



Praadis Education
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SCIENCE WORKSHEET SOLVED

CARBON AND ITS COMPOUNDS

Section -1 (MULTIPLE CHOICE QUESTIONS):

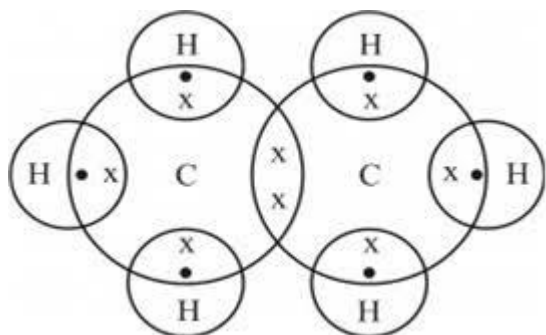
1M

1. Pentane with molecular formula C_5H_{12} has
(a) 12 covalent bonds (b) 16 covalent bonds (c) 18 covalent bonds (d) 15 covalent bonds
2. Which of the following statements is incorrect regarding a homologous series?
(i) Compounds in a homologous series can have the same or different functional group.
(ii) Compounds in a homologous series have very less similarity in chemical properties.
(iii) Difference between the two successive compounds in a homologous series differ by a CH_2 group.
(iv) Successive members in a homologous series differ in molecular mass by 14 units
(a) i and ii
(b) ii and iii
(c) iii and iv
(d) i and iv
3. Which of the following aliphatic compounds, is saturated molecule?
(a) C_6H_{12} (b) C_2H_2 (c) C_5H_{10} (d) C_4H_{10}
4. Three of the four compounds belong to a homologous series. Identify the odd one out.
(a) C_4H_{10} (b) C_2H_4 (c) C_3H_8 (d) C_5H_{12}
5. Which of these is not a property of Carbon?
(a) Catenation (b) Tetravalency
(c) Formation of ionic bonds (d) Tendency to form multiple bonds
6. Name the metal that is not present in carbon family
a) Si b) Ge c) Sb d) Sn

7. Which among the following is an unsaturated molecule that has the molecular formula of a cycloalkane.

- a) C_3H_6 b) C_8H_{18} c) C_5H_{12} d) C_3H_4

8. which of the following statements is correct about the given electron dot structure



- a. The compound has 8 bonds of which one is a double bond
b. The compound is formed of all single bonds of which one is a C-C bond.
c. The electrons in every shell of the atoms are shown in the structure.
d. Electron dot structure doesn't help to identify the bonds in a compound

9. Which of the following is unsaturated molecule?

- a) C_3H_8 b) C_2H_2 c) C_5H_{12} d) C_4H_{10}

10. 3rd homologue of alkyne series is---

- a) Propyne b) propene c) butyne d) butane

11. Number of covalent bonds in cyclobutane is

- a) 12 b) 10 c) 4 d) 14

12. Which of the following is not an alkane, alkene or alkyne?

- a) CH_4 b) C_2H_2 c) CH_3 d) C_5H_8

13. Which of the statement regarding homologous series is wrong?
- a) only alkanes have homologous series
 - b) consecutive members of a homologous series differ by an atomic mass of 14u
 - c) A given homologous series can be expressed by a general formula
 - d) Homologues of a given series show gradation in physical properties.

- 14.. Which of the following homologue does not belong to a given homologous series
- a) C_5H_{12}
 - b) C_8H_{18}
 - c) CH_4
 - d) C_2H_4

SECTION -2 (ASSERTION REASON TYPE QUESTIONS):

1M

Following questions consist of two statements – Assertion (A) and Reason (R). Answer these questions selecting the appropriate option given below:

- (a) Both A and R are true and R is the correct explanation of A.
- (b) Both A and R are true but R is not the correct explanation of A.
- (c) A is true but R is false.
- (d) A is false but R is true

1. Assertion(A): Diamond and graphite are allotropes of carbon.

Reason (R): Some elements can have several different structural forms while in the same physical state. These forms are called allotropes.

