

GRADE 10TH Science
CHAPTER 4

Carbon and its Compounds

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OBJECTIVE TYPE QUESTIONS

Multiple Choice Questions (MCQs)

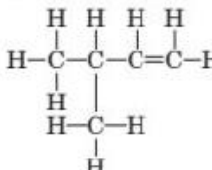
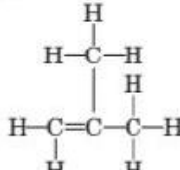
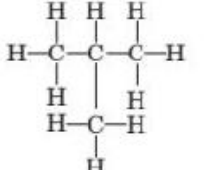
1. Which of the following organic compounds does not have the same chemical properties as methanol?

- (a) C_2H_6O (b) $C_5H_{10}O$
(c) $C_4H_{10}O$ (d) $C_7H_{16}O$

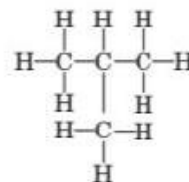
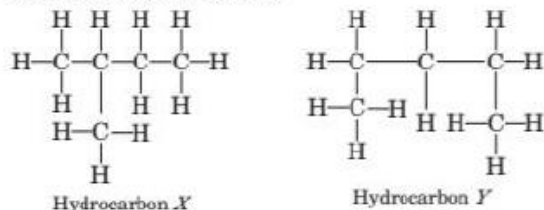
2. Which of the following is correct about the structure of diamond?

- (a) Carbon atoms are held together by single covalent bonds.
(b) Electrons move freely through the structure.
(c) Layers of atoms slide easily over each other.
(d) Carbon atoms conduct electricity in the molten state.

3. Which of the following hydrocarbons represents the isomer of butene?

- (a)  (b) 
(c)  (d) $CH_3CH_2-C(CH_3)=CH_2$

4. The structures of three hydrocarbons, *X*, *Y* and *Z* are shown below:

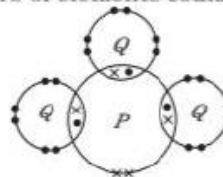


Hydrocarbon *Z*

Which of the statements about *X*, *Y* and *Z* are correct?

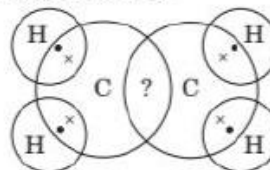
- X* and *Y* are isomers.
 - X* and *Y* have the same percentage composition by mass.
 - Y* is the isomer of alkane having formula, C_5H_{12} .
 - Z* has the same boiling point as *n*-butane.
- (a) 1, 2 and 3 (b) 2 and 4
(c) 1 and 4 (d) 1, 3 and 4

5. The diagram given below shows the electron arrangement of the valence electrons in a molecule of compound PQ_3 . Which of the following pairs of elements could be *P* and *Q*?



- P** (a) Argon (b) Phosphorus (c) Nitrogen (d) Sulphur
- Q** Neon Hydrogen Chlorine Oxygen

6. Number of electrons shared between carbon-carbon atoms in ethene is



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- (a) 2 (b) 4
(c) 6 (d) 8
7. How many structural isomers are possible for pentane (C_5H_{12})?

- (a) 1 (b) 4
(c) 2 (d) 3

8. In C_6H_{14} the number of possible isomers is
- (a) 3 (b) 6
(c) 4 (d) 5

9. _____ is widely used as a fuel and is a major component of bio-gas and CNG. It is also one of the simplest compounds formed by carbon.

- (a) Ethane (b) Propane
(c) Carbon dioxide (d) Methane

10. Which of the following compounds has a triple bond?

- (a) C_2H_4 (b) C_3H_4
(c) C_3H_8 (d) C_4H_{10}

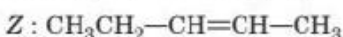
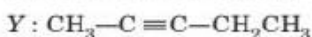
11. Which of the following statements is correct?

- (a) Most organic compounds are ionic compounds.
(b) Ethane and ethene belong to the same homologous series.
(c) Propene contains three hydrogen atoms per molecule.
(d) Chloroethane contains two carbon atoms per molecule.

12. All the members of homologous series of alkynes have the general formula

- (a) C_nH_{2n} (b) C_nH_{2n+2}
(c) C_nH_{2n-2} (d) C_nH_{2n-4}

13. Three hydrocarbons X, Y and Z are shown below :



Identify the incorrect statements about these three hydrocarbons.

