
	<b>INDIAN SCHOOL AL WADI AL KABIR</b>	
<b>Class: X</b>	<b>Department: SCIENCE 2021 – 22</b> <b>SUBJECT : CHEMISTRY</b>	<b>Date of completion:</b> <b>13-02-2022</b>
<b>Worksheet No: 04</b> <b>WITH ANSWERS</b>	<b>CHAPTER:</b> <b>CARBON AND ITS COMPOUNDS</b>	<b>Note:</b> <b>A4 FILE FORMAT</b>
<b>Name of the student:</b>	<b>Class &amp; Sec:</b>	<b>Roll No:</b>

### OBJECTIVE TYPE QUESTIONS

#### MULTIPLE CHOICE QUESTIONS

- The number of covalent bonds in pentane( $C_5H_{12}$ ) is:  
(a) 5            (b) 12            (c) 17            (d) 16
- 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)  $C_6H_{10}$
- The number of isomers formed by the hydrocarbon with molecular formula  $C_5H_{12}$  is:  
(a) 2            (b) 5            (c) 3            (d) 4

#### 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.

- Assertion:- Carbon shows maximum catenation property in the periodic table.  
Reason:- Carbon has small size and thus forms strong c-c bonds.
- Assertion:- Most of the carbon compounds are good conductors of electricity.  
Reason:- They do not dissociate to form ions and remain as molecules.

6. Assertion:  $-C_3H_8$  and  $C_4H_{10}$  are the successive members of alkane homologous series.  
Reason:-Successive members in a homologous series differ by  $CH_3$  unit.

### ONE MARK QUESTIONS

7. Which element exhibits the property of catenation to maximum extent and why?  
8. Name an element other than carbon which exhibits catenation. Are these compounds stable?  
9. Write the name and formula of third member of the series of carbon compounds whose general formula is  $C_nH_{2n}$ .  
10. Write the name and molecular formula of the fifth member of alkane series.  
11. Write the molecular formula of an alkyne containing 6 atoms of hydrogen.

### TWO MARK QUESTIONS

12. Explain why carbon generally forms compounds by covalent bonds.  
13. Atom of an element contains five electrons in its valence shell. This element is major component of air. It exists as a diatomic molecule.  
(i) Identify the element.  
(ii) Show the bond formed between two atoms of this element.  
(iii) Write the nature of the bond between the two atoms.  
14. (a) What are hydrocarbons? Give examples.  
(a) Give the structural differences between saturated and unsaturated hydrocarbons with two examples each.  
15. Write the structural formulae of all the isomers of hexane.  
16. Define the term structural isomerism. Explain why propane cannot exhibit this property.

### THREE MARK QUESTIONS

17. (i) What would be the electron dot structure of carbon dioxide which has the formula  $CO_2$ ?  
(ii) 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)  
18. Explain the nature of the covalent bond using the bond formation in  $CH_3Cl$ .  
19. (i) Select saturated hydrocarbons from the following:-  
 $C_3H_6$ ,  $C_5H_{10}$ ,  $C_4H_{10}$ ,  $C_6H_{14}$ ,  $C_2H_4$   
(ii) Select alkene and alkyne from the following:-  
 $C_6H_{12}$ ,  $C_3H_4$ ,  $C_2H_4$ ,  $CH_4$ ,  $C_4H_8$ ,  $C_5H_8$

### FIVE MARK QUESTIONS

20. (i)What are isomers? Draw the structures of two isomers of butane,  $C_4H_{10}$

- (ii) Differentiate between alkenes and alkynes.
21.  $C_3H_6$ ,  $C_4H_8$  and  $C_5H_{10}$  belong to the same homologous series.
- (i) Why the melting and boiling points of  $C_5H_{10}$  is higher than  $C_4H_8$ ?
- (ii) Arrange these hydrocarbons in order of increasing boiling points.
22. Draw the possible isomers of pentane,  $C_5H_{12}$

