



INDIAN SCHOOL AL WADI AL KABIR

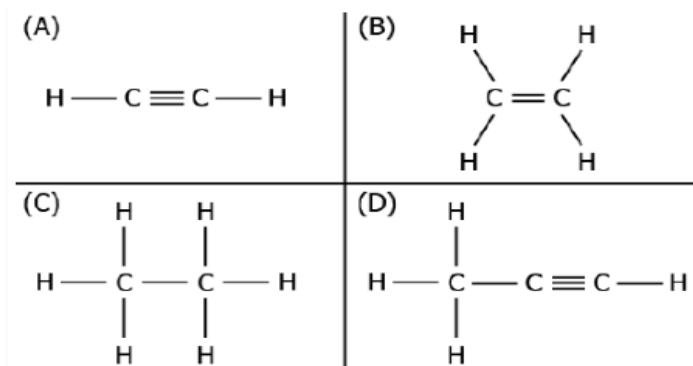


<b>Class: X</b>	<b>Department: SCIENCE 2022 – 23</b> <b>SUBJECT: CHEMISTRY</b>	<b>Date of submission: 10.11.22</b>
<b>Worksheet No:4</b> <b>with answers</b>	<b>Topic:</b> <b>Carbon and its compounds</b>	<b>Note:A4 FILE FORMAT</b>
<b>Name of the student:</b>	<b>Class &amp; sec:</b>	<b>Roll no:</b>

**OBJECTIVE TYPE QUESTIONS**

**MULTIPLE CHOICE QUESTIONS**

1. The electronic configuration of an element is found to be 2, 4. How many bonds can one carbon atom form in a compound?
- (a) 1  
(b) 2  
(c) 4  
(d) 6
2. The image represents the structure of a few hydrocarbon compounds.



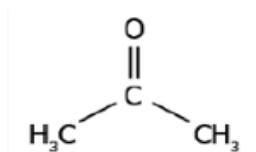
Which of these compounds can be classified as alkynes?

- (a) only (A)  
(b) only (B)

(c) both (A) and (D)

(d) both (B) and (C)

3. The image represents a carbon compound.



Which functional group is present in the compound?

(a) alcohol

(b) aldehyde

(c) carboxylic acid

(d) ketone

4. The number of covalent bonds in pentane ( $C_5H_{12}$ ) is:

(a) 5

(b) 12

(c) 17

(d) 16

5. 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)  $C_6H_{10}$

6. Which of the following is the molecular formula of cyclobutane?

a)  $C_4H_{10}$

b)  $C_4H_6$

c)  $C_4H_8$

### **ASSERTION-REASONING QUESTIONS**

7. Assertion:- Carbon shows maximum catenation property in the periodic table.

Reason:- Carbon has small size and thus forms strong c-c bonds.

8. Assertion:- Most of the carbon compounds are good conductors of electricity.

Reason:- They do not dissociate to form ions and remain as molecules.

9. Assertion(A): Diamond is the hardest natural known substance.

Reason (R) : Diamond is used for cutting marble, granite and glass.

10. Assertion(A) : Soaps are not suitable for washing purpose when water is hard.

Reason (R) : Soaps have relatively weak cleansing action.

### **ONE MARK QUESTIONS**

11. Name an element other than carbon which exhibits catenation. Are these compounds stable?

12. Write the name and molecular formula of the fifth member of alkane series.

13. Write the molecular formula of an alkyne containing 6 atoms of hydrogen.

14. Name the functional groups present in this compound-  $CH_3COCH_2CH_2CH_2CH_3$

15. What is a homologous series?

### **TWO MARK QUESTIONS**

16. Explain why carbon generally forms compounds by covalent bonds.

17. 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.
18. Why are carbon and its compounds used as fuels for most applications?
19. Draw the electron dot structure for - ethanoic acid
20. (a) What are hydrocarbons? Give examples.

### **THREE MARK QUESTIONS**

21. Explain the nature of the covalent bond using the bond formation in  $\text{CH}_3\text{Cl}$ .
22. (i) Select saturated hydrocarbons from the following:-  
 $\text{C}_3\text{H}_6$ ,  $\text{C}_5\text{H}_{10}$ ,  $\text{C}_4\text{H}_{10}$ ,  $\text{C}_6\text{H}_{14}$ ,  $\text{C}_2\text{H}_4$   
(ii) Select alkene and alkyne from the following:-  
 $\text{C}_6\text{H}_{12}$ ,  $\text{C}_3\text{H}_4$ ,  $\text{C}_2\text{H}_4$ ,  $\text{CH}_4$ ,  $\text{C}_4\text{H}_8$ ,  $\text{C}_5\text{H}_8$
23. Draw the possible isomers of pentane,  $\text{C}_5\text{H}_{12}$