- I. X and Y both differ by a $-CH_2$ unit.
II. X and Z have the same boiling point.
III. All have different general formulae.
IV. Y and Z have different molecular masses.

- (a) I and II
(b) II and III
(c) I and IV
(d) All the statements are incorrect.

14. Graphite is a good conductor of electricity. Diamond is a poor conductor of electricity. Substance X is a moderate conductor of electricity. Substance X has the structure shown below:



Which statement about substance X is correct?

- (i) It is a covalent compound.
(ii) It has a giant molecular structure.
(iii) It has the same structure as graphite.
(iv) It has the same structure as diamond.
- (a) (i) and (iii) (b) (ii) and (iii)
(c) (ii) and (iv) (d) (i), (ii) and (iv)

15. Which of the following statements is correct about a substance that has a giant covalent structure?

- (a) All its ions are arranged in a giant three dimensional lattice.
(b) A large amount of energy is needed to break down the lattice structure.
(c) It conducts electricity in the molten state.
(d) It dissolves in water but is more soluble in organic solvents.

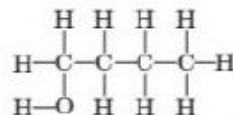
16. The general formula of cycloalkanes is

- (a) C_nH_{2n+2} (b) C_nH_{2n-2}
(c) C_nH_{2n-1} (d) C_nH_{2n}

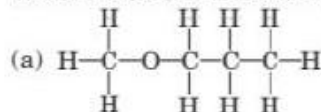
17. Which of the following exists as a simple triatomic molecule?

- (a) Argon (b) Fluorine
(c) Nitrogen (d) Ozone

18. The organic compound, R, has the structure shown below:



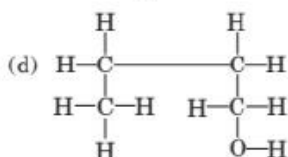
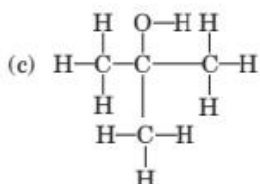
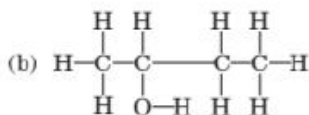
Which structure is not an isomer of R?



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19. Which of the following molecules has all its atoms joined together by double covalent bonds?

- (a) Methane (b) Water
(c) Carbon dioxide (d) Nitrogen trichloride

20. Which 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 regular and predictable manner.
(c) Their formulae fit the general molecular formula.
(d) Adjacent members differ by one carbon and two hydrogen atoms.

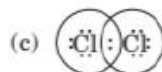
21. Which covalent molecule contains the structure where the central atom is bonded to four other atoms by covalent bonds?

1. Diamond 2. Graphite
3. Methane 4. Silicon dioxide
(a) 1 and 2 (b) 2 and 4
(c) 3 and 4 (d) 1, 3 and 4

22. Which of the following represent saturated hydrocarbons?

1. $\text{CH}(\text{CH}_3)_3$
2. CH_2CHCH_3
3. $\text{CH}_3\text{CH}(\text{CH}_3)\text{CH}_2\text{CH}_3$
4. $(\text{CH}_3)_2\text{CCHCH}_3$
(a) 1 and 3 (b) 2 and 4
(c) 1, 2 and 3 (d) 1, 2, 3 and 4

23. Chlorine forms a diatomic molecule, Cl_2 . The electron dot structure for this molecule is



24. Which of the following has shortest carbon-carbon bond length?

- (a) C_2H_2 (b) C_2H_4
(c) C_2H_6 (d) C_6H_6

25. Which type of bond is present between carbon-carbon atoms in acetylene?

- (a) Single covalent bond
(b) Double covalent bond
(c) Triple covalent bond
(d) Electrovalent bond

26. Number of free electron(s) in each carbon atom in graphite is/are

- (a) two (b) four
(c) one (d) three.

27. The table shows the formulae of three organic compounds that belong to the same homologous series.

First member of the homologous series	$\text{CH}_3-\text{O}-\text{CH}_3$
Second member of the homologous series	$\text{CH}_3\text{CH}_2-\text{O}-\text{CH}_3$
Third member of the homologous series	$\text{CH}_3\text{CH}_2\text{CH}_2-\text{OCH}_3$

What is the general formula of this series?

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

28. 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 $-\text{CH}_2$ group.
(c) The members of a homologous series can be represented by one general formula.
(d) Different members of a homologous series have similar chemical properties.