### PREVIOUS YEAR BOARD QUESTIONS

23. Give reason why carbon neither forms  $C^{4+}$  cations nor  $C^{4-}$  anions, but forms covalent compounds which are bad conductors of electricity and have low melting and boiling points.
24. What are covalent compounds? Why are they different from ionic compounds? List their three characteristic properties.
25. Define homologous series of organic compounds. List its two characteristics. Write the name and formula of the first member of the series of alkenes.
26. Write the general formula of (i) alkenes and (ii) alkynes. Draw the structure of first member of each series to show the bonding between the two carbon atoms.
27. Write the molecular formula of the following compounds and draw their electron dot structures.
- (a) Ethane                      (b) Ethene                      (c) Ethyne

### CASE STUDY BASED QUESTIONS

28. Study the table related to three hydrocarbons A, B, C and answer the questions that follow.

Organic compound	Molecular formula
A	$C_3H_8$
B	$C_5H_{10}$
C	$C_4H_6$

- (i) A, B and C are classified as hydrocarbons because:
- (a) They contain hydrogen
- (b) They contain carbon
- (c) They contain both carbon and hydrogen
- (d) None of these
- (ii) Which of these organic compounds is an alkyne
- (a) A
- (b) B
- (c) C
- (d) All of these
- (iii)  $C_5H_{10}$  belongs to:
- (a)  $C_nH_{2n+2}$  series
- (b)  $C_nH_{2n-2}$  series
- (c)  $C_nH_{2n}$  series
- (d) None of these

- (iv) Identify the incorrect statement about these three hydrocarbons.
- All have different general formula
  - A and B differ by  $-\text{CH}_2$  unit
  - C is an alkyne
  - B is an alkene
29. A series of organic compounds having same functional group with similar or almost identical chemical characteristics in which all the members can be represented by the same general formula and the two consecutive members of the series differ by  $\text{CH}_2$  group or 14 mass unit in their molecular formulae is called a homologous series.
- (i) Which of the following is not a characteristic of members of a homologous series?
- They possess varying chemical properties
  - Their physical properties vary in regular and predictable manner.
  - All the members can be represented by the same general formula.
  - Adjacent members differ by one carbon and two hydrogen atoms.
- (ii) All the members of homologous series of alkynes have the general formula
- $\text{C}_n\text{H}_{2n+2}$
  - $\text{C}_n\text{H}_{2n-2}$
  - $\text{C}_n\text{H}_{2n}$
  - $\text{C}_n\text{H}_{2n-4}$
- (iii) Which of the following statements is not correct?
- A common functional group is present in different members of a homologous series.
  - Two consecutive members of a homologous series differ by a  $-\text{CH}_3$  group.
  - The molecular mass of a compound in the series differ by 14 amu from that of its neighbour.
  - All the members of a homologous series have common general methods of preparation.
- (iv) Identify the correct statements
- As the molecular mass increases in any homologous series, gradation in physical properties is seen.
  - The melting and boiling point decrease with increasing molecular mass.
  - Physical properties such as solubility in a particular solvent decrease with increasing molecular mass.
  - The chemical properties which are determined solely by the functional group remain similar in a homologous series.
- (II) and (III)
  - (II) and (IV)
  - (I), (III) and (IV)
  - (I), (II), (III) and (IV)

## ANSWERS

### OBJECTIVE TYPE QUESTIONS

#### MULTIPLE CHOICE QUESTIONS

Qn.No.	Answers
1	(d) 16
2	(c) C <sub>6</sub> H <sub>6</sub>
3	(c) 3

#### ASSERTION-REASONING QUESTIONS

4	(i) Both A and R are true and R is the correct explanation of the Assertion.
5	(iv) A is false but R is true.
6	(iii) A is true but R is false

#### ONE MARK QUESTIONS

7	Carbon. Because it forms strong covalent bonds.
8	Silicon. These compounds are unstable and reactive.
9	Butene
10	Pentane, C <sub>5</sub> H <sub>12</sub>
11	C <sub>4</sub> H <sub>6</sub>