2. Assertion(A): Carbon compounds can form chain, branched and ring structures.

Reason (R): Carbon exhibits the property of catenation.

3. Assertion (A): Graphite is a good conductor of electricity.

Reason (R): It has one free valence electron.

4. Assertion (A): Diamond is not good conductor of electricity.

Reason: It has no free electrons.

5. Assertion (A): Graphite is slippery to touch.

Reason: The various layers of carbon atoms in graphite are held together by weak forces of attractions.

6. Assertion (A): Covalent compounds are generally poor conductor of electricity.

Reason (R): They consist of molecules and not ions which can transfer charge.

7. Assertion(A): The functional group present in alcohols is – OH.

Reason (R): It is the same group as present in water, hence water and alcohol have similar properties.

SECTION -3 (DESCRIPTIVE TYPE QUESTIONS):

1. An element of group 14 has two common allotropes, A and B. A is very hard and is bad conductor of electricity while B is soft to touch and good conductor of electricity. Identify the element and its allotropes. **3M**
2. Identify the following-
 - (i) An allotrope of carbon which has a two-dimensional layered structure consisting of flat hexagonal rings.
 - (ii) An allotrope of carbon which looks like a soccer ball.
 - (iii) An allotrope of carbon which contains both single and double bonds. **3M**
3. A hydrocarbon molecule contains 3 carbon atoms. What would be its molecular formula in case it is (i) an alkane (ii) an alkene (iii) an alkyne? **3M**
4. A hydrocarbon molecule has 4 carbon atoms. What would be its molecular formula in case it is (i) an alkane (ii) an alkene (iii) an alkyne? **3M**
5. Allotropes of carbon has same chemical properties. Give reason. **1M**
6. How many non-bonded electrons are there in?
a) Ammonia b) Methane c) Nitrogen **3M**
7. Alkenes and alkynes are unsaturated. What does it mean? **2M**
8. List any two properties of homologous series. **2M**
9. Compare the catenation ability of Carbon and Silicon. **2M**
10. Atom of an element contains 5 electrons in the valence shell. This element exists as diatomic molecules, and is a major component of air. **3M**
 - (a) Identify the element.
 - (b) Show the bond formation between two atoms of this element.
 - (c) What is the nature of bond formed between the 2 atoms.
11. An element X found in nature in solid form has 4 electrons in valence shell of its atom. Its allotrope Y has properties that allows it to be used as a dry lubricant, as also as a part of pencil lead. **5M**
 - (a) Identify the element.
 - (b) What is this allotrope Y?

- (c) Write any 1 other use of this allotrope other than those mentioned here.
(d) Predict the ability of this allotrope to conduct electricity. Give reason.
(e) Name two other allotropes of this element other than Y.

12. Two elements A and B have the property C by which they can combine with more atoms of their same type. Element A is a component of the gas D that is a respiratory byproduct, while element B is the second most abundant element in the crust. **5M**

- (a) Identify the elements A and B.
(b) What is the property C?
(c) Identify the gas D.
(d) Among A and B, which one shows the property C to a greater extent? Why?

13. A and B are two organic compounds with the same molecular formula C_5H_{10} . Write their names and structural formulae in case **5M**

- (a) A is a cyclic compound.
(b) B is a straight chain compound.
(c) Among A and B, which one will have only single bonds?
(d) Will it be A or B that has both single and double bonds?

14. In the electron dot structure of hydrogen molecules, each individual atom is not satisfying the octet. Justify. **2M**

15. How many saturated hydrocarbons can be made using three carbon atoms and hydrogen atoms? Name them. **2M**

16. Carbon cannot make ionic compounds. Why? **2M**

17. Give the general formula of alkanes. Write the name, structural formula and physical state of the compound containing: **3M**

- (i) 3-carbon atoms
(ii) 8-carbon atoms.