29. Identify the correct statements.

- (i) As the molecular mass increases in any homologous series, a gradation in physical properties is seen.
(ii) The melting and boiling points decrease with increasing molecular mass.
(iii) Other physical properties such as solubility in a particular solvent decreases with increasing molecular mass.

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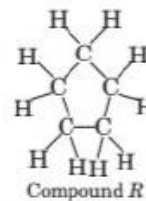
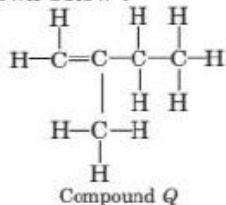


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(iv) The chemical properties, which are determined solely by the functional group, remain similar in a homologous series.

- (a) (ii) and (iii) (b) (ii) and (iv)
(c) (i), (iii) and (iv) (d) All are correct.

30. The structural formulae of compounds *Q* and *R* are shown below :

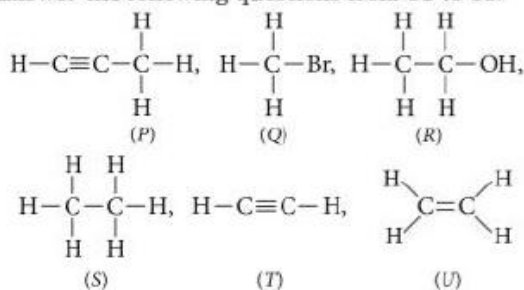


Which statement about compounds *Q* and *R* is correct?

- (a) They belong to the same homologous series.
(b) They have the same percentage composition by mass.
(c) They have the same boiling point.
(d) They have different general formulae.

Case Based MCQs

Case I : Read the passage given below and answer the following questions from 31 to 35.



31. Which of the following compounds belong to same homologous series?

- (a) *S* and *T* (b) *T* and *U*
(c) *P* and *U* (d) *P* and *T*

32. The functional group of compound (*R*) is

- (a) alcohol (b) aldehyde
(c) ketone (d) carboxylic acid.

33. Compound (*T*) belongs to homologous series of

- (a) alkynes (b) alkenes
(c) alkanes (d) none of these.

34. Which of the following compounds is unsaturated hydrocarbon?

- (a) *S* (b) *Q*
(c) *U* (d) *R*

35. Which of the following compounds belongs to alkane series?

- (a) *P* (b) *S*
(c) *T* (d) *U*

Case II : Read the passage given below and answer the following questions from 36 to 40.

Two allotropic forms of carbon which are crystalline in nature, are diamond and graphite. They differ physically but chemically they are similar. Diamond is the hardest crystalline form of carbon. In diamond, each carbon atom is linked to four other carbon atoms by covalent bonds. In graphite, each carbon atom is linked to three other carbon atoms by covalent bond. Graphite is relatively soft and greasy. It is also a good conductor of electricity.

The C — C bond length in graphite is 141.5 pm while in diamond it is 154 pm.

36. Which of the following is a good conductor of heat and electricity?

- (a) Coal (b) Diamond
(c) Charcoal (d) Graphite

37. Graphite is a good conductor of electricity because

- (a) it has free electrons (b) it has free atoms
(c) it is crystalline (d) it is soft and greasy.

38. Which of the following types of binding forces is present in the structure of diamond?

- (a) Ionic (b) van der Waals'
(c) Covalent (d) None of these

39. Diamond is not a good conductor of electricity because

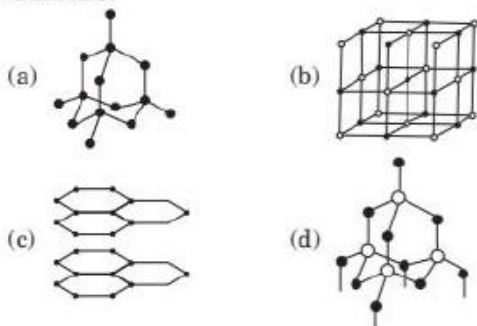
- (a) it is very hard
(b) its structure is very compact
(c) it is not water soluble
(d) it has no free electron.

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40. Which of the following is the structure of diamond?



Case III : Read the passage given below and answer the following questions from 41 to 45.

