound is propanol
$CH_3CH_2CH_2OH$.

Q. 15. A student puts a drop of reaction mixture of a saponification reaction first on a blue litmus paper and then on a red litmus paper. He may observe that:
(a) There is no change in the blue litmus paper and the red litmus paper turns white.
(b) There is no change in the red litmus paper and the blue litmus paper turns red.

(c) There is no change in the blue litmus paper and the red litmus paper turns blue.

(d) No change in colour is observed in both the litmus papers.

[CBSE OD, Term 2, Set 1, 2016]

Ans. **(c)** There is no change in the blue litmus paper and the red litmus paper turns blue.

Q. 16. For preparing soap in the laboratory we require an oil and a base. Which of the following combinations of an oil and a base would be best suited for the preparation of soap?

(a) Castor oil and calcium hydroxide

(b) Turpentine oil and sodium hydroxide

(c) Castor oil and sodium hydroxide

(d) Mustard oil and calcium hydroxide

[CBSE OD, Term 2, Set 1, 2016]

Ans. **(c)** Castor oil and sodium hydroxide

Q. 17. Write the name and structure of an alcohol with four carbon atoms in its molecule.

[CBSE OD, Term 2, Set 2, 2016]

Ans. Butanol, $CH_3CH_2CH_2CH_2OH$.

Q. 18. Write the name and structure of an aldehyde with four carbon atoms in its molecule.

[CBSE OD, Term 2, Set 3, 2016]

Ans. Butanal

$CH_3–CH_2–CH_2–CHO$

Q. 19. Write the next homologue of each of the following:

(i) C_2H_4 **(ii) C_4H_6**

[CBSE Delhi, Term 2, Set 1, 2016]

Ans. **(i)** C_3H_6 **(ii)** C_5H_8

Q. 20. A student takes four test tubes marked P, Q, R and S of 25 mL capacity and fill 10 mL of distilled water in each. He dissolves one spoon full of four different salts in each as KCl in P, NaCl in Q, $CaCl_2$ in R and $MgCl_2$ in S. He then adds about 2 mL of a sample of soap solution to each of the above test-tubes. On shaking the contents of each of the test-tubes, he is likely to observe a good amount of lather (foam) in the test tubes marked:

(a) P and Q **(b) R and S**

(c) P, Q and R **(d) P, Q and S**

[CBSE Delhi, Term 2, Set 1, 2016]

Ans. **(a)** P and Q

Q. 21. Consider the following comments about saponification reactions:

I Heat is evolved in these reactions.

II For quick precipitation of soap sodium chloride is added to the reaction mixture.

III Saponification reactions are special kind of neutralisation reactions.

IV Soaps are basic salts of long chain fatty acids.

The correct comments are:

(a) I, II and III **(b) II, III and IV**

(c) I, II and IV **(d) Only I and IV**

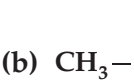
[CBSE Delhi, Term 2, Set 1, 2016]

Ans. **(c)** I, II and IV

Q. 22. Name the following compounds:

(a) $CH_3—CH_2—OH$;

(b)



[CBSE Delhi, Term 2, Set 2, 2016]

Ans. **(a)** Ethanol **(b)** Ethanal

Q. 23. Select saturated hydrocarbons from the following:

C_3H_6; C_5H_{10}; C_4H_{10}; C_6H_{14}; C_2H_4

[CBSE Delhi, Term 2, Set 3, 2016]

Ans. C_4H_{10} and C_6H_{14} are the saturated hydrocarbons.

Q. 24. Write the number of covalent bonds in the molecule of ethane.

[CBSE OD, Term 2, Set 1, 2015]

Ans. Molecule of ethane has 7 covalent bonds.

Q. 25. While preparing soap a small quantity of common salt is generally added to the reaction mixture of vegetable oil and sodium hydroxide. Which one of the following may be the purpose of adding common salt?

(a) To reduce the basic nature of the soap

(b) To make the soap neutral

(c) To enhance the cleansing power of the soap

(d) To favour the precipitation of the soap

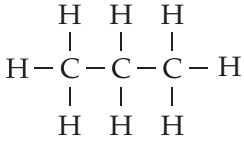
[CBSE OD, Term 2, Set 1, 2015]

Ans. **(d)** To favour the precipitation of the soap

Q. 26. Write the number of covalent bonds in the molecule of propane, C_3H_8.

[CBSE OD, Term 2, Set 2, 2015]

Ans.

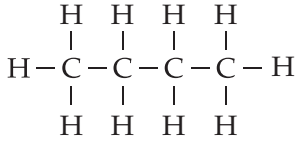


10 Bonds

Q. 27. Write the number of covalent bonds in the molecule of butane, C_4H_{10}.

[CBSE OD, Term 2, Set 3, 2015]

Ans. Thirteen



Q. 28. Write the name and formula of the 2nd member of homologous series having general formula C_nH_{2n}.

[CBSE Delhi, Term 2, Set 1, 2015]

Ans. Propene C_3H_6

Q. 29. A student prepared 20% sodium hydroxide solution in a beaker to study saponification reaction. Some observations related to this are given below:

(i) Sodium hydroxide solution turns red litmus blue

(ii) Sodium hydroxide readily dissolves in water

(iii) The beaker containing solution appears cold when touched from outside.

(iv) The blue litmus paper turns red when dipped into the solution

The correct observations are:

(a) I, II and IV

(b) I, II, and III

(c) only III and IV

(d) only I and II

[CBSE Delhi, Term 2, Set 1, 2015]

Ans. **(d)** only I and II

Q. 30. Hard water is not available for an experiment. Some salts are given below:

(i) Sodium chloride

(ii) Sodium sulphate

(iii) Calcium chloride

(iv) Calcium sulphate

(v) Potassium chloride

(vi) Magnesium sulphate

Select from the following a group of these salts, each member of which may be dissolved in water to make it hard.

(a) I, II, V **(b) I, III, V**

(c) III, IV, VI **(d) II, IV, VI**

[CBSE Delhi, Term 2, Set 1, 2015]

Ans. **(c)** III, IV, VI

Q. 31. Write the name and formula of the 2nd member of homologous series having general formula C_nH_{2n+2}.

[CBSE Delhi, Term 2, Set 2, 2015]

Ans. Ethane C_2H_6.

Q. 32. Write the name and formula of the 2nd member of homologous series having general formula C_nH_{2n-2}.

[CBSE Delhi, Term 2, Set 3, 2015]

Ans. Propyne C_3H_4

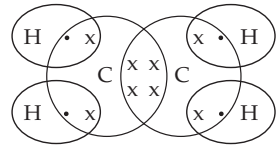
Short Answer Type Questions-I (2 marks each)

Q. 1. Write the molecular formula of ethene and draw its electron dot structure.

[CBSE OD, Set 1, 2019]

Ans. Molecular formula of ethene is C_2H_4

Electron dot structure of ethene.



or CH_2=CH2

Q. 2. Draw electron dot structure of carbon dioxide and write the nature of bonding between carbon and oxygen in its molecule.
[CBSE OD, Set 2, 2019]

Ans. :Ö: :C: :Ö: or O=C=C

Covalent bond (double bond) is present in between C and O.