### **PREVIUOS YEAR BOARD QUESTIONS**

24. Give reason why carbon neither forms  $\text{C}^{4+}$  cations nor  $\text{C}^{4-}$  anions, but forms covalent compounds which are bad conductors of electricity and have low melting and boiling points. (2021)
25. Give reasons for the following:  
(i) Element carbon forms compounds mainly by covalent bonding.  
(ii) Graphite is a good conductor of electricity. (Foreign 2011)
26. Write the molecular formula of first two members of homologous series having functional group -Cl. (Delhi 2017)
27. 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 reactant and the product of the reaction. (AI 2015, Delhi 2014)

### **CASE STUDY/PASSAGE BASED QUESTIONS**

28. The compounds which have the same molecular formula but differ from each other in carbon atoms can be linked together in the form of straight chains, branched chains or even rings. physical or chemical properties are called isomers and the phenomenon is called isomerism. When the isomerism is due to difference in the arrangement of atoms within the molecule, without any reference to space, the phenomenon is called structural isomerism. In other words. Structural isomers are compounds that have the same molecular formula but different structural formulas, i.e., they are different in the order in which different atoms are linked. In these compounds, carbon atoms can be linked together in the form of straight chains, branched chains or even rings.
- (i) Which of the following sets of compounds have same molecular formula?**
- (a) Butane and iso butane  
(b) Cyclohexane and hexene  
(C) Propanal and propanone  
(d) All of these
- (ii) In order to form branching, an organic compound must have a minimum of**
- (a) four carbon atoms  
(b) three carbon atoms

(c) five carbon atoms

(d) any number of carbon atoms.

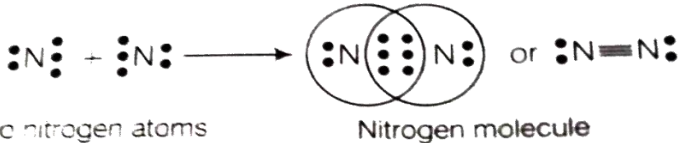
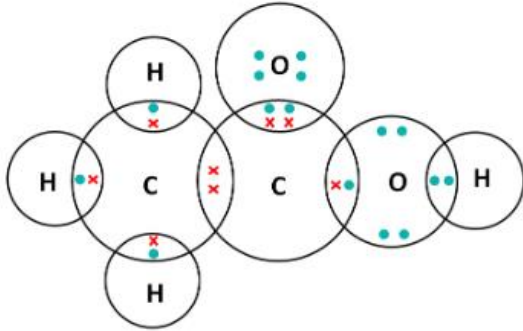
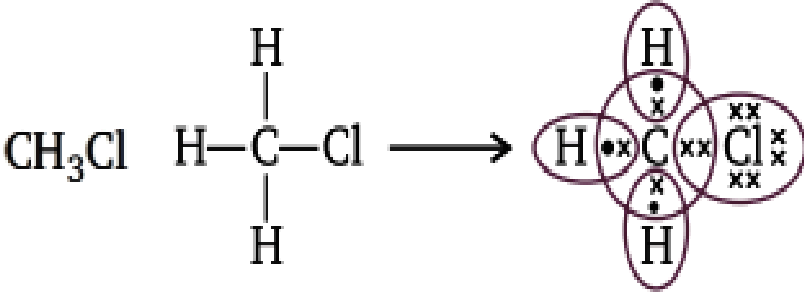
**(iii) What are isomers? What are the isomers of butane?**

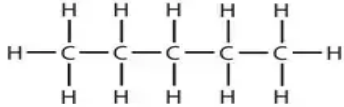
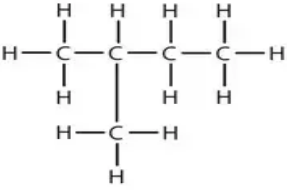
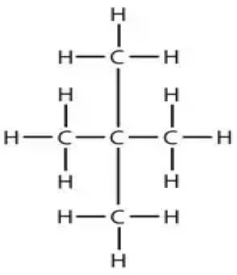
**FIVE MARK QUESTIONS**

29. (i) What would be the electron dot structure of carbon dioxide which has the formula  $\text{CO}_2$ ?  
(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)
30. (i) What happens when 5% alkaline  $\text{KMnO}_4$  solution is added drop by drop to warm ethanol taken in a test tube? State the role of alkaline  $\text{KMnO}_4$  solution in this reaction. (Foreign 2016)  
(ii) Two carbon compounds X and Y have the molecular formula  $\text{C}_4\text{H}_8$  and  $\text{C}_5\text{H}_{12}$  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).
31. 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. (Delhi 2017, AI 2015)

