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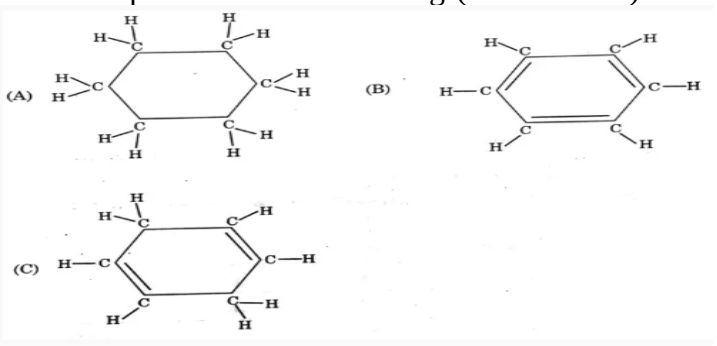
| | **INDIAN SCHOOL AL WADI AL KABIR** | |
| **Class: X** | **Department: SCIENCE 2025 – 26**<br>**SUBJECT: SCIENCE(CHEMISTRY)** | **Date: 19/10/2025** |
| **Worksheet No: 04**<br>**WITH ANSWERS** | **CHAPTER / UNIT: CARBON AND ITS COMPOUNDS** | **Note:**<br>**A4 FILE FORMAT** |
| **NAME OF THE STUDENT** | **CLASS & SEC:** | **ROLL NO.** |

## OBJECTIVE TYPE QUESTIONS

## MULTIPLE CHOICE QUESTIONS

1. The number of covalent bonds in pentane($C_5H_{12}$) is:
   (a) 5 (b) 12 (c) 17 (d) 16
2. The hydrocarbon which has alternate single and double bonds arranged in the form of a ring is:
   (a) $C_6H_{12}$ (b)$C_6H_{14}$ (c) $C_6H_6$ (d) $C_6H_{10}$
3. Which of the following will give a pleasant smell of ester when heated with ethanol and a quantity of sulphuric acid?
   (a) $CH_3COOH$
   (b) $CH_3CH_2OH$
   (c) $CH_3OH$
   (d) $CH_3CHO$
4. Which functional group is present in $CH_3COOH$?
   (a) Alcohol
   (b) Aldehyde
   (c) Carboxylic acid
   (d) Ketone
5. Consider the structures of the three cyclic carbon compounds A, B, and C given below and select the correct option from the following-(CBSE 22-23)



(a) A and C are isomers of hexane and B is benzene
(b) A is an isomer of hexane, B is benzene and C is an isomer of hexene
(c) A is a saturated cyclic hydrocarbon and B and C are unsaturated cyclic hydrocarbons
(d) A is cyclohexane and B and C are the isomers of benzene

6. An organic compound X with molecular formula $C_2H_4O_2$ turns blue litmus red and gives brisk effervescence with sodium bicarbonate. Identify the compound.
(a) Methanoic acid
(b) Ethanoic acid
(c) Ethanol
(d) Methanol

7. A soap molecule has a
(a) hydrophobic head and hydrophobic tail
(b) hydrophobic head and hydrophilic tail
(c) hydrophilic head and hydrophilic tail
(d) hydrophilic head and hydrophobic tail

8. Ethanol on complete oxidation gives
(a) acetic acid/ethanoic acid
(b) $CO_2$ and water
(c) ethanal
(d) acetone/ethanone

9. $C_3H_8$ belongs to the homologous series of
(a) Alkynes
(b) Alkenes
(c) Alkanes
(d) Cyclo alkanes

10. Which of the given represents a saponification reaction?
(a) $CH_3COONa + NaOH + CaO \rightarrow CH_4 + Na_2CO_3$
(b) $CH_3COOH + C_2H_5 + H_2SO_4 \rightarrow CH_3COOC_2H_5 + H_2O$
(c) $2CH_3COOH + 2Na \rightarrow 2CH_3COONa + H_2$
(d) $CH_3COOC_2H_5 + NaOH \rightarrow CH_3COONa + C_2H_5OH$

## ASSERTION-REASONING QUESTIONS

For the following questions, two statements are given-one labelled Assertion (A) and the other labelled Reason(R). Select the correct answer to these questions from the options (i) , (ii), (iii) and (iv)as given below:

(i) Both A and R are true and R is the correct explanation of the Assertion.
(ii)Both A and R are true but R is not the correct explanation of the Assertion.
(iii)A is true but R is false.
(iv)A is false but R is true.