Q. 3. List two properties of carbon which lead to the huge number of carbon compounds we see around us, giving reason for each. [CBSE OD, Set 2, 2019]

Ans. Two properties of carbon which lead to the huge number of carbon compounds are:

(i) Catenation: It is the ability of carbon to form bonds with other atoms of carbon.

(ii) Tetravalency: With the valency of four, carbon is capable of bonding with 4 other atoms. This forms huge number of compounds.

Q. 4. List two chemical properties on the basis of which ethanol and ethanoic acid may be differentiated and explain how.
[CBSE OD, Set 3, 2019]

Ans. (i) Ethanol does not react with sodium bicarbonate but ethanoic acid reacts with sodium bicarbonate releasing CO_2 gas.

(ii) Ethanol does not change the colour of blue litmus paper but ethanoic acid changes the colour of blue litmus to red due to presence of carboxylic acid group.

Q. 5. Unsaturated hydrocarbons contain multiple bonds between two carbon atoms and these compounds show addition reactions. Out of saturated and unsaturated carbon compounds, which compounds are more reactive? Write a test to distinguish ethane from ethene.
[CBSE OD, Set 3, 2019]

Ans. Unsaturated carbon compounds are more reactive than saturated carbon compounds. Bromine water is decolourized by ethene but there is no change of colour of bromine water with ethane.

$$\underset{\text{Ethene}}{CH_2=CH_2} + \underset{\text{Bromine}}{Br_2} \xrightarrow{\text{Ni catalyst}} \underset{\text{Dibromoethene}}{BrCH_2—CH_2Br}$$

Q. 6. In three test tubes A, B and C, three different liquids namely, distilled water, underground water and distilled water in which a pinch of calcium sulphate is dissolved, respectively are taken. Equal amount of soap solution is added to each test tube and the contents are shaken. In which test tube will the length of the foam (lather) be longest? Justify your answer. [CBSE Delhi, Set 1, 2019]

Ans. Length of foam would be longest in the test tube A. It is because it does not have any ions, so length of the foam would be longest.

Q. 7. A compound 'X' on heating with excess conc. sulphuric acid at 443 K gives an unsaturated compound 'Y'. 'X' also reacts with sodium metal to evolve a colourless gas 'Z'. Identify 'X', 'Y' and 'Z'. Write the equation of the chemical reaction of formation of 'Y' and also write the role of sulphuric acid in the reaction. [CBSE, 2018]

Ans. Compound X $\xrightarrow[\text{excess conc. } H_2SO_4 \text{ at } 443\text{ K}]{\text{Heating}}$ Unsaturated compound Y

$$\underset{\text{Ethanol}}{CH_3—CH_2OH} \xrightarrow[443\text{ K}]{\text{Conc.}H_2SO_4} \underset{\text{Ethene}}{CH_2=CH_2} + \underset{\text{Water}}{H_2O}$$

X : CH_3CH_2OH(ethanol)

Y : $CH_2 = CH_2$(ethene)

$CH_3CH_2OH + Na \rightarrow CH_3CH_2ONa + H_2$

Z : Hydrogen gas.

Here concentrated sulphuric acid acts as a dehydrating agent, it removes water molecule from ethanol.

Q. 8. Mention the essential material (chemicals) to prepare soap in the laboratory. Describe in brief the test of determining the nature (acidic/alkaline) of the reaction mixture of saponification reaction. [CBSE OD, Term 2, Set 1, 2017]

Ans. The essential chemicals required to prepare soap in the laboratory are oil and sodium hydroxide solution. In order to determine the nature of the reaction mixture of saponification reaction, we dip red litmus paper into it which will turn blue after a while indicating that it is a basic mixture.

Q. 9 . A student adds a spoon full of powdered sodium hydrogen carbonate to a flask containing ethanoic acid. List two main observations, he must note in his note book, about the reaction that takes place. Also write chemical equation for the reaction.

[CBSE OD, Term 2, Set 1, 2016]

Ans. The two main observations are:

(i) Brisk effervescence.

(ii) Evolution of colourless and odourless gas.

$$CH_3COOH + NaHCO_3 \rightarrow CH_3COONa + H_2O + CO_2$$

Short Answer Type Questions-II (3 marks each)

Q. 1. 3 mL of ethanol is taken in a test tube and warmed gently in a water bath. A 5% solution of alkaline potassium permanganate is added first drop by drop to this solution, then in excess.

(i) How is 5% solution of $KMnO_4$ prepared?

(ii) State the role of alkaline potassium permanganate in this reaction. What happens on adding it in excess?

(iii) Write chemical equation of this reaction. [CBSE Delhi, Set 1, 2020]

Ans. (i) 5% solution of $KMnO_4$ is prepared by adding 100ml water in 5g $KMnO_4$ solution.

(ii) Alkaline potassium permanganate is used as an oxidising agent in the reaction and when alkaline potassium permanganate is added in excess then it will add oxygen in the ethanol to form ethanoic acid.

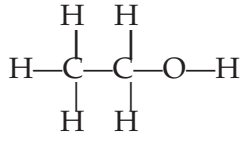
(iii) $\underset{\text{Ethanol}}{C_2H_5OH} \xrightarrow{\text{Alk.}KMnO_4} \underset{\text{Ethanoic acid}}{CH_3COOH}$

Q. 2. (a) Draw the structures for (i) ethanol, (ii) ethanoic acid.

(b) Why is the conversion of ethanol to ethanoic acid considered an oxidation reaction? Write the oxidising agent used in the reaction involved. [CBSE Delhi, Set 3, 2020]

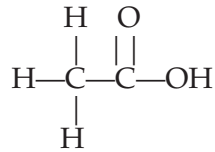
Ans. (a) Structures for ethanol and ethanoic acid are as follows:

(i)



Ethanol

(ii)



Ethanoic acid

(b) Conversion of ethanol to ethanoic acid is considered as an oxidation reaction because oxygen is added to ethanol to convert it to ethanoic acid.

$$\underset{\text{Ethanol}}{CH_3-CH_2OH} \xrightarrow[\text{(or) Acidified } K_2Cr_2O_7 + \text{Heat}]{\text{Alc. } KMnO_4 + \text{Heat}} \underset{\text{Ethanoic acid}}{CH_3COOH}$$

In the above reaction alkaline $KMnO_4$ or acidified $K_2Cr_2O_7$ adds oxygen to ethanol hence they are the oxidising agent used in the reaction involved.

Q. 3. What is a homologous series of carbon compounds? Give an example and list its three characteristics.

[CBSE OD, Set 1, 2019]

Ans. A homologous series is a group of organic compounds having similar structures and similar chemical properties in which the successive compounds differ by CH_2 group.