The table given below shows six organic compounds A, B, C, D, E and F having different molecular formula :

Organic compound	Molecular formula
A	C_7H_{16}
B	C_8H_{16}
C	C_4H_6
D	C_6H_{10}
E	C_5H_{10}
F	C_9H_{20}

41. Which of the following compounds belong to same homologous series?

- (a) E and F (b) B and C
(c) A and B (d) C and D

42. Which of the following is the member of the same homologous series as E?

- (a) D (b) A
(c) F (d) B

43. Identify the correct statements.

- (a) A and F are saturated hydrocarbons while all others are unsaturated hydrocarbons.
(b) C and D belong to a homologous series having general formula C_nH_{2n} .
(c) B and E are alkynes.
(d) All the compounds have same physical and chemical properties.

44. Compound B is

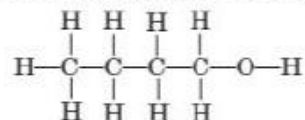
- (a) an alkane (b) an alkene
(c) an alkyne (d) none of these.

45. Compound (F) has a general formula

- (a) C_nH_{2n-2} (b) C_nH_{2n}
(c) C_nH_{2n+4} (d) C_nH_{2n+2}

Case IV : Read the passage given below and answer the following questions from 46 to 50.

An organic molecule has the following structure :



46. To which homologous series does this molecule belong?

- (a) Aldehydes (b) Ketones
(c) Alcohols (d) Alkanes

47. What is the general formula of this homologous series?

- (a) $C_nH_{2n+1}OH$ (b) C_nH_{2n+2}
(c) $C_nH_{2n}O$ (d) $C_nH_{2n+1}CHO$

48. Which is the next member of this series?

- (a) C_4H_9OH (b) C_3H_7OH
(c) $C_5H_{11}OH$ (d) $C_6H_{13}OH$

49. Which is the third member of this series?

- (a) C_3H_7OH (b) C_4H_9OH
(c) C_2H_5OH (d) CH_3OH

50. Which is the second member of this series?

- (a) Ethanol (b) Methanol
(c) Propanol (d) Butanol

Case V : Read the passage given below and answer the following questions from 51 to 55.

When an element exists in two or more different forms in the same physical state, these different forms are called allotropes and the phenomenon is known as allotropy. Allotropes have similar chemical properties but they differ in their physical properties. Carbon exists in crystalline and amorphous forms. In crystalline form, it occurs as diamond, graphite and fullerenes. Diamond is a colourless, transparent substance having extraordinary brilliance. It is the hardest natural substance known. It is used for cutting marble, granite and glass. Graphite is a greyish-black, opaque substance. It is lighter than diamond *i.e.*, it has lower density. It has sheet like structure having hexagonal layers. One layer slides over the other layer which makes it soft to touch. It is the reason that graphite is used as a lubricant.

51. Substance X is a moderate conductor of electricity. Substance X has the structure shown below :

Which statements about substance X are correct?



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- (I) It is a covalent compound.
 (II) It has a giant molecular structure.
 (III) It has the same structure as graphite.
 (IV) It has the same structure as diamond.
 (a) (I) and (III)
 (b) (II) and (III)
 (c) (II) and (IV)
 (d) (I), (II) and (IV)

52. Which of the following is correct about the structure of diamond?

- (a) Carbon atoms are held together by single covalent bonds.
 (b) Electrons move freely through the structure.
 (c) Layers of atoms slide easily over each other.
 (d) Carbon atoms conduct electricity in the molten state.

53. Which three allotropes of carbon, do the given figures represent?



(I) (II) (III)
 (I) (II) (III)

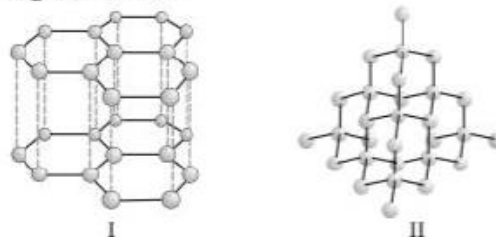
- (a) Diamond Graphite Buckminster fullerene
 (b) Graphite Buckminster fullerene Diamond
 (c) Diamond Buckminster fullerene Graphite
 (d) Graphite Diamond Buckminster fullerene

54 Identify the incorrect statement(s).

- (I) Diamond is the hardest substance known while graphite is smooth and slippery.
 (II) Diamond is made up of billions of carbon atoms. Each carbon atom is bonded to four other carbon atoms in a tetrahedral manner to form a giant lattice. All carbon atoms are bonded by strong covalent bonds.
 (III) Graphite is a poor conductor of electricity unlike other non-metals.
 (IV) Graphite has a giant covalent structure that is made up of layers of carbon atoms. In each layer, each carbon atom is bonded to three other carbon atoms to form hexagonal rings of carbon atoms.