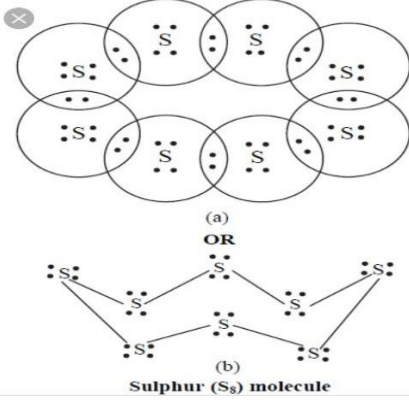
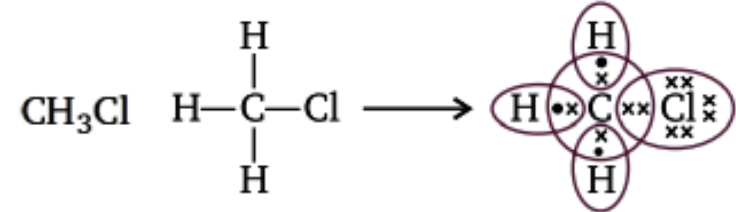
#### TWO MARK QUESTIONS

12	Carbon cannot lose four electrons easily because very high energy is required. It cannot gain four electrons easily because 6 protons cannot hold 10 electrons. Carbon can easily share four electrons forming covalent bonds.
13	(i) Nitrogen. (ii) <p>Two nitrogen atoms                      Nitrogen molecule</p> <p>(iii) Covalent bond.</p>
14	(a) Hydrocarbons are the compounds made up of carbon and hydrogen atoms only. Eg:-methane, ethane, ethene etc. (b) Saturated hydrocarbons contain single covalent bonds only. Eg:- methane and ethane are saturated hydrocarbons.

	<div style="display: flex; justify-content: space-around; align-items: center;"> <div style="text-align: center;"> <math display="block">\begin{array}{c} \text{H} \\   \\ \text{H}-\text{C}-\text{H} \\   \\ \text{H} \end{array}</math> <p>METHANE</p> </div> <div style="text-align: center;"> <math display="block">\begin{array}{c} \text{H} \quad \text{H} \\   \quad   \\ \text{H}-\text{C}-\text{C}-\text{H} \\   \quad   \\ \text{H} \quad \text{H} \end{array}</math> <p>ETHANE</p> </div> </div> <p>Unsaturated hydrocarbons contain double or triple covalent bonds. Eg:- ethene and ethyne</p> <div style="display: flex; justify-content: space-around; align-items: center; margin-top: 20px;"> <div style="text-align: center;"> <math display="block">\begin{array}{c} \text{H} \quad \quad \text{H} \\ \diagdown \quad / \\ \text{C}=\text{C} \\ / \quad \diagdown \\ \text{H} \quad \quad \text{H} \end{array}</math> <p><i>Ethene</i></p> </div> <div style="text-align: center;"> <p>Ethyne <math>\text{C}_2\text{H}_2</math></p> <math display="block">\text{H}-\text{C}\equiv\text{C}-\text{H}</math> </div> </div>
15	<div style="display: flex; justify-content: space-around; align-items: flex-start;"> <div style="text-align: center;"> <math display="block">\text{CH}_3-\text{CH}_2-\text{CH}_2-\text{CH}_2-\text{CH}_2-\text{CH}_3</math> <p>Hexane 1</p> </div> <div style="text-align: center;"> <math display="block">\begin{array}{c} \text{CH}_3-\text{CH}-\text{CH}_2-\text{CH}_2-\text{CH}_3 \\   \\ \text{CH}_3 \end{array}</math> <p>2 - methyl pentane 2</p> </div> <div style="text-align: center;"> <math display="block">\begin{array}{c} \text{CH}_3-\text{CH}_2-\text{CH}-\text{CH}_2-\text{CH}_3 \\   \\ \text{CH}_3 \end{array}</math> <p>3 - methyl pentane 3</p> </div> </div> <div style="display: flex; justify-content: space-around; align-items: flex-start; margin-top: 20px;"> <div style="text-align: center;"> <math display="block">\begin{array}{c} \text{CH}_3 \\   \\ \text{CH}_3-\text{C}-\text{CH}_2-\text{CH}_3 \\   \\ \text{CH}_3 \end{array}</math> <p>2,2 - Dimethyl butane 4</p> </div> <div style="text-align: center;"> <math display="block">\begin{array}{c} \text{CH}_3-\text{CH}-\text{CH}-\text{CH}_3 \\   \quad   \\ \text{CH}_3 \quad \text{CH}_3 \end{array}</math> <p>2,3 - Dimethyl butane 5</p> </div> </div>
16	<p>The phenomenon in which compounds have same molecular formula but different structures is called structural isomerism.</p> <p>Lower alkanes till propane do not show isomerism. They cannot have a branched chain structure to exhibit isomerism.</p>