Example: Alkanes with general formula C_nH_{2n+2}

Characteristics of homologous series of carbon compound:

(i) All the members of a homologous series can be represented by the same general formula and they have same functional group.

(ii) Any two adjacent homologues differ by 1 carbon atom and 2 hydrogen atoms in their molecular fomulae.

(iii) The difference in the molecular masses of any two adjacent homologues is 14 u.

Q. 4. Which compounds are called (i) alkanes, (ii) alkenes and (iii) alkynes? C_4H_{10} belongs to which of these? Draw two structural isomers of this compound.

[CBSE OD, Set 2, 2019]

Ans. **(i)** The hydrocarbons in which carbon atoms are connected by only single covalent bonds are called alkanes.

(ii) The hydrocarbons in which carbon atoms are connected by double bond are called alkene.

(iii) The hydrocarbons in which carbon atoms are connected by triple bond are called alkynes.

C_4H_{10} belongs to alkane.

Structural Isomers of C_4H_{10}:

$CH_3-CH_2-CH_2-CH_3$ **(a)**

$CH_3-\underset{\displaystyle CH_3}{\underset{|}{CH}}-CH_3$ **(b)**

Q. 5. **(a) Why are most carbon compounds poor conductors of electricity?**

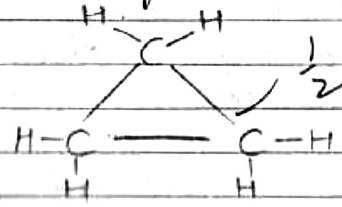
(b) Write the name and structure of a saturated compound in which the carbon atoms are arranged in a ring. Give the number of single bonds present in this compound.

[CBSE, 2018]

Topper's Answers

Answer : 8

(a) Carbon compounds are covalently bonded and hence the bond is formed by sharing of electrons between two or more combining atoms. Due to this, they don't form any ions or electrons. charged particles within the solution nor they give free. As we know, conduction of electricity requires flow of free electrons in solids & ions in fluids, they don't conduct electricity.

(b) 

Cyclopropane

Structure

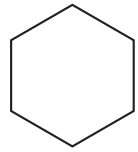
Name of the structure :-

Cyclopropane

No. of single bonds :- '9' single covalent bonds

Ans. **(a)** Electricity is conducted by moving electrons. But carbon forms covalent bonds by sharing of electrons. It does not have free electrons.

(b) Cyclohexane is a saturated compound in which carbon atoms are arranged in a ring.



Cyclohexane

There are 6 single bonds present in this compound.

Q. 6. Write the structural formula of ethanol. What happens when it is heated with excess of conc. H_2SO_4 at 443 K? Write the chemical equation for the reaction stating the role of conc. H_2SO_4 in this reaction.

[CBSE OD, Term 2, Set 1, 2017]

Ans. Structural formula of ethanol is:

$$CH_3CH_2OH$$

When ethanol is heated with excess of conc. H_2SO_4 at 443 K it results in the dehydration of ethanol to give ethene.

$$\underset{\text{Ethanol}}{CH_3CH_2OH} \xrightarrow[443\text{ K}]{\text{Conc. } H_2SO_4} \underset{\text{Ethene}}{CH_2{=}CH_2} + H_2O$$

Conc. H_2SO_4 acts as a dehydrating agent which removes water from the ethanol.

Q. 7. Distinguish between esterification and saponification reaction with the help of the chemical equations for each. State one use of each (i) esters, and (ii) saponification process.

[CBSE OD, Term 2, Set 1, 2017]

Ans. Esterification is opposite of saponification. In esterification:

$$RCOOH + R'OH \xrightarrow{\Delta} RCOOR' + H_2O$$

Whereas in saponification:

$$RCOOR' + NaOH \longrightarrow RCOONa + R'OH$$

(i) Esters are used in making perfumes.

(ii) Saponification reaction is used in making soaps and soap products on a large scale.

Q. 8. What happens when
(write chemical equation in each case)

(a) ethanol is burnt in air?

(b) ethanol is heated with excess conc. H_2SO_4 at 443 K?

(c) a piece of sodium is dropped into ethanol?

[CBSE OD, Term 2, Set 2, 2017]

Ans. **(a)** $CH_3CH_2OH + 3O_2 \xrightarrow{\text{Air}} 2CO_2 + 3H_2O$ + Heat + light

(b) $CH_3CH_2OH \xrightarrow[\Delta,\ 443k]{\text{Conc. } H_2SO_4} CH_2{=}CH_2 + H_2O$

(c) $2\,CH_3CH_2OH + 2Na \rightarrow 2\,CH_3CH_3ONa + H_2\uparrow$

Q. 9. Explain esterification reaction with the help of a chemical equation. Describe an activity to show esterification.

[CBSE OD, Term 2, Set 2, 2017]

Ans. The reaction of carboxylic acid with alcohol forms an ester. This process of formation of ester is called esterification.

$$CH_3COOH + CH_3CH_2OH \xrightarrow{H^+} CH_3COOCH_2CH_3 + H_2O$$

Activity:

(i) Take 1 ml of ethanol and 1 ml of glacial acetic acid in a boiling tube and mix the contents well.

(ii) Add few drops of conc. H_2SO_4 to it.

(iii) Warm the contents on a water bath for a few minutes.

(iv) Now pour the solution in a beaker containing 20-50 mL of water.

(v) A sweet fruity smell indicating formation of an ester is observed.

Q. 10. Two carbon compounds X and Y have the molecular formula C_4H_8 and C_5H_{12} respectively. Which one of these is most likely to show addition reaction? Justify your answer. Also give the chemical equation to explain the process of addition reaction in this case.

[CBSE Delhi, Term 2, Set 1, 2017]

Ans. $X = C_4H_8$ is an alkene.

$Y = C_5H_{12}$ is an alkane.

X being an alkene *i.e.*, butene is unsaturated compound and will show addition reaction as they have free electrons for bonding.

$$CH_3CH_2CH{=}CH_2 + H_2 \xrightarrow{Pd/Ni} CH_3CH_2CH_2CH_3$$

$$CH_3CH{=}CHCH_3 + Cl_2 \xrightarrow{h\nu} CH_3ClCHClCHCH_3$$

Q. 11. Complete the following chemical equations:

(i) $\mathbf{CH_3COOC_2H_5 + NaOH \longrightarrow}$

(ii) $\mathbf{CH_3COOH + NaOH \longrightarrow}$

(iii) $\mathbf{C_2H_5OH + CH_3COOH \xrightarrow{Conc.\ H_2SO_4}}$

[CBSE Delhi, Term 2, Set 1, 2017]

Ans. (i) $CH_3COOC_2H_5 + NaOH \xrightarrow{H_2O} C_2H_5OH + CH_3COONa$

(ii) $CH_3COOH + NaOH \longrightarrow CH_3COONa + H_2O$

(iii) $C_2H_5OH + CH_3COOH \xrightarrow{Conc.\ H_2SO_4} CH_3COOC_2H_5 + H_2O$

Q. 12. Complete the following chemical equations:

(i) $\mathbf{CH_3COOH + Na_2CO_3 \longrightarrow}$

(ii) $\mathbf{CH_4 + O_2 \longrightarrow}$

(iii) $\mathbf{2C_2H_5OH + Na \longrightarrow}$

[CBSE Delhi, Term 2, Set 2, 2017]

Ans. (i) $2CH_3COOH + Na_2CO_3 \longrightarrow 2CH_3COONa + H_2O + CO_2\uparrow$

(ii) $CH_4 + 2O_2 \xrightarrow{\Delta} CO_2\uparrow + 2H_2O$

(iii) $2C_2H_5OH + 2Na \longrightarrow 2C_2H_5ONa + H_2\uparrow$

Q. 13. Two carbon compounds X and Y have the molecular formula C_3H_6 and C_4H_{10} respectively. Which one of the two is most likely to show addition reaction? Justify your answer. Also give the chemical equation to explain the process of addition reaction in this case.