- (a) (I) and (III) (b) Only (III)
 (c) (II) and (IV) (d) (I), (II) and (IV)

55. Structures of two different forms of carbon are given below :



Identify the two forms (I and II respectively) and how are they related to each other?

- (a) Diamond, Graphite, Isotopes of carbon
 (b) Graphite, Diamond, Allotropes of carbon
 (c) C^{12} , C^{14} , Allotropes of carbon
 (d) C^{14} , C^{12} , Isotopes of carbon

➡ Assertion & Reasoning Based MCQs

For question numbers 56-70, a statement of assertion followed by a statement of reason is given. Choose the correct answer out of the following choices.

- (a) Both assertion and reason are true, and reason is correct explanation of the assertion.
 (b) Both assertion and reason are true, but reason is not the correct explanation of the assertion.
 (c) Assertion is true, but reason is false.
 (d) Assertion is false, but reason is true.

56. **Assertion :** In alkanes, alkenes and alkynes the valency of carbon is always four.

Reason : All hydrocarbons except alkanes contain double bonds.

57. **Assertion :** Carbon possesses property of catenation.

Reason : Carbon atoms form double as well as triple bonds during catenation.

58. **Assertion :** Ethanol is first member of the alcohol homologous series.

Reason : A homologous series can be represented by a general formula.

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59. Assertion : Diamond is the hardest natural known substance.

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

60. Assertion : Diamond is not a good conductor of electricity.

Reason : It has no free electrons.

61. Assertion : Two members of a homologous series have similar chemical properties.

Reason : Propane and butane are members of same homologous series.

62. Assertion : Saturated hydrocarbons are chemically less reactive.

Reason : All the valencies of carbon atom are satisfied by single covalent bonds.

63. Assertion : Covalent compounds are generally poor conductor of electricity.

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

64. Assertion : Graphite is a good conductor of electricity.

Reason : It has one free valence electron.

65. Assertion : The functional group present in alcohols is $-OH$.

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

66. Assertion : Diamond and graphite do not have the same crystal structure.

Reason : Diamond is crystalline while graphite is amorphous.

67. Assertion : Carbon and its compounds can be used as fuels.

Reason : They are highly inflammable and have high calorific value.

68. Assertion : Olefins have the general formula C_nH_{2n+1} .

Reason : There is atleast one double bond between two carbon atoms in their molecules.

69. Assertion : Graphite is soft and slippery to touch.

Reason : Graphite has sheet like layered structure.

70. Assertion : Both aldehydes and ketones contain carbonyl group.

Reason : In aldehydes, the functional group is attached to atleast one hydrogen atom.

SUBJECTIVE TYPE QUESTIONS

Very Short Answer Type Questions (VSA)

1. LPG (liquefied petroleum gas) is used as a fuel for cooking in homes. Why is LPG stored as a liquid?

2. Why carbon does not form the ionic compounds?

3. What are covalent compounds?

4. Give different forms in which carbon occurs in nature.

5. Write the molecular formula of first two members of homologous series having functional group $-Cl$.

6. Write the molecular formula of the 2nd and

3rd member of the homologous series whose first member is methane.

7. Select saturated hydrocarbons from the following :



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

9. Give the electron dot structures for (a) CCl_4 and (b) C_2H_2 .

10. An organic compound burns with a sooty flame. Is it a saturated or an unsaturated compound?

Short Answer Type Questions (SA-I)

11. The molecular formulae of alkenes X and Y are C_xH_8 and $C_{10}H_y$ respectively. What are the relative molecular masses of X and Y?

12. Define isomerism. Write down the structures and names of isomers of butane.

13. What is homologous series of compounds? List any two characteristics of homologous series.

14. A hydrocarbon molecule has 3 carbon atoms. Write down its molecular formula if it is an : (i) alkane (ii) alkene (iii) alkyne.



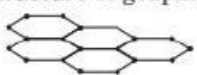
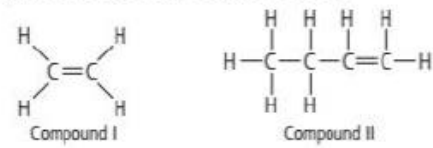
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15. What would be the electron dot structure of carbon dioxide which has the formula CO_2 ?
16. Explain the nature of the covalent bond using the bond formation in CH_3Cl .
17. What are covalent bonds? Show their formation with the help of electron dot structure of methane. Why are covalent compounds generally poor conductors of electricity?
18. State two properties of carbon which lead to a very large number of carbon compounds.
19. An allotrope of carbon has a molecular mass of 720. Discuss its structure.
20. Two non-metals *A* and *B* combine with each other by sharing of electrons to form compound *C*.
- What is the nature of compound *C*?
 - Will it dissolve in water or organic solvents?
 - Will it be a good or bad conductor of electricity?
 - Will it have high or low melting/boiling point?