18. Why does carbon form compounds mainly by covalent bonding? **2M**

19. List the common physical properties of carbon compounds. **2M**

20. Compare the structures of diamond and graphite. **2M**

21. Write the general IUPAC names of alcohol, carboxylic acid, aldehyde and ketone. **2M**

22. Draw the electron dot structure of ethyne and also draw its structural formula. **2M**

23. Draw the electron dot structure of O₂ and N₂ molecules

24. Define homologous series of organic compounds. List its two characteristics. **5M**

Write the name and formula of the first member of the series of alkenes.

25. Why homologous series of carbon compounds are so called? Write chemical formula of two consecutive members of a homologous series and state the part of these compounds that determines their

(i) physical properties, and (ii) chemical properties. **5M**

26. (a) State two characteristic features of carbon which when put together give rise to a large number of carbon compounds. **5M**

(b) Catenation is the ability of an atom to form bonds with other atoms of the same element. It is exhibited by both carbon and silicon. Compare the ability of catenation of the two elements. Give reasons.

27. a) How can you prove that butene and propane are not in a given homologous series? **5M**

a) Name the first four homologues of alkene series?

b) How many covalent bonds are there in propene?

CASE STUDY BASED

5M

1. Read the following carefully.

In covalent compounds atoms share valence electrons to satisfy the octet. Each atom shares one pair or two pairs or three pairs of electrons depending on their combining capacity. In electron dot structures only number of valence electrons are shown around the symbols of constituent atoms. Carbon using its valency of four can make either single, double or triple bonds with other carbon atoms or any other atoms. Carbon's self-linking property is called catenation. In hydrocarbons carbon makes aliphatic or cyclic molecules they are either saturated or unsaturated. Based on these facts Read the following paragraph and answer the questions given below.

An element X combines with Y to form a colourless odourless gas, Z which turns lime water milky is the major constituent of all organic molecules. Five X atoms combine with hydrogens to form a cyclic saturated hydrocarbon J and aliphatic unsaturated hydrocarbon Q. Q is used in gas welding.

a) Identify compound Z and draw its electron dot structure.

b) Write the chemical formula and IUPAC name of compound Q

c) What is the common name of Q

d) How many single covalent bonds are present in compound J?

e) Draw the structure of J and write its chemical formula.

2. Read the following and answer any four questions from (i) to (v) 5M
The compounds which have the same molecular formula but differ from each other in 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) Which of the following is an isomeric pair?
(a) Ethane and propane
(b) Ethane and ethene
(c) Propane and butane
(d) Butane and 2-methylpropane
- (iv) Among the following the one having longest chain is
(a) neo-pentane
(b) iso-pentane
(C) 2-methylpentane
(d) 2,2-dimethylbutane.
- (v) The number of isomers of pentane is
(a) 2
(b) 3
(c) 4
(d) 5

3. Read the following and answer any four questions from 1(i) to 1(v). 5M

A series of organic compounds having the 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. For example, all the members of the alcohol family can be represented by the general formula, $\text{C}_n\text{H}_{2n+1}\text{OH}$ where n may have the values 1, 2, 3, etc. The various members of a particular homologous series are called homologues. The physical properties such as density, melting point, boiling point, solubility etc. of the members of a homologous series show almost regular variation in ascending and descending the series.

(i) Which one of the following is not a characteristic of members of a homologous series?

- (a) They possess varying chemical properties.
- (b) Their physical properties vary in a regular and predictable manner.
- (c) Their formulae fit the general molecular formula
- (d) Adjacent members differ by one carbon and two hydrogen atoms

(ii) All the members of homologous series of alkynes have the general formula

- (a) C_nH_{2n}
- (b) $\text{C}_n\text{H}_{2n+2}$
- (c) $\text{C}_n\text{H}_{2n-2}$
- (d) $\text{C}_n\text{H}_{2n-4}$

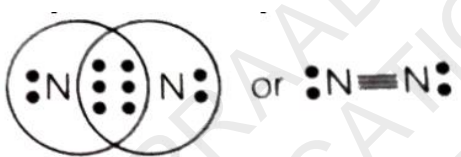
(iii) Which of the following statements is not correct?