[CBSE Delhi, Term 2, Set 2, 2017]

Ans. C_3H_6 is propene *i.e.*, unsaturated hydrocarbon. C_4H_{10} is butane *i.e.*, saturated hydrocarbon. Thus propene being unsaturated shows addition reaction.

$$CH_3{-}CH{=}CH_2 + Cl_2 \longrightarrow CH_3CH(Cl){-}CH_2Cl$$

Q. 14. Complete the following chemical equations:

(i) $\mathbf{C_2H_5OH + O_2 \longrightarrow}$

(ii) $\mathbf{C_2H_5OH \xrightarrow[443\ K]{Conc.\ H_2SO_4}}$

(iii) $\mathbf{CH_3COOH + NaHCO_3 \longrightarrow}$

[CBSE Delhi, Term 2, Set 3, 2017]

Ans. (i) $C_2H_5OH + 3O_2 \xrightarrow{\Delta} 2CO_2 + 3H_2O$ + Energy

(ii) $C_2H_5OH \xrightarrow[443\ K]{Conc.\ H_2SO_4} CH_2{=}CH_2 + H_2O$

(iii) $CH_3COOH + NaHCO_3 \longrightarrow CH_3COONa + H_2O + CO_2\uparrow$

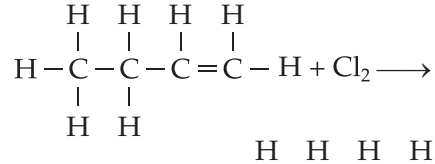
Q. 15. The molecular formula of two carbon compounds are C_4H_8 and C_3H_8. Which one of the two is most likely to show addition reaction? Justify your answer. Also give the chemical equation to explain the process of addition reaction in this case.

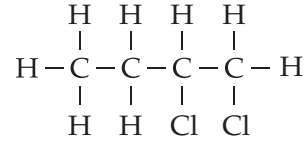
[CBSE Delhi, Term 2, Set 3, 2017]

Ans. 1. C_4H_8: Butene - alkene (unsaturated hydrocarbon)

2. C_3H_8: propane-alkane (saturated hydrocarbon)

C_4H_8 *i.e.*, butene shows addition reaction as it is unsaturated hydrocarbon.





Q. 16. Write the electronic configuration of two elements X and Y whose atomic numbers are 20 and 17 respectively. Write the molecular formula of the compound formed when element X reacts with element Y. Draw electron-dot structure of the product and also state the nature of the bond formed between both the elements.[CBSE OD, Term 2, Set 3, 2017]

Ans. X = 20; Electronic configuration = 2, 8, 8, 2

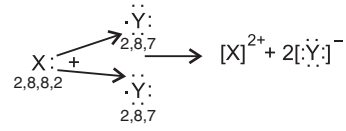
Y = 17; Electronic configuration = 2, 8, 7

$$X \longrightarrow X^{2+} + 2e^-$$

$$2Y + 2e^- \longrightarrow 2Y^-$$

$$X^{2+} + 2Y^- \longrightarrow XY_2$$

Electron-dot structure:

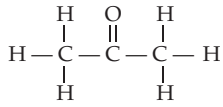


The nature of bond will be ionic.

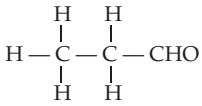
Q. 17. An aldehyde as well as a ketone can be represented by the same molecular formula, say C_3H_6O. Write their structures and name them. State the relation between the two in the language of science.

[CBSE OD, Term 2, Set 1, 2016]

Ans. C_3H_6O



Propanone (Ketone)



Propanal (aldehyde)

They are functional isomers *i.e.,* they have same molecular formula and different structural formula having different functional groups.

Q. 18. On dropping a small piece of sodium in a test-tube containing carbon compound 'X' with molecular formula C_2H_6O, a brisk effervescence is observed and a gas 'Y' is produced. On bringing a burning splinter at the mouth of the test-tube the gas evolved burns with a pop sound. Identify 'X' and 'Y'. Also write the chemical equation for the reaction. Write the name and structure of the product formed, when you heat 'X' with excess conc. sulphuric acid.

[CBSE OD, Term 2, Set 2, 2016]

Ans. X = Ethanol C_2H_5OH

Y = H_2 gas

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

$C_2H_5OH \xrightarrow{\text{Conc. } H_2SO_4} CH_2{=}CH_2 + H_2O$

Products:

$CH_2{=}CH_2$ (ethene)

H_2O (water)

Q. 19. Write three different chemical reactions showing the conversion of ethanoic acid to sodium ethanoate. Write balanced chemical equation in each case. Write the name of the reactants and the products other than ethanoic acid and sodium ethanoate in each case.

[CBSE OD, Term 2, Set 3, 2016]

Ans. **(i)** $\underset{\text{Ethanoic acid}}{2CH_3COOH} + \underset{\text{Sodium carbonate}}{Na_2CO_3} \longrightarrow$

$\underset{\text{Sodium ethanoate}}{2CH_3COONa} + \underset{\text{Water}}{H_2O} + \underset{\text{Carbon dioxide}}{CO_2\uparrow}$

(ii) $\underset{\text{Ethanoic acid}}{CH_3COOH} + \underset{\text{Sodium hydroxide}}{NaOH} \longrightarrow$

$\underset{\text{Sodium ethanoate}}{CH_3COONa} + \underset{\text{Water}}{H_2O} + \underset{\text{Carbon dioxide}}{CO_2\uparrow}$

(iii) $\underset{\text{Ethanoic acid}}{CH_3COOH} + \underset{\text{Sodium biocarbonate}}{NaHCO_3} \longrightarrow$

$\underset{\text{Sodium ethanoate}}{CH_3COONa} + \underset{\text{Water}}{H_2O} + \underset{\text{Carbon dioxide}}{CO_2\uparrow}$

Q. 20. When ethanol reacts with ethanoic acid in the presence of conc. H_2SO_4, a substance with fruity smell is produced. Answer the following:

(i) State the class of compounds to which the fruity smelling compounds belong. Write the chemical equation for the reaction and write the chemical name of the product formed.