Short Answer Type Questions (SA-II)

21. (i) Which allotrope of carbon is used for making cores of lead pencils?
(ii) Which allotrope of carbon is used for making expensive jewellery?
(iii) Name an allotrope of carbon which contains both single and double bonds.
22. What are covalent compounds? Why are they different from ionic compounds? List their three characteristic properties.
23. Write the molecular formula of the following compounds and draw their electron-dot structures:
(i) Ethane (ii) Ethene (iii) Ethyne
24. Why is homologous series of carbon compounds so called? Write the chemical formula of two consecutive members of any homologous series and state the part of these compounds that determines their (i) physical and (ii) chemical properties.
25. An element *X* has a proton number of 15, while element *Y* has a proton number of 17. Draw a 'dot-and-cross' diagram to show all electrons in a molecule formed from elements *X* and *Y*.
26. (a) What type of bond holds the two chlorine atoms together in a chlorine molecule?
(b) Briefly describe how this bond is formed.
(c) Draw a 'dot-and-cross' diagram to show the bonding in a chlorine molecule.
27. The diagram shows one layer of carbon atoms in the structure of graphite:
- 
- Identify the types of bonding in graphite.
 - Which property of graphite makes it suitable for use as a dry lubricant? Explain your answer.
28. Taking a suitable example show the formation of a molecule bonded by triple covalent bond.
29. 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. What are the two properties of carbon which lead to the huge number of carbon compounds we see around us?
31. What is a homologous series? Explain with an example.
32. (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.
33. (a) What is a homologous series of compounds? List any two of its characteristics.
(b) What is the next higher homologue of $\text{C}_3\text{H}_7\text{OH}$? What is its formula and what is it called?
34. Consider the molecular models of the two organic compounds shown below:
- 
- Name the homologous series that compounds I and II belong to and give its general formula.

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(b) Write the molecular formulae of next homologue of both compounds I and II.

35. Why are carbon and its compounds used as fuels for most applications?

➤ Long Answer Type Questions (LA)

36. The compounds, methanal, ethanal, propanal and butanal belong to the homologous series, called aldehydes. The table shows some information on these four aldehydes.

Name	Formula	Boiling point/°C	Solubility in water
Methanal	HCHO	-21	Very soluble
Ethanal	CH ₃ CHO	21	Very soluble
Propanal	CH ₃ CH ₂ CHO	49	Soluble
Butanal	CH ₃ CH ₂ CH ₂ CHO	76	Slightly soluble

- List two characteristics of this homologous series using the information shown in the table.
- Compare the molecular formulae of the four aldehydes listed in the table. What conclusion can you make?
- Draw the electronic structure of ethanal. You need to show only the outer shell electrons.

37. The table given below shows some information about four organic compounds *P*, *Q*, *R* and *S*.

Organic compound	Molecular formula	Melting point (°C)	Boiling point (°C)
<i>P</i>	C ₃ H ₈	-188	-42
<i>Q</i>	C ₄ H ₁₀	-138	-1
<i>R</i>	C ₅ H ₁₂	-130	36
<i>S</i>	C ₆ H ₁₂	6	80

- Which homologous series does C₃H₈ belong to?
 - Why are *P*, *Q*, *R* and *S* classified as hydrocarbons?
- Which of these organic compounds belong to the alkane series?
- Based on the information given above, state one characteristic of the alkane series.

38. (a) State the reason why carbon can neither form C⁴⁺ cations nor C⁴⁻ anions, but forms covalent bonds. Also state reasons to explain why covalent compounds

- are bad conductors of electricity
 - have low melting and boiling points.
- (b) Write the structural formula of benzene, C₆H₆.

39. (a) Define the term 'isomers'.

(b) Draw two possible isomers of the compound with molecular formula C₃H₆O and write their names.

(c) Give the electron dot structures of the above two compounds.

40. (a) Why two carbon atoms cannot be linked by more than three covalent bonds.

(b) Explain the following :

- Diamond is a covalent solid, yet has high melting point.
- Graphite is a good conductor of electricity but diamond is not.
- Diamond is used for making tools for cutting and drilling.

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