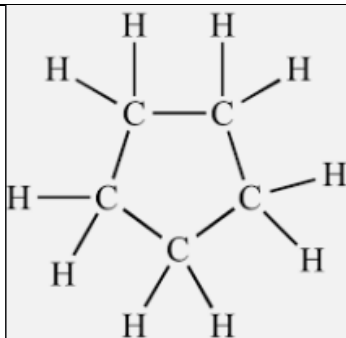
- (a) A common functional group is present in different members of a homologous series.
- (b) Two consecutive members of a homologous series differ by a $-\text{CH}_3$ group.
- (c) The molecular mass of a compound in the series differs by 14 a.m.u. from that of its neighbour.
- (d) All the members of a homologous series have common general methods of preparation.

(iv) Identify the correct statements:

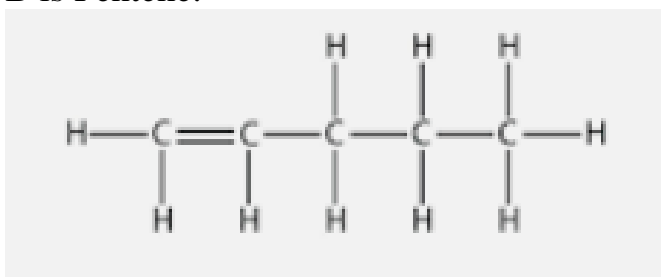
- (a) As the molecular mass increases in any homologous series, a gradation in physical properties is seen.
- (b) The melting and boiling points decrease with increasing molecular mass.
- (c) As the molecular mass increases in any homologous series, variation in chemical properties is observed a gradation in physical properties is seen.
- (d) Adjacent members in a homologous series differ by 18u.

2	(a) Explanation: The unique property of self-linking of carbon atoms through covalent bonds to form long straight or branched chains and rings of different sizes is called catenation.
3	(a) Explanation: In graphite, each carbon atom is covalently bonded with three other carbon atoms. So, only 3 valence electrons are used in bond formation and the 4 th valence electron is free to move. Due to the presence of these free electrons (1 per carbon atom), graphite is a good conductor of electricity.
4	(a) Explanation: In a diamond crystal, each carbon atom is linked to four other carbon atoms by covalent bonds. So, all 4 valence electrons are used up in bond formation. Due to the absence of any free electron, diamond cannot conduct electricity.
5	(a) Explanation: The various layers formed of flat hexagonal rings of carbon atoms in graphite are quite far apart so that no covalent bond exists between them. The layers are held together by weak Van der Waals forces and so can slide over one another, making them slippery to touch
6	a) Explanation: Covalent compounds are formed by sharing of electrons. Since there is no loss or gain of electrons, there is no ion formation.
7	(c) Explanation: Water does not have -OH as functional group. So, reason statement is false.
<u>SECTION -3 (DESCRIPTIVE TYPE QUESTIONS):</u>	
1	Ans. Element is carbon A is Diamond. B is graphite
2	Ans. (i) Graphite (ii) Buckminsterfullerene (iii) Graphite
3	Ans. (i) General formula of alkanes = C_nH_{2n+2} ; if $n=3$, formula will be C_3H_8 (ii) General formula of alkanes = C_nH_{2n} ; So, if $n=3$, formula will be C_3H_6 (iii) General formula of alkanes = C_nH_{2n-2} . So, if $n=3$, formula will be C_3H_4
4	Ans. (i) General formula of alkanes = C_nH_{2n+2} ; if $2n+2=10$, $n=4$; so, formula will be C_4H_{10} (ii) General formula of alkanes = C_nH_{2n} ; So, if $2n=8$, $n=4$; so, formula will be C_4H_8 (iii) General formula of alkanes = C_nH_{2n-2} . So, if $2n-2=6$, $n=4$; so, formula will be C_4H_6
5	Chemical properties of an element depends on valence electrons. Allotropes have same number of valence electrons, hence same chemical properties.