(ii) State the role of conc. H_2SO_4 in this reaction.

[CBSE Delhi, Term 2, Set 1, 2016]

Ans. **(i)** Ester

$$\underset{\text{Ethanoic acid}}{CH_3COOH} + \underset{\text{Ethanol}}{CH_3CH_2OH} \xrightarrow[H_2SO_4]{\text{conc.}} \underset{\text{Ethyl ethanoate}}{CH_3COOCH_2CH_3} + H_2O$$

(ii) Concentrated H_2SO_4 acts as a dehydrating agent.

Q. 21. What is an oxidising agent? What happens when an oxidising agent is added to propanol? Explain with the help of a chemical equation.

[CBSE Delhi, Term 2, Set 2, 2016]

Ans. Oxidising agent is a substance which can give oxygen to other substance. When an oxidising agent is added to propanol it is oxidised to propanoic acid.

$$\underset{\text{Propanol}}{CH_3CH_2CH_2OH} \xrightarrow[\Delta]{\text{Alk. } KMnO_4} \underset{\text{Propanoic acid}}{CH_3CH_2COOH}.$$

Q. 22. Name the compound formed when ethanol is heated in excess of conc. sulphuric acid at 443 K. Also write the chemical equation of the reaction stating the role of conc. sulphuric acid in it. What would happen if hydrogen

is added to the product of this reaction in the presence of catalysts such as palladium or nickel?

[CBSE Delhi, Term 2, Set 3, 2016]

Ans. Ethene is formed.

$$\underset{\text{Ethanol}}{C_2H_5OH} \xrightarrow[443\ K]{\text{Conc. } H_2SO_4 + \Delta} \underset{\text{Ethene}}{H_2C{=}CH_2} + H_2O$$

Conc. H_2SO_4 acts as a dehydrating agent.

If hydrogen is added to the product in presence of a catalyst, ethane is formed

$$\underset{\text{Ethene}}{H_2C{=}CH_2} + H_2 \xrightarrow{Ni/Pt} \underset{\text{Ethane}}{H_3C{-}CH_3}.$$

Q. 23. Write chemical equation of the reaction of ethanoic acid with the following:

(a) Sodium

(b) Sodium hydroxide

(c) Ethanol

Write the name of one main product of each reaction.

[CBSE OD, Term 2, Set 1, 2016]

Ans. (a) $\underset{\text{Ethanoic acid}}{2CH_3COOH} + 2Na \rightarrow \underset{\text{Sodium ethanoate}}{2CH_3COONa} + H_2\uparrow$

(b) $\underset{\text{Ethanoic acid}}{CH_3COOH} + NaOH \rightarrow \underset{\text{Sodium ethanoate}}{CH_3COONa} + H_2O$

(c) $\underset{\text{Ethanoic acid}}{CH_3COOH} + CH_3CH_2OH \rightarrow \underset{\text{Ethyl ethanoate}}{CH_3COOC_2H_5} + H_2O$

Q. 24. List two tests for experimentally distinguishing between an alcohol and a carboxylic acid and describe how these tests are performed.

[CBSE OD, Term 2, Set 1, 2015]

Ans. (i) Test I-Litmus test

Take two strips of blue litmus paper. Place a drop each of the alcohol and carboxylic acid on these strips separately. The blue litmus paper turns red in the case of carboxylic acid and remains unaffected in the case of alcohol.

(ii) Test II-Sodium bicarbonate test

Add a pinch of sodium bicarbonate to both alcohol and carboxylic acid. If brisk effervescence with evolution of colourless, tasteless gas is evolved, then it is carboxylic acid and if no change is observed then alcohol.

Q. 25. What is meant by homologous series of carbon compounds? Classify the following carbon compounds into two homologous series and name them.

C_3H_4, C_3H_6, C_4H_6, C_4H_8, C_5H_8, C_5H_{10}.

[CBSE OD, Term 2, Set 2, 2015]

Ans. A series of carbon compounds in which the same functional group substitutes for hydrogen in a carbon chain is called homologous series.

Alkynes – C_3H_4, C_4H_6, C_5H_8

Alkene – C_3H_6, C_4H_8, C_5H_{10}

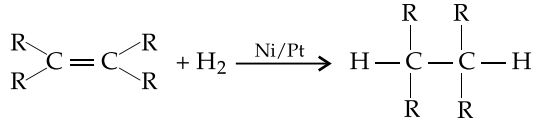
Q. 26. Write the name and general formula of a chain of hydrocarbons in which an addition reaction with hydrogen is possible. State the essential condition for an addition reaction stating this condition, write a chemical equation giving the name of the reactants and the product of the reaction.

[CBSE OD, Term 2, Set 3, 2015]

Ans. Alkene C_nH_{2n}

Alkyne C_nH_{2n-2}

Presence of Ni, Pd and Pt as catalyst and the compound must be unsaturated in nature.



Alkene Alkane

Q. 27. With the help of an example, explain the process of hydrogenation. Mention the essential conditions for the reaction and state the change in physical property with the formation of the product.

[CBSE Delhi, Term 2, Set 1, 2015]

Ans. $H_2C{=}CH_2 + H_2 \xrightarrow{Ni/Pt} H_3C{-}CH_3$

OR

Vegetable oil + H_2 $\xrightarrow{Ni/Pt}$ Vanaspati ghee.

Essential condition for hydrogenation is the presence of a catalyst like Ni, Pt or Pd. Change observed in the physical property during hydrogenation is the change of the unsaturated compound from the liquid state to the corresponding saturated compound in the solid state.

Q. 28. What is the difference between the molecules of soaps and detergents, chemically? Explain the cleansing action of soaps.

[CBSE Delhi, Term 2, Set 1, 2015]

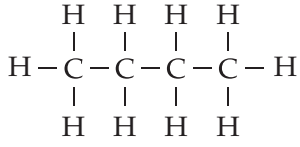
Ans. Soaps are sodium or potassium salts of long chain carboxylic acid whereas detergents are ammonium or sulphonate salt.

Cleansing action of soap: The ionic part of soap molecule dissolves in water and the non-ionic part dissolves in oil. Thus soap molecules arrange themselves in the form of micelles, pulling the dirt or grease from the cloth. On rinsing with water, soap is washed off, lifting the only dirt particles with it.

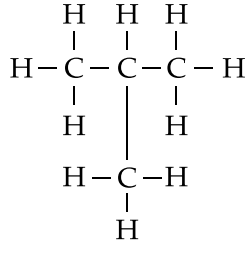
Q. 29. What is meant by isomers? Draw the structures of two isomers of butane, C_4H_{10}. Explain why we cannot have isomers of first three members of alkane series.