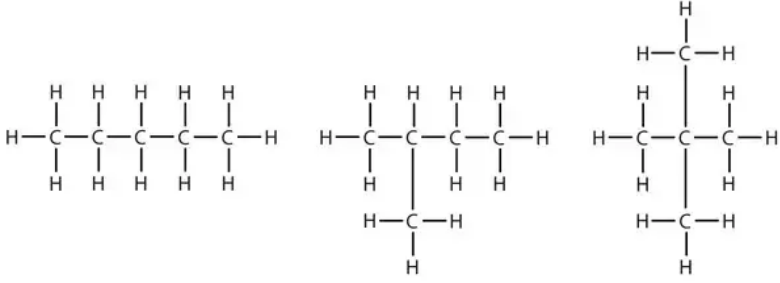
### THREE MARK QUESTIONS

17	(i)	<div style="border: 2px solid black; padding: 10px; display: inline-block;"> <math display="block">\begin{array}{c} \text{:}\ddot{\text{O}}\text{:} + \text{:}\text{C}\text{:} + \text{:}\ddot{\text{O}}\text{:} \rightarrow \begin{array}{c} \text{:}\ddot{\text{O}}\text{:} \quad \text{C} \quad \text{:}\ddot{\text{O}}\text{:} \\ \text{  } \quad \text{  } \\ \text{O} \quad \text{O} \end{array} \\ \text{or } \text{O}=\text{C}=\text{O} \end{array}</math> </div>
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	 <p>(ii) Sulphur (S<sub>8</sub>) molecule</p>
18	<p>Carbon has four valence electrons. It shares one electron with chlorine and one electron each with three hydrogen atoms.</p> 
19	<p>(i) C<sub>6</sub>H<sub>14</sub> and C<sub>4</sub>H<sub>10</sub> are saturated hydrocarbons.  (ii) Alkenes:- C<sub>6</sub>H<sub>12</sub>, C<sub>2</sub>H<sub>4</sub>, C<sub>4</sub>H<sub>8</sub></p> <p>Alkynes:- C<sub>3</sub>H<sub>4</sub>, C<sub>5</sub>H<sub>8</sub></p>

### FIVE MARK QUESTIONS

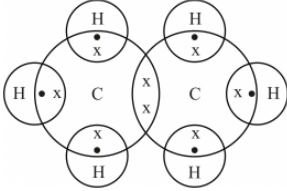
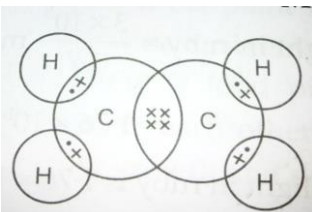
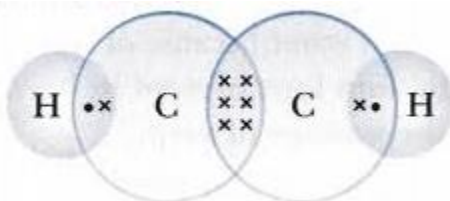
20	<p>(i) Isomers are those compounds which have same molecular formula but different structural formulae.</p> <p>Structures of two isomers of butane are:-</p> <table style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="text-align: center; width: 50%;">Butane</th> <th style="text-align: center; width: 50%;">Isobutane</th> </tr> </thead> <tbody> <tr> <td style="text-align: center;"> <pre> H   H   H   H               H-C-C-C-C-H               H   H   H   H </pre> </td> <td style="text-align: center;"> <pre> H   H   H           H-C-C-C-H           H       H           H-C-H           H </pre> </td> </tr> </tbody> </table> <p>(ii) Alkenes are unsaturated hydrocarbons with carbon-carbon double bonds. The general formula is C<sub>n</sub>H<sub>2n</sub>  Alkynes are unsaturated hydrocarbons with carbon-carbon triple bonds. The general formula is C<sub>n</sub>H<sub>2n-2</sub>.</p>	Butane	Isobutane	<pre> H   H   H   H               H-C-C-C-C-H               H   H   H   H </pre>	<pre> H   H   H           H-C-C-C-H           H       H           H-C-H           H </pre>
Butane	Isobutane				
<pre> H   H   H   H               H-C-C-C-C-H               H   H   H   H </pre>	<pre> H   H   H           H-C-C-C-H           H       H           H-C-H           H </pre>				