6	a) two electrons(1 pair) b) 0 c) 4(two pairs)
7	Unsaturated molecules have carbon carbon double bonds or triple bonds. Alkenes and alkynes contain double or triple bond between carbon atoms, hence they are unsaturated. Unsaturated molecules are those in which more atoms can be added.(They undergo addition reaction)
8	i) They show gradation in physical properties. ii) Similarity in chemical properties iii) They can be represented by a general formula (any two properties can be written)
9	Ans. Carbon and Silicon, both with valency 4, have the ability to form covalent bonds by sharing of electrons. Both show the ability of self- combination- catenation. In Carbon, the small size of carbon atoms, as also the formation of strong bonds by Carbon atoms among themselves and with atoms of other elements, makes carbon compounds very stable. Silicon can form compounds having Si chains of up to 7 or 8 atoms. But due to weak bonds, these compounds are not stable.
10	(a) Nitrogen (b)  (c) Covalent bond
11	(a) Carbon (b) Graphite (c) Used for making electrodes in dry cells. (d) It is a good conductor of electricity. Reason: In graphite, each carbon atom is covalently bonded with three other carbon atoms. So, only 3 valence electrons are used in bond formation and the 4 th valence electron is free to move. Due to the presence of these free electrons (1 per carbon atom), graphite is a good conductor of electricity. (e) Diamond, Buckminsterfullerene.
12	(a) A is Carbon; B is Silicon. (b) Catenation. (c) Carbon dioxide. (d) A (Carbon) shows greater extent of catenation than B (Silicon) Reason: Carbon atoms are smaller than that of silicon. So, carbon- carbon bonds are much stronger than silicon- silicon bonds.
13	(a) A is Cyclopentane.



(b) B is Pentene.

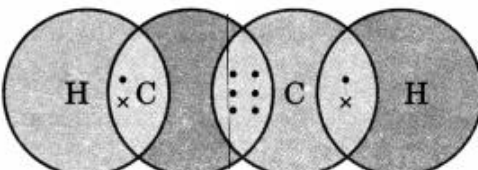
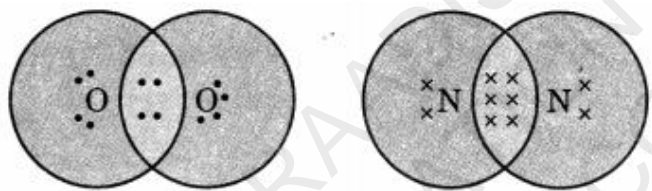


(Note: the double bond can be between any 2 of the 5 carbon atoms)

(c) A (Cyclopentane).

(d) B (Pentene)

14	For hydrogen atom as there is only a K shell, it can occupy a maximum of two electrons.
15	Ans. Two. Propane and cyclopropane.
16	Due to small size and high effective nuclear charge, carbon cannot lose electrons to form C^{4+} ion and as carbon with 6 protons cannot afford four more electrons in its L shell, it cannot form C^{4-} ions. As carbon cannot form an anion or cation, it cannot make ionic bonds.
17	General formula of alkanes is C_nH_{2n+2} where $n = 1, 2, 3, \dots$ (i) Propane, $CH_3-CH_2-CH_3$ Propane is a gas. (ii) $CH_3-CH_2-CH_2-CH_2-CH_2-CH_2-CH_2-CH_3$ Octane is a liquid
18	Carbon atoms have 4 valence electrons in their valence shell, it needs to gain or lose 4 electrons to attain the noble gas configuration. (i) It could gain four electrons forming C^{4-} anion. But it would be difficult for the nucleus with six protons to hold on to ten electrons. (ii) It could lose four electrons forming C^{4+} cation. But it would require a large amount of energy to remove four electrons from its outermost shell. Therefore, carbon shares its valence electrons to complete its octet with other atoms to form covalent bonds.
19	They have covalent bonds between their atoms therefore they do not form ions. So they are poor conductors of electric current. These compounds have low melting and