[CBSE Delhi, Term 2, Set 2, 2015]

Ans. Isomers are compounds which have the same molecular formula but different structures.



n-butane



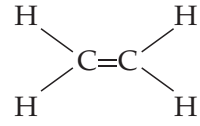
Isobutane

Since, branching is not possible in first 3 members thus isomers of these first members of alkane series is not possible.

Q. 30. Write the name and structural formula of the compound obtained when ethanol is heated at 443 K with excess of conc. H_2SO_4. Also write the chemical equation for the reaction starting the role of conc. H_2SO_4 in it.

[CBSE Delhi, Term 2, Set 3, 2015]

Ans. Ethene (C_2H_4)



$$C_2H_5OH \xrightarrow[443k]{\text{Conc. } H_2SO_4} C_2H_4 + H_2O$$

Ethanol Ethene

Conc. H_2SO_4 acts as dehydrating agent.

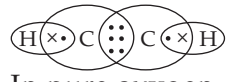
Q. 31. When soap is scrubbed on a stain of curry on a white cloth, why does it become reddish brown, and turns yellow again when the cloth is washed with plenty of water? [CBSE Delhi, Term 1, Set 1, 2015]

Ans. The curry might contain turmeric powder which is the indicator of acids and bases. Soap being basic in nature turns the colour of the turmeric from yellow to reddish brown. After washing with lot of water the soap is removed and the turmeric returns to its yellow colour.

Q. 32. Draw the electron-dot structure for ethyne. A mixture of ethyne and oxygen is burnt for welding. In your opinion, why cannot we use a mixture of ethyne and air for this purpose?

[CBSE OD, Term 2, Set 1, 2015]

Ans.



In pure oxygen, ethyne undergoes complete combustion and high temperature is suitable for welding.

We cannot use air instead of oxygen because air contains less percentage of oxygen which results in incomplete combustion of ethyne and temperature required for welding is not acquired.

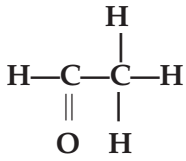
Long Answer Type Questions (5 marks each)

Q. 1. (a) Compare soaps and detergents on the basis of their composition and cleansing action in hard water.

(b) What happens when ethanol is treated with sodium metal? State the behaviour of ethanol in this reaction.

(c) Draw the structure of cyclohexane.

(d) Name the following compound.



[CBSE OD, Set 1, 2020]

Ans. **(a)** Soaps are potassium or sodium salts of a carboxylic acid having a long aliphatic chain attached to it. They are surfactants (compounds that reduce surface tension between a liquid and another substance) so, help in the emulsification of oils in water. They are not effective in hard water and saline water. Detergents are the potassium or sodium salts of a long alkyl chain ending with a sulphonated group. They are soluble in hard water. This solubility is attributed to the fact that the sulphonated group does not attach itself to the ions present in hard water.

(b) When ethanol is treated with sodium metal, sodium ethoxide is obtained with the liberation of hydrogen gas. Sodium is an alkali metal, its standard reduction potential is low. Hence it can displace hydrogen from alcohol.

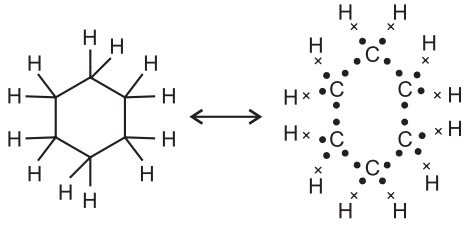
$$2CH_3 - CH_2 - OH + 2Na \rightarrow 2CH_3 - CH_2 - ONa + H_2$$

Ethanol acts as an oxidising agent in the reaction as:

(i) There is increase in oxidation number of sodium.

(ii) Since sodium is an electropositive element, its addition in ethanol will reduce ethanol.

(c) Structure of cyclohexane



(d) Acetaldehyde or Ethanal

Q. 2. (a) Carry out the following conversions:

(i) Ethanol to Ethene

(ii) Ethanol to Ethanoic acid

(b) Differentiate between addition reaction and substitution reaction. Give one example of each.

[CBSE OD, Set 2, 2020]

Ans. **(a) (i) Conversion of ethanol to ethene:** Heating ethanol at 443 K with excess concentrated sulphuric acid results in the dehydration of ethanol to give ethene.

$$\underset{\text{Ethanol}}{CH_3—CH_2OH} \xrightarrow[H_2SO_4]{\text{Hot conc.}} \underset{\text{Ethene}}{CH_2 = CH_2} + H_2O$$

The concentrated sulphuric acid can be regarded as a dehydrating agent which removes water from ethanol.

(ii) Conversion of ethanol to ethanoic acid: Ethanol can be converted to ethanoic acid in the presence of alkaline $KMnO_4$ and by heating the solution to give the ethanoic acid.

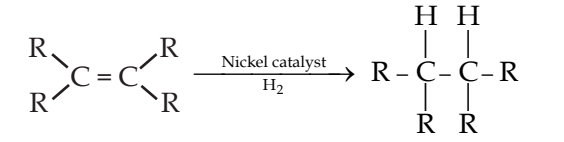
$$\underset{\text{Ethanol}}{CH_3—CH_2OH} \xrightarrow[\text{Or acidified } K_2Cr_2O_7 + \text{Heat}]{\text{Alkaline } KMnO_4 + \text{Heat}} \underset{\text{Ethanoic acid}}{CH_3COOH}$$

(b) Difference between addition and substitution reaction:

S.No	Addition reaction	Substitution reaction
1.	It is the combination of two or more atoms or molecules in order to form a large molecule.	It is the replacement of an atom or group of atoms by another atom or group of atoms.
2.	The large molecules formed after the reaction is called the adduct.	The leaving group or the molecular components which leave the reaction and are being replaced are called substrates.
3.	No by-product is formed.	A by-product is formed.

Example of addition reaction:

Addition reaction is commonly used in the hydrogenation of vegetable oils using a nickel catalyst. Vegetable oils generally have long unsaturated carbon chains while animal fats have saturated carbon chains.



(Unsaturated hydrocarbon) (Saturated hydrocarbon)

Alkene Alkane

Example of substitution reaction:

In the presence of sunlight, chlorine is added to hydrocarbons in a very fast reaction. Chlorine can replace the hydrogen atoms one by one. Thus these reactions are used in the synthesis of the intermediates.

$$CH_4 + Cl_2 \xrightarrow{\text{in the presence of sunlight}} CH_3Cl + HCl$$

Q. 3. Write the chemical formula and name of the compound which is the active ingredient of all alcoholic drinks. List its two uses. Write chemical equation and name of the product formed when this compound reacts with:

(i) sodium metal

(ii) hot concentrated sulphuric acid

[CBSE Delhi, Set 1, 2019]

Ans. The name of the ingredient of the alcoholic drink is ethanol.

Its formula is C_2H_5OH.

Two uses of ethanol (C_2H_5OH) are:

(a) It is used as a solvent in various industries.

(b) It is also used as an antiseptic solution.