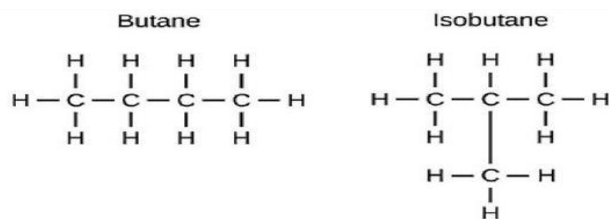
**ANSWERS**

1	(c) 4
2	(c) both (A) and (D)
3	(d) ketone
4	(d) 16
5	(c) $\text{C}_6\text{H}_6$
6	c) $\text{C}_4\text{H}_8$
7	(i) Both A and R are true and R is the correct explanation of the Assertion.
8	(iv) A is false but R is true.
9	Both A and R are true but R is not the correct explanation of A.
10	Both A and R are true but R is not the correct explanation of A.
11	Silicon. These compounds are unstable and reactive.
12	Pentane, $\text{C}_5\text{H}_{12}$
13	$\text{C}_4\text{H}_6$
14	A ketone functional group
15	Homologous series is a group of organic compounds having similar structures and similar chemical properties in which the successive compounds differ by $\text{CH}_2$ unit.

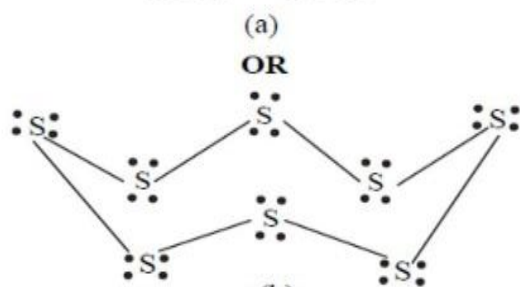
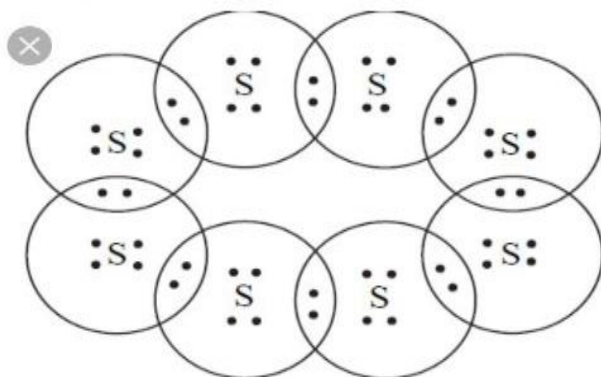
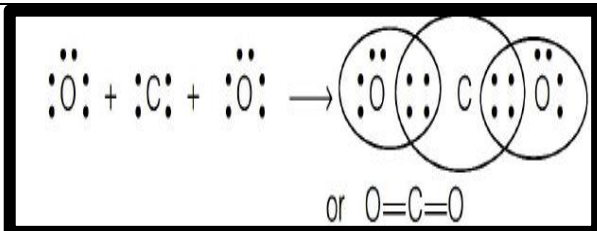
16	Carbon cannot lose four electrons easily because very high energy is required. It cannot gain four electrons easily because 6 protons cannot hold 10 electrons. Carbon can easily share four electrons forming covalent bonds.
17	<p>(i) Nitrogen</p> <p>(ii)</p> <div style="text-align: center;">  <p>Two nitrogen atoms                      Nitrogen molecule</p> </div> <p>(iii) Covalent bond.</p>
18	Carbon burns with a clean flame and no smoke is produced on combustion it gives carbon dioxide and water. This reaction involves the evolution of heat and light. The same takes place for compounds of carbon. That is the reason why carbon and its compounds are used as fuel for most applications.
19	<div style="text-align: center;">  </div>
20	(a) Hydrocarbons are the compounds made up of carbon and hydrogen atoms only. Eg:-methane, ethane, ethene etc.
21	Carbon has four valence electrons. It shares one electron with chlorine and one electron each with three hydrogen atoms. <div style="text-align: center;">  </div>
22	<p>(i) C<sub>6</sub>H<sub>14</sub> and C<sub>4</sub>H<sub>10</sub> are saturated hydrocarbons.</p> <p>(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> Alkynes:- C<sub>3</sub>H<sub>4</sub>, C<sub>5</sub>H<sub>8</sub></p>