	low boiling points. They are generally insoluble in water but soluble in the organic solvents like ether, carbon- tetrachloride, etc.										
20.	In diamond, each carbon atom is bonded to four other carbon atoms forming a rigid three dimensional structure. In graphite, each carbon atom is bonded to three other carbon atoms in the same plane giving a hexagonal array. One of these bonds is a double bond.										
21.	<table border="1"> <thead> <tr> <th>Compound</th> <th>General IUPAC name</th> </tr> </thead> <tbody> <tr> <td>Alcohol</td> <td>alkanol</td> </tr> <tr> <td>Carboxylic acid</td> <td>Alkanoic acid</td> </tr> <tr> <td>Aldehyde</td> <td>Alkanal</td> </tr> <tr> <td>Ketone</td> <td>Alkanone</td> </tr> </tbody> </table>	Compound	General IUPAC name	Alcohol	alkanol	Carboxylic acid	Alkanoic acid	Aldehyde	Alkanal	Ketone	Alkanone
Compound	General IUPAC name										
Alcohol	alkanol										
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Aldehyde	Alkanal										
Ketone	Alkanone										
22.	 $\text{H}-\text{C}\equiv\text{C}-\text{H}$										
23	 <p style="text-align: center;"> $\text{O}=\text{O}$ O_2 molecule </p> <p style="text-align: center;"> $\text{N}\equiv\text{N}$ N_2 molecule </p>										
24.	The series of organic compounds having same functional group and similar chemical properties is called homologous series. Each member differs from successive member by $-\text{CH}_2-$ group. The difference in molecular weight between two successive members is 14 u. Characteristics: (i) It has same general formula, from which, all members can be derived. (ii) They have similar chemical properties. C_2H_4 , $\text{CH}_2=\text{CH}_2$, Ethene is first member of alkene series.										
25	The series consists of members of same family with similar physical and chemical properties, therefore, called homologous series (i) CH_3OH , and (ii) $\text{CH}_3\text{CH}_2\text{OH}$ are two consecutive members of homologous series. Alkyl group $-\text{CH}_3$ and $-\text{CH}_3\text{CH}_2$ part determines physical properties. Functional group $-\text{OH}$ determines chemical properties of the compounds.										

26	<p>(a) The size of carbon atom is very small (Atomic radius = 77 pm) The strength C—C bond is quite high (355 kJ mol⁻¹) Therefore, any number of carbon atoms can be linked by covalent bonds, This self-linking property is called catenation.</p> <p>(b) Carbon shows catenation to large extent as compared to silicon as well as any other element due to smaller size of carbon. C—C bond is stronger than Si-Si bond because Si is larger in size, forms weaker bond.</p>
27	<p>a) Propane has the formula C₃H₈ and butene is C₄H₈. C₃H₈ is of the form C_nH_{2n+2} and belongs to alkane homologous series and C₄H₈ has the general formula C_nH_{2n+2} which shows that it is an alkene. Hence those molecules are not in the same homologous series. Mention their chemical formula</p> <p>b) Ethene(C₂H₄), Propene(C₃H₆), Butene(C₄H₈), Pentene(C₅H₁₀)</p> <p>7 single covalent bond and one double bond</p>
1	<p>CASE STUDY BASED</p> <p>a) Z is CO₂ its electron dot structure is</p> <div data-bbox="209 1003 560 1167" data-label="Chemical-Block"> </div> <p>b) C₂H₂, ethyne</p> <p>c) Acetylene</p> <p>d) 15</p> <p>e)</p> <div data-bbox="204 1397 657 1742" data-label="Chemical-Block"> <p style="text-align: center;">C₅H₁₀</p> </div> <p>Its chemical formula is C₅H₁₀</p>
2	<p>(i) (d) All of these</p> <p>(ii) (a) four carbon atoms</p> <p>(iii) (d) Butane and 2-methylpropane</p>

	(iv) (C) 2-methylpentane (v) (b) 3
3	(i) a (ii) c (iii) b (iv) (a)

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