(i) Reaction of ethanol with sodium metal

$$\underset{\text{Ethanol}}{C_2H_5OH} + Na \rightarrow \underset{\text{Sodium ethanoate}}{C_2H_5ONa} + H_2$$

(ii) Reaction of ethanol with conc. H_2SO_4

$$\underset{\text{Ethanol}}{C_2H_5OH} \xrightarrow[H_2SO_4]{\text{Conc.}} \underset{\text{Ethene}}{CH_2=CH_2} + H_2O$$

Q. 4. What is methane? Draw its electron dot structure. Name the type of bonds formed in this compound. Why are such compounds:

(i) poor conductors of electricity? and

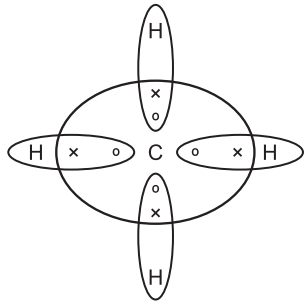
(ii) have low melting and boiling points? What happens when this compound burns in oxygen?

[CBSE Delhi, Set 1, 2019]

Ans. Methane is a hydrocarbon formed by the combination of carbon with hydrogen.

Its molecular formula is CH_4. It is a main green house gas. The type of bond formed in methane is covalent bond.

Electron dot structure of methane (CH_4):



(i) Covalent compounds are poor conductors of electricity because it has no free electrons to conduct electricity. Moreover this compound is formed by sharing of electrons. So no electron is available for the conduction.

(ii) They have weak forces of attraction between them so less energy is required to break the force of binding. Thus they have low melting and boiling points.

When this compound burns in oxygen, combustion reaction takes place.

$$CH_4 \xrightarrow{O_2} CO_2 + H_2O + \text{Heat} + \text{light}$$

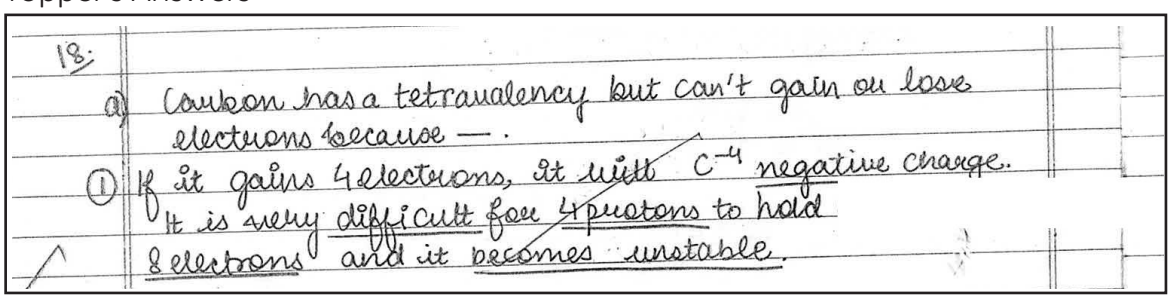
Q. 5. (a) State the reason why carbon can neither form C^{4+} cations nor C^{4-} anions, but forms covalent bonds. Also state reasons to explain why covalent compounds

(i) are bad conductors of electricity.

(ii) have low melting and boiling points.

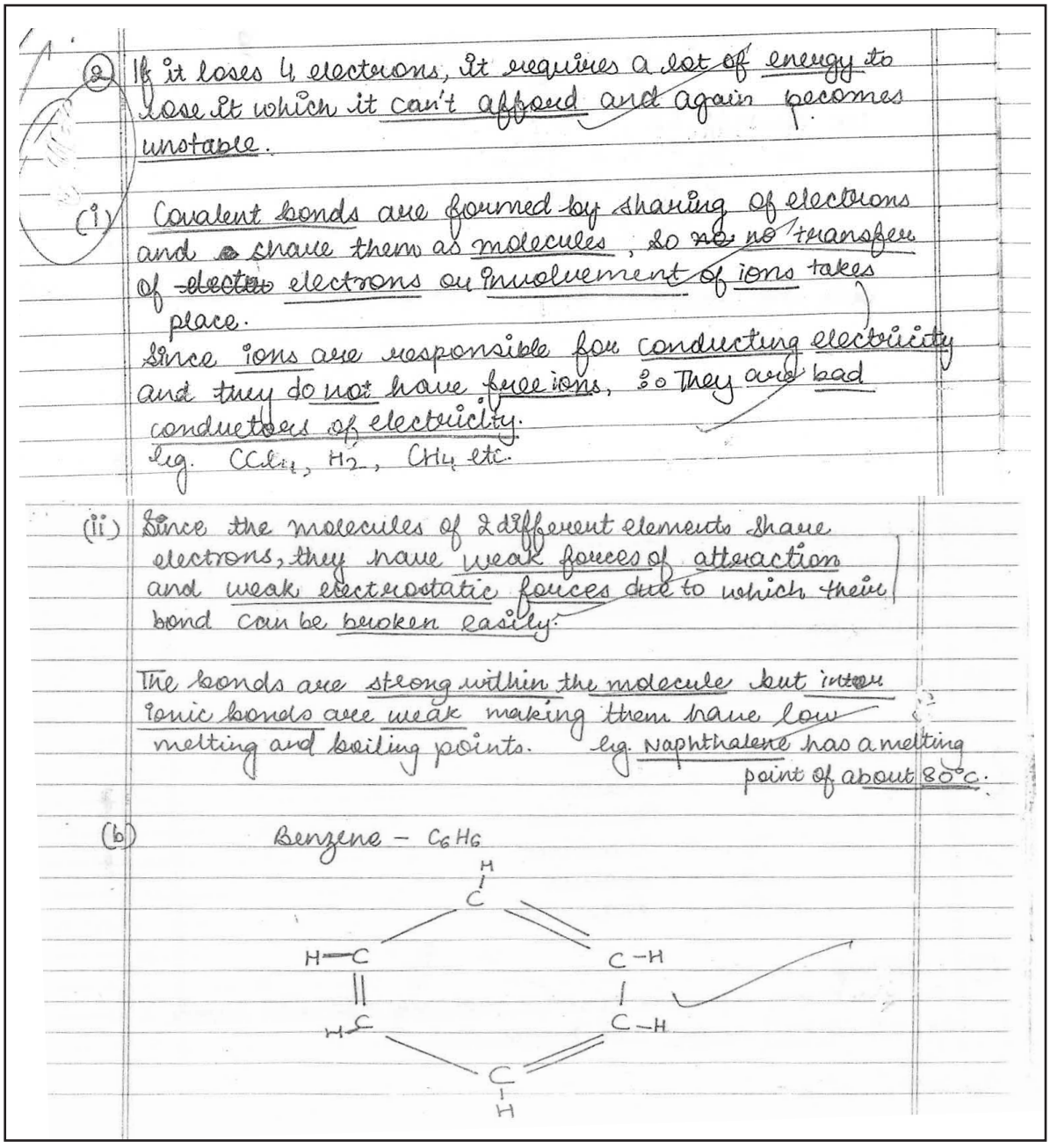
(b) Write the structural formula of benzene, C_6H_6. [CBSE, 2019]

Topper's Answers


18.

a) Carbon has a tetravalency but can't gain or lose electrons because —.