11. Assertion(A): Carbon has a strong tendency to either lose or gain electrons to attain noble gas configuration.
Reason (R): Carbon has four electrons in its outermost shell and has the tendency to share electrons with carbon or other elements.

12. Assertion(A): Esterification is a process in which a sweet-smelling substance is produced.
Reason (R): When esters react with sodium hydroxide an alcohol and sodium salt of carboxylic acid are obtained.

13. Assertion: Ethene can be catalytically hydrogenated.
Reason : Ethene contains all C-H bonds.

14. Assertion (A): Functional groups determine the chemical properties of organic compounds.
Reason (R): Functional groups are specific atoms or groups of atoms that replace hydrogen in hydrocarbons.
15. Assertion (A): Soap molecules form micelles when added to water.
Reason (R): Micelles are spherical structures that trap dirt and grease inside, allowing them to be washed away.

## ONE MARK QUESTIONS

16. Write the molecular formula of an alkyne containing 6 atoms of hydrogen.
17. Write the name and formula of third member of the series of carbon compounds whose general formula is $C_nH_{2n}$.
18. Name the functional group present in this compound- $CH_3COCH_2CH_2CH_2CH_3$

## TWO MARKS QUESTIONS

19. Draw the electron dot structure for ethanoic acid
20. What is meant by functional group in carbon compounds? Write in tabular form the structural formula and the functional group present in the following compounds:
(i) Ethanol
(ii) Ethanoic acid
21. Explain isomerism. State any four characteristics of isomers. Draw the structures of possible isomers of butane, $C_4H_{10}$
22. 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. (Delhi 2017)

## THREE MARKS QUESTIONS

23 . (a) Write the molecular formula of the following carbon compounds:
(i) Methane (ii) Propane
(b) Carbon compounds have low melting and boiling points. Why? (Term II, 2021-22)
24. Draw the electron dot structure of the molecules of (a) Oxygen, and (b) Nitrogen. The atomic numbers of oxygen and nitrogen are 8 and 7 respectively. (Term II, 2021-22 C)
25. What is a homologous series? Find the difference in molecular mass between the two consecutive members of a homologous series. State how in a homologous series of carbon compounds the following properties vary with increase in molecular mass: (Term II, 2021-22)
(i) Melting and boiling points (ii) Chemical properties

## PREVIOUS YEAR BOARD QUESTIONS

26. A saturated organic compound 'A' with two carbon atoms belongs to the homologous series of alcohols. On oxidation, it forms an organic acid 'B' with molecular mass 60 u. On heating 'A' with excess concentrated sulphuric acid at 443 K, an unsaturated hydrocarbon 'C' is formed.
(i) Name A, B, and C.
(ii) Calculate molecular mass of C.
(iii) What happens when a pinch of sodium carbonate is added to compound B? Write chemical equation for the reaction.
(iv) Draw electron dot structure of compound B. (CBSE 24-25)
27. (i) A compound 'X' having two carbon atoms in its molecule turns blue litmus red and 5-8% solution of 'X' in water is widely used as a preservative. Identify the compound 'X' and write its structure.
(ii) Compare its pH nature with a mineral acid.
(iii) 'X' on reacting with alcohols produces sweet smelling compounds, used in making perfumes. Name the reaction and write its chemical equation.

(iv) When sodium carbonate is added to 'X', a colourless gas is produced which turns lime water milky. Write the chemical equation for the reaction giving the name of the salt produced. (CBSE 24-25)

28. 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.
29. A saturated organic compound 'A' belongs to the homologous series of alcohols. On heating 'A' with concentrated sulphuric acid at 443 K, it forms an unsaturated compound 'B' with molecular mass 28 u. The compound 'B' on addition of one mole of hydrogen in the presence of Nickel, changes to a saturated hydrocarbon 'C'.
    (A) Identify A, B and C.
    (B) Write the chemical equations showing the conversion of A into B.
    (C) What happens when compound C undergoes combustion?
    (D) State one industrial application of hydrogenation reaction.
    (E) Name the products formed when compound A reacts with sodium. (CBSE 2023)