23	<div style="display: flex; justify-content: space-around; align-items: center;"> <div style="text-align: center;">  <p>Pentane</p> </div> <div style="text-align: center;">  <p>Isopentane</p> </div> <div style="text-align: center;">  <p>Neopentane</p> </div> </div>
24	<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.</p> <p>They have low melting and boiling points due to weak force of attraction between molecules.</p>
25	<p>(i) As carbon has four valence electrons and it can neither lose nor gain four electrons thus, it attains noble gas configuration only by sharing of electrons. In fact, it forms covalent compounds.</p> <p>(ii) In graphite, each carbon atom is bonded to three other carbon atoms by covalent bonds in the same plane giving a hexagonal array. Thus, only three valence electrons are used for bond formation and hence, the fourth valence electron is free to move. As a result, graphite is a good conductor of electricity.</p>
26	<p>The molecular formula of first two members of homologous series having -Cl functional group are <math>CH_3Cl</math> and <math>CH_3CH_2Cl</math>.</p>
27	<p>Alkenes, having general formula as <math>C_nH_{2n}</math> and alkynes, having general formula as <math>C_nH_{2n-2}</math> are the class of hydrocarbons in which addition reaction is possible.</p> <p>The essential conditions for addition reaction are :</p> <p>(i) Presence of unsaturated hydrocarbon.</p> <p>(ii) Presence of catalyst such as Ni/Pt/Pd.</p> <p>Let us take an example of ethene. It undergoes addition reaction with hydrogen when it is heated in the presence of nickel catalyst to form ethane. The reaction is known as hydrogenation.</p> $  \begin{array}{c}  CH_2=CH_2 + H_2 \xrightarrow[\text{Catalyst}]{Ni} CH_3-CH_3 \\  \text{Ethene} \qquad \qquad \qquad \qquad \qquad \text{Ethane}  \end{array}  $
28	i (d) All of these
	ii (a) four carbon atoms
	iii (i) Isomers are those compounds which have same molecular formula but

different structural formulae.  
Structures of two isomers of butane are:-



29



**Sulphur (S<sub>8</sub>) molecule**

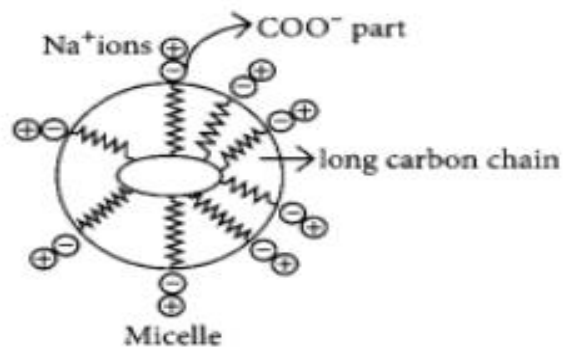
30 (i)

When 5% alkaline KMnO<sub>4</sub> solution is added drop by drop to warm ethanol then it gets oxidised to ethanoic acid.



	<p>Here, alkaline <math>\text{KMnO}_4</math> acts as an oxidising agent i.e., the substance which is capable of adding oxygen to others. Thus, alkaline <math>\text{KMnO}_4</math> provides oxygen to ethanol to form ethanoic acid.</p>
(ii)	<p>All unsaturated hydrocarbons (containing double or triple bonds) have tendency to get converted to saturated hydrocarbons (single bonds) by adding small molecules like hydrogen (<math>\text{H}_2</math>). Such reactions are called addition reactions.</p> <p>Compound X i.e., <math>\text{C}_4\text{H}_8</math> belongs to alkene series (<math>\text{C}_n\text{H}_{2n}</math>) while compound Y i.e., <math>\text{C}_5\text{H}_{12}</math> belongs to alkane series (<math>\text{C}_n\text{H}_{2n+2}</math>). Thus, compound X will undergo addition reaction.</p> $  \begin{array}{c} \text{R} & & \text{R} \\ & \diagdown & / \\ & \text{C}=\text{C} & \\ & / & \diagdown \\ \text{R} & & \text{R} \end{array} \xrightarrow[\text{H}_2]{\text{Nickel catalyst}} \begin{array}{c} \text{H} & \text{H} \\   &   \\ \text{R}-\text{C} & - & \text{C}-\text{R} \\   &   \\ \text{R} & \text{R} \end{array}  $
31	<p>The molecules of soap are sodium or potassium salts of long-chain carboxylic acids.</p> <p>Detergents are generally ammonium or sulphonate salts of long chain carboxylic acids.</p> <p>The ionic group in soaps is <math>-\text{COO}^-\text{Na}^+</math>. The ionic group in synthetic detergents is <math>-\text{SO}_3^-\text{Na}^+</math> or <math>-\text{OSO}_3^-\text{Na}^+</math></p> <p>Cleansing action of soap:  A soap molecule contains a polar part (<math>\text{COO}^-\text{Na}^+</math>) called polar end and a non-polar part consisting of a long chain carbon atoms. This part is called hydrocarbon end. The polar end is water soluble whereas hydrocarbon part is water-repellent and oil soluble.</p> <p>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 <math>-\text{COO}^-</math> end orients itself towards water. <math>\text{Na}^+</math> ions in solution arrange themselves around the <math>-\text{COO}^-</math> 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.</p>





In hard water, soap does not form lather as hard water contains  $\text{Ca}^{2+}$  and  $\text{Mg}^{2+}$  ions. Soap reacts with these ions to form insoluble calcium and magnesium salts of fatty acids.

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.

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