(i) If it gains 4 electrons, it will C^{-4} negative charge. It is very difficult for 4 protons to hold 8 electrons and it becomes unstable.

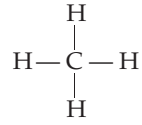


Q. 6. Why are certain compounds called hydrocarbons? Write the general formula for homologous series of alkanes, alkenes and alkynes and also draw the structure of the first member of each series. Write the name of the reaction that converts alkenes into alkanes and also write a chemical equation to show the necessary conditions for the reaction to occur.

[CBSE OD, Term 2, Set 1, 2017]

Ans. Compounds consisting of carbon and hydrogen are known as hydrocarbons.

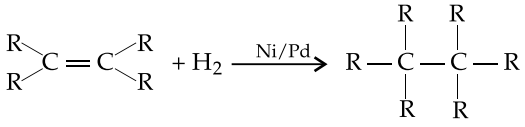
(i) Saturated hydrocarbons: Alkanes (C_nH_{2n+2}) are the compounds of carbon which have single bond.



(ii) Unsaturated hydrocarbons: The compounds of carbon having double bonds are alkene (C_nH_{2n}) and those having triple bonds are alkyne (C_nH_{2n-2}).

The reaction which converts unsaturated hydrocarbons to saturated hydro-

carbons *i.e.*, alkenes to alkane is known as hydrogenation reaction. It is used to obtain ghee from oil.



Oil (unsaturated) Ghee (saturated)

Q. 7. Soaps and detergents are both types of salts. State the difference between the two. Write the mechanism of the cleansing action of soaps. Why do soaps not form lather (foam) with hard water? Mention any two problems that arise due to the use of detergents instead of soaps.

[CBSE Delhi, Term 2, Set 1, 2017]

Ans.

S. No.	Soap	Detergents
1.	Soaps are sodium salts of long chain carboxylic acids.	Detergents are sodium salt of long chain benzene sulphonic acids.
2.	The ionic group in soap is $COONa^+$	The ionic groups in detergents is SO_3^-, Na^+
3.	Soaps are not useful when water is hard.	Detergent can be used for washing purpose even when water is hard.
4.	Soaps are biodegradable.	Some of the detergents are non-biodegradable.
5.	Soaps have relatively weak cleansing action.	Detergents have strong cleansing action.

Mechanism of the cleansing action of soaps: The dirt present on clothes is organic matter and insoluble in water. Therefore it cannot be removed by only washing with water. 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 micelles form 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.

Soaps do not form lather with hard water: Soap is a sodium or potassium salt of long chain fatty acids. Hard water contains salts of calcium and magnesium. When soap is added to hard water, calcium and magnesium ions present in water displace sodium or potassium ion present in soap forming insoluble substance called scum. A lot of soap is wasted in this process.

Problems that arise due to the use of detergents instead of soap:

(i) Detergents being non-biodegradable, they accumulate in the environment causing pollution. In soil, the presence of detergents leads to pH changes making soil infertile.

(ii) The entry of detergents into food chain leads to bio-accumulation in living beings and tends towards serious health issues.

Q. 8. A carbon compound 'P' on heating with excess conc. H_2SO_4 forms another carbon compound 'Q' which on addition of hydrogen in the presence of nickel catalyst forms a saturated carbon compound 'R'. One molecule of 'R' on combustion forms two molecules of carbon dioxide and three molecules of water. Identify P, Q and R and write chemical equations for the reactions involved.

[CBSE OD, Term 2, Set 1, 2016]

Ans. $CH_3CH_2OH \xrightarrow[\text{conc.}]{H_2SO_4} CH_2=CH_2$ (P) (Q)

$CH_2=CH_2 + H_2 \xrightarrow{Ni} CH_3-CH_3$ (R)

Combustion of Ethane:

$$CH_3{-}CH_3 + \frac{7}{2}O_2 \rightarrow 2CO_2 + 3H_2O$$

P = Ethyl alcohol (C_2H_5OH)
Q = Ethene ($CH_2=CH_2$)
R = Ethane (C_2H_6)

Q. 9. (a) Give a chemical test to distinguish between saturated and unsaturated hydrocarbon.

(b) Name the products formed when ethane burns in air. Write the balanced chemical equation for

the reaction showing the types of energies liberated.

(c) Why is reaction between methane and chlorine in the presence of sunlight considered a substitution reaction?

[CBSE Delhi, Term 2, Set 1, 2016]

Ans. **(a)** Pass the vapours of the given samples of saturated and unsaturated hydrocarbons into bromine water, in unsaturated hydrocarbons colour changes from brown to colourless solution while in saturated it does not.

(b) On burning ethane in air, the products obtained are CO_2 and H_2O with heat and light.

$$2C_2H_6\,(g) + 7O_2(g) \rightarrow 4CO_2(g) + 6H_2O(l) + \text{Heat} + \text{Light}$$

(c) It is a substitution reaction as chlorine atom displaces hydrogen atoms of methane.

Q. 10. Both soap and detergent are some type of salts. What is the difference between them? Describe in brief the cleansing action of soap. Why do soaps not form lather in hard water? List two problems that arise due to the use of detergents instead of soaps.

[CBSE OD, Term 2, Set 1, 2015]

Ans. Soaps are the sodium and potassium salts of long chain carboxylic acids whereas detergents are ammonium or sulphonate salts.

Cleansing action of soap: One part of soap molecules is ionic and dissolves in water. The other part is non-ionic hydrophobic part which dissolves in oil. Thus soap molecules arrange themselves in the form of a micelle. On rinsing with water soap is washed off lifting the oily dirt particles with it. Soap does not forms lather in hard water because hard water contains ions of magnesium and calcium which combine with soap components to form insoluble precipitate.

Problem due to the use of detergent are:

(i) Detergent are non-biodegradable.

(ii) It leads to water or soil pollution.

Q. 11. Explain why carbon forms compounds mainly by covalent bond. Explain in brief two main reasons for carbon forming a large number of compounds. Why does carbon form strong bonds with most other elements?

[CBSE Delhi, Term 2, Set 1, 2015]

Ans. Carbon forms covalent bonds due to tetravalency *i.e.*, have 4 electrons in the outer most shell. Losing and gaining 4 electrons is not possible due to effective nuclear charge, thus electrons are shared to form covalent bond.

Two reasons for large number of carbon compounds:

(i) Catenation: Ability of a carbon atom to form bonds with itself giving rise to long chains.

(ii) Tetravalency: Since carbon has a valency of 4, it is capable of bonding with four other atoms of carbon or atoms of element like oxygen, hydrogen, nitrogen, sulphur, chlorine etc.

Carbon forms strong bond with other elements because it is small in size due to which nucleus holds shared pair of electrons strongly.