**CASE STUDY/PASSAGE BASED QUESTIONS**

30. Carbon is a versatile element that forms the basis of all living organisms and many of the things we use. A large variety of compounds is because of its tetravalency. Compounds of carbon are formed with oxygen, hydrogen, nitrogen, sulphur, chlorine and many other elements.
    Answer the following questions:
    (a) Which one of the following hydrocarbons is different from the others? (1 Mark) (2024)
    (i) $C_4H_{10}$ (b) $C_7H_{14}$ (c) $C_5H_{12}$ (d) $C_2H_6$
    (b) List two properties by virtue of which carbon can form a large number of compounds.
    (c) (i) Write the formula of the functional group present in (1) aldehydes and (2) ketones. Write chemical equation for the reaction that occurs between ethanoic acid and ethanol in the presence of a catalyst.

    OR

    (c)(ii) What are structural isomers? Write the structures of two isomers of butane.

## ANSWERS

| | Answers |
|---|---|
| 1 | (d) 16 |
| 2 | (c) $C_6H_6$ |
| 3 | (a) $CH_3COOH$ |
| 4 | (c) Carboxylic acid |
| 5 | (c) A is a saturated cyclic hydrocarbon and B and C are unsaturated cyclic hydrocarbons |
| 6 | (b) Ethanoic acid |
| 7 | (d) hydrophilic head and hydrophobic tail |
| 8 | (b) $CO_2$ and water |
| 9 | (c)Alkanes |
| 10 | (d) $CH_3COOC_2H_5 + NaOH \rightarrow CH_3COONa + C_2H_5OH$ |
| 11 | (iv)A is false but R is true. |
| 12 | (ii)Both A and R are true but R is not the correct explanation of the Assertion. |
| 13 | (iii)A is true but R is false. |
| 14 | (i) Both A and R are true and R is the correct explanation of the Assertion. |
| 15 | (i) Both A and R are true and R is the correct explanation of the Assertion. |

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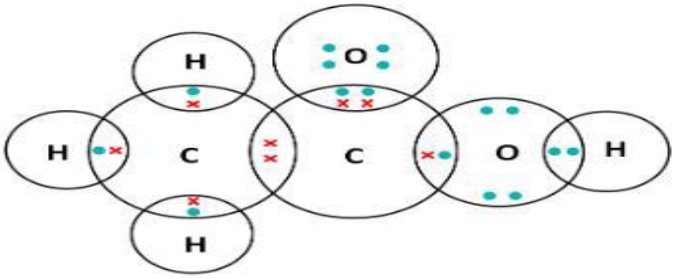
| 16 | $C_4H_6$ |
| 17 | Butene |
| 18 | Ketone |
| 19 |   |
| 20 | An atom or a group of atoms present in a molecule which largely determines its chemical properties, is called functional group. |

| | Compound | Structural formula | Functional group |
|---|---|---|---|
| (i) | Ethanol ($C_2H_5OH$) | H H<br>H — C — C — OH<br>H H | —OH<br>(alcoholic) |
| (ii) | Ethanoic acid ($CH_3COOH$) | H O<br>H — C — C — OH<br>H | O<br>— C — OH<br>(carboxylic acid) |

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| 21 | Isomers are those compounds which have same molecular formula but different structures. The phenomenon of existing these isomers are called isomerism.<br>Four characteristics of isomers are :<br>(i) They have same molecular formula but different structures.<br>(ii) For hydrocarbons, isomers is possible only with hydrocarbons having four or more carbon atoms.<br>(iii) Due to isomerism, a given molecular formula can represent two or more different compounds.<br>(iv) Due to isomerism, the different compounds have different properties.<br>The structures of possible isomers of butane ($C_4H_{10}$) are:<br>H H H H<br>H — C — C — C — C — H<br>H H H H<br>*n*-Butane<br>(I)<br>H H H<br>H — C — C — C — H<br>H H<br>H — C — H<br>H<br>2-Methylpropane<br>(II) |
| 22 | All unsaturated hydrocarbons (containing double or triple bonds) have tendency to get converted to saturated hydrocarbons (single bonds) by adding small molecules such as hydrogen ($H_2$), halogens ($X_2$), etc. Such reactions are called addition reactions. |