21	(i) It is because $C_5H_{10}$ has higher molecular weight, more force of attraction and higher boiling points and melting points. (ii) $C_3H_6 < C_4H_8 < C_5H_{10}$
22	 <p style="text-align: center;">Pentane                      Isopentane                      Neopentane</p>

### PREVIUOS YEAR BOARD QUESTIONS

23	<p>Carbon cannot lose 4 electrons to form <math>C^{4+}</math> ions as very high energy is required to remove 4 electrons. Carbon cannot gain four electrons to form <math>C^{4-}</math> ions as 6 protons cannot hold 10 electrons.</p> <p>Carbon can share 4 electrons to form covalent compounds. Carbon compounds do not conduct electricity as they do not form ions. They have low melting and boiling points due to weak force of attraction between molecules.</p>
24	<p>Those compounds which are formed by sharing of electrons are called covalent compounds. They differ from ionic compounds because they do not have ions. Ionic compounds are formed by the transfer of electrons.</p> <p>Properties of covalent compounds: -</p> <ol style="list-style-type: none"> <li>1. They have low melting and boiling points.</li> <li>2. They do not conduct electricity in molten state or in aqueous solution.</li> <li>3. They are mostly insoluble in water but soluble in organic solvents.</li> </ol>
25	<p>The series of organic compounds having similar chemical properties and similar structure is called homologous series.</p> <p>Each member differs from successive member by <math>-CH_2</math> group. The difference in molecular mass between two successive members is 14u.</p> <ol style="list-style-type: none"> <li>(i) It has same general formula, from which all members can be derived.</li> <li>(ii) They have similar chemical properties. Ethene, (<math>C_2H_4</math>), <math>CH_2=CH_2</math> is the first member of alkene series.</li> </ol>
26	<p>(i) Alkenes-<math>C_nH_{2n}</math> and (ii) Alkynes-<math>C_nH_{2n-2}</math> First member of alkene is ethane (<math>C_2H_4</math>) and alkyne is ethyne (<math>C_2H_2</math>)</p>



	<div style="display: flex; justify-content: space-around; align-items: center;"> <div style="text-align: center;"> <math display="block">\begin{array}{c} \text{H} &amp; &amp; \text{H} \\ &amp; \diagdown &amp; / \\ &amp; \text{C} = \text{C} \\ &amp; / &amp; \diagdown \\ \text{H} &amp; &amp; \text{H} \end{array}</math> <p>Ethene</p> </div> <div style="text-align: center;"> <p>Ethyne <math>\text{C}_2\text{H}_2</math></p> <math display="block">\text{H}-\text{C}\equiv\text{C}-\text{H}</math> </div> </div>
27	<div style="text-align: center;">  <p>(a) Ethane (<math>\text{C}_2\text{H}_6</math>)</p> </div> <div style="text-align: center; margin-top: 20px;">  <p>(b) Ethene (<math>\text{C}_2\text{H}_4</math>)</p> </div> <div style="text-align: center; margin-top: 20px;">  <p>(c) Ethyne (<math>\text{C}_2\text{H}_2</math>)</p> </div>

### CASE STUDY BASED QUESTIONS

28	<ul style="list-style-type: none"> <li>(i) (c) They contain both carbon and hydrogen</li> <li>(ii) (c) C</li> <li>(iii) (c) <math>\text{C}_n\text{H}_{2n}</math> series</li> <li>(iv) (b) A and B differ by <math>-\text{CH}_2</math> unit</li> </ul>
29	<ul style="list-style-type: none"> <li>(i) (a) They possess varying chemical properties</li> <li>(ii) (b) <math>\text{C}_n\text{H}_{2n-2}</math></li> <li>(iii) (b) Two consecutive members of a homologous series differ by a <math>-\text{CH}_2</math> group.</li> <li>(iv) (c) (I), (III) and (IV)</li> </ul>

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