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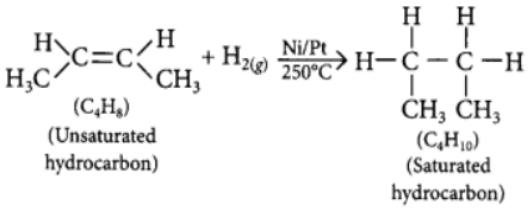
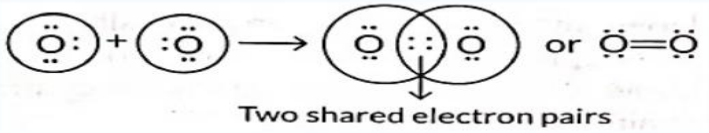
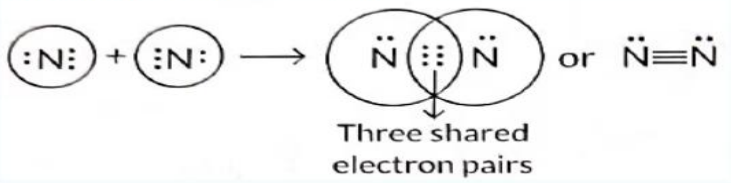
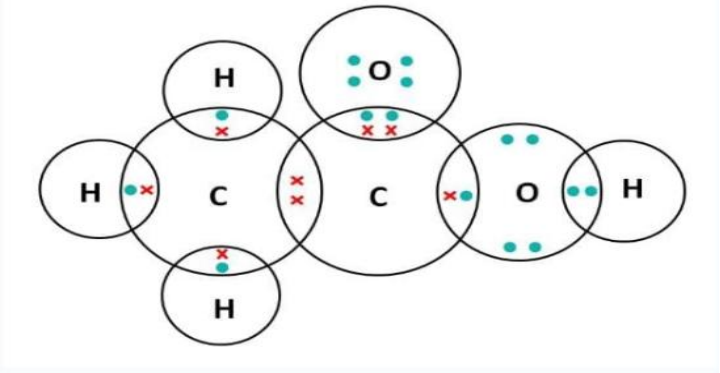
| | Compound X i.e., $C_4H_8$ belongs to alkene series ($C_nH_{2n}$) while compound Y i.e., $C_5H_{12}$ belongs to alkane series ($C_nH_{2n+2}$). Thus, compound X will undergo addition reaction.<br>  <br><br>($C_4H_8$) (Unsaturated hydrocarbon)<br>($C_4H_{10}$) (Saturated hydrocarbon) |
| 23 | (a) (i) Methane ($CH_4$) (ii) Propane ($CH_3CH_2CH_3$) or $C_3H_8$<br>(b) Due to weak intermolecular forces of attraction, covalent compounds generally have low melting and boiling points. |
| 24 | **Ans: (a)** Formation of oxygen molecule:<br>  <br><br>**(b)** Formation of nitrogen molecule:<br>  <br> |
| 25 | A homologous series is the family of organic compounds having the same functional group, similar chemical properties but the successive (adjacent members of the series differ by a —$CH_2$ unit or 14 mass units. (i) As the molecular mass increases in a homologous series, melting and boiling points also increases. (ii) Chemical properties remains same for the members of homologous series because they all have same functional group. |
| 26 | (i) A: Ethanol ($C_2H_5OH$); B: Ethanoic acid ($CH_3COOH$); C: Ethene ($C_2H_4$). (ii) Molecular Mass of C: $C_2H_4 = (2\times12) + (4\times1) = 28$ u. (iii) Reaction: $CO_2$ gas evolves, turning lime water milky. $CH_3COOH + Na_2CO_3 \rightarrow CH_3COONa + H_2O + CO_2$ (iv) Electron Dot Structure of B ($CH_3COOH$):<br>  <br> |

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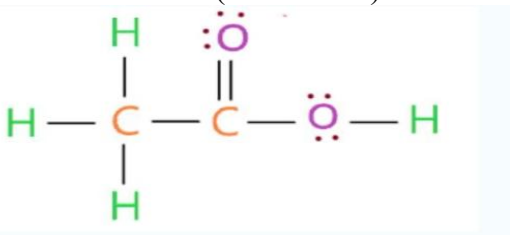
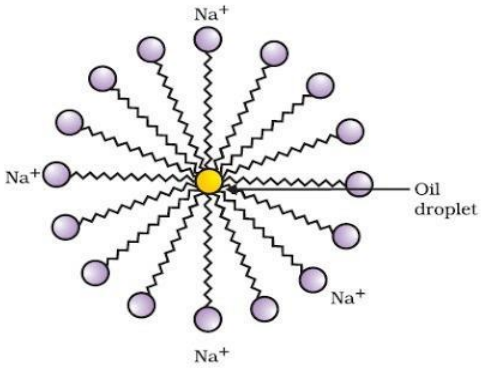
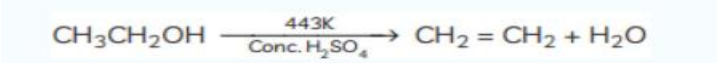
| 27 | (i) X: Ethanoic acid ($CH_3COOH$).<br>  <br>(ii) pH Comparison: Ethanoic acid (weak acid, pH ~3-4) is less acidic than mineral acids (e.g., HCl, pH ~1).<br>(iii) Reaction: Esterification; $CH_3COOH + C_2H_5OH \rightarrow CH_3COOC_2H_5 + H_2O$.<br>(iv) Equation: $CH_3COOH + Na_2CO_3 \rightarrow 2CH_3COONa$ (sodium ethanoate) + $H_2O + CO_2$. |
| 28 | The molecules of soap are sodium or potassium salts of long-chain carboxylic acids. Detergents are generally ammonium or sulphonate salts of long chain carboxylic acids. The ionic group in soaps is -COO–Na+. The ionic group in synthetic detergents is -SO3–Na+ or -OSO3 –Na+<br>**Cleansing action of soap:** A soap molecule contains a polar part (COO–Na+) called polar end and a non-polar part consisting of a long chain carbon atom. This part is called hydrocarbon end. The polar end is water soluble whereas hydrocarbon part is water-repellent and oil soluble.<br>When an oily (dirty) piece of cloth is put into soap solution, the hydrocarbon part of the molecule attaches itself to the oily drop and the -COO– end orients itself towards water. Na+ ions in solution arrange themselves around the -COO– ions. The negatively charged micelle so formed entraps the oily dirt. The negatively charged micelle repel each other due to the electrostatic repulsion. As a result, the tiny oily dirt particles do not come together and get washed away in water during rinsing.<br>  <br><br>In hard water, soap does not form lather as hard water contains $Ca^{2+}$ and $Mg^{2+}$ ions. Soap reacts with these ions to form insoluble calcium and magnesium salts of fatty acids.<br>Two problems which arise due to the use of detergents instead of soaps are: (i) Synthetic detergents are non-biodegradable and hence, cause water pollution. (ii) Synthetic detergents also cause skin related problems. |
| 29 | **(A)** Ethanol ($C_2H_5OH$) belongs to alcohol's homologous series. A- Ethanol (C2H5OH) B- Ethene ($C_2H_4$) C- Ethane (C2H6)<br>**(B)** Dehydration occurs when ethanol is heated with concentrated sulphuric acid at 443 K, resulting in the formation of ethene Concentrated sulphuric acid serves as a dehydrating agent in this reaction.<br>  <br> |

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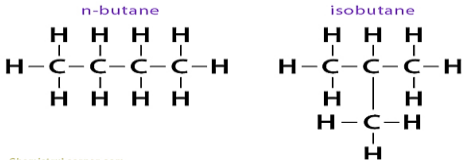
| | **(C)** Compound C is ethane. When it undergoes combustion, it forms CO2 and water.<br>$C_2H_6 + 3\frac{1}{2} O_2 \longrightarrow 2CO_2 + 3H_2O$<br>**(D)** Hydrogenation reactions are used in the production of saturated vegetable ghee from unsaturated vegetable oils.<br>**(E)** Sodium ethoxide is formed when ethanol ($C_2H_5OH$) reacts with sodium (Na). The reaction is as follows:<br>$2CH_3CH_2OH_{(l)} + 2Na_{(s)} \longrightarrow 2CH_3CH_2ONa_{(l)} + H_{2(g)}$ |
| 30 | (a) (ii) $C_7H_{14}$<br>(b) Catenation and tetravalency<br>(c) (i) (1) Aldehydes- CHO<br>  <br><br>Ethyl ethanoate<br>(c)(ii) Structural isomers- Organic compounds having same molecular formula but different structures.<br>Isomers of butane:<br>  <br> |

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