

Lakhmir Singh Solutions for Class 10 Chemistry Chapter 4 Carbon And Its Compounds

1. Name the element whose one of the allotropic forms is buckminsterfullerene.

Solution:

Carbon is the element whose one of the allotropic forms is buckminsterfullerene.

2. What are the two properties of carbon which lead to the formation of a large number of carbon compounds?

Solution:

Catenation (Self linking of carbon atoms to form long chains) and Tetravalency.

3. State whether the following statement is true or false:

Diamond and graphite are the covalent compounds of carbon element (C).

Solution:

False. Diamond and graphites are allotropes of carbon.

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4. Name the scientist who disproved the 'vital force theory' for the formation of organic compounds.

Friedrich Wohler is the scientist who disproved the vital force theory for the formation of organic compounds.

5. Name the element whose allotropic form is graphite.

Solution:

Carbon is the element whose allotropic form is graphite.

6. In addition to some propane and ethane, LPG cylinders contain mainly two isomers of another alkane. Name the two isomers and write their condensed structural formula.

Solution:

n-butane and iso-butane are the two isomers of another alkane.

n-butane: $\text{CH}_3\text{CH}_2\text{CH}_2\text{CH}_3$

Iso-butane: CH_3CHCH_3

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CH_3

7. Buckminsterfullerene is a spherical molecule in which 60 carbon atoms are arranged in interlocking hexagonal and pentagonal rings of carbon atoms.

(a) How many hexagons of carbon atoms are present in one molecule of buckminsterfullerene?

(b) How many pentagons of carbon atoms are present in one molecule of buckminsterfullerene?

Solution:

- (a) 20 hexagons of carbon atoms are present in one molecule of buckminsterfullerene
(b) 12 pentagons of carbon atoms are present in one molecule of buckminsterfullerene

8. Name the black substance of pencil. Will the current flow through the electrical circuit when we use the sharpened ends of the pencil to complete the circuit?

Solution;

Black substance inside a pencil is graphite. Yes, current will flow through the electrical circuit since graphite is a good conductor of electricity.

9. How does graphite act as a lubricant?

Solution:

Graphite has a hexagonal structure and a force exist between the layers. This weak force can slide over one another making the graphite in a slippery form and act as lubricant.

10. Name the hardest natural substance known.

Solution:

Diamond is the hardest natural substance.

11. Which of the following molecule is called buckminsterfullerene?

C_{90} , C_{60} , C_{70} , C_{120}

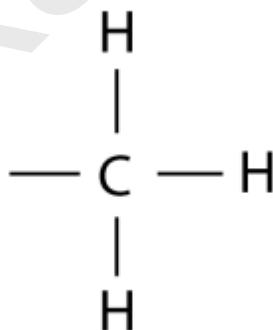
Solution:

C_{60} is called buckminsterfullerene

12. Give the name and structural formula of an alkyl group.

Solution:

Methyl



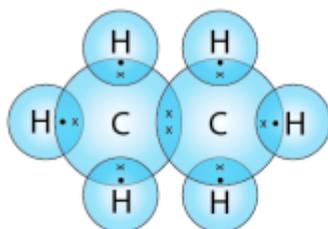
Methyl Group

13. Write the electron-dot structures for:

(i) ethane, (ii) ethene and (iii) ethyne.

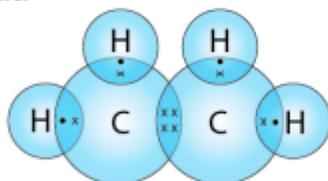
Solution:

Electron-dot structure:



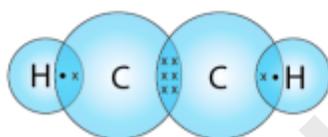
(ii) Ethene: The molecular formula is C_2H_4

Electron-dot structure:



(iii) Ethyne: The molecular formula is C_2H_2

Electron-dot structure:



14. Give the IUPAC name of the following compound:

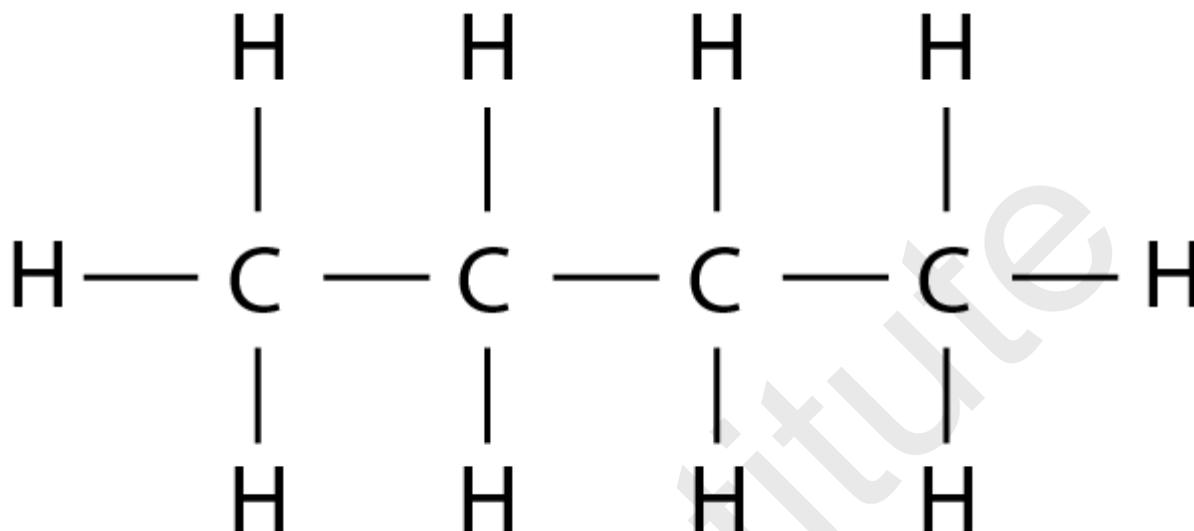


Solution:

Ethane is the IUPAC name for C_2H_6

15. Write the structural formula of propene.

Solution:



18. What do you call the compounds having the same molecular formula but different structural arrangements of atoms?

Solution:

Isomer are the compounds having the same molecular formula but different structural arrangements of atoms

19. Write the names of any two isomers represented by the molecular formula C_5H_{12} .

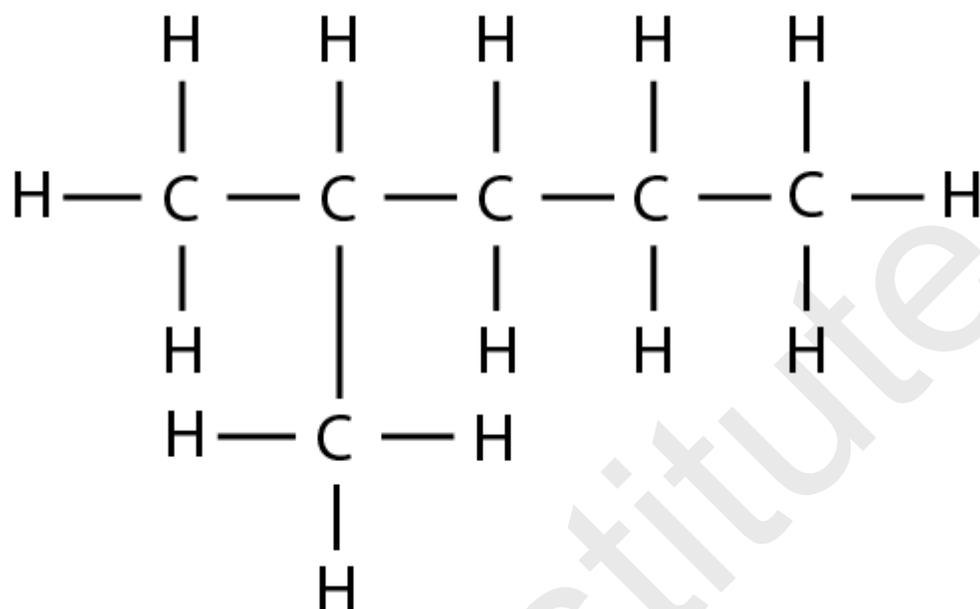
Solution:

Isopentane and neopentane are the two isomers of C_5H_{12} .

20. Write down (i) structural formula, and (ii) electron-dot formula, of any one isomer of hexane (C_6H_{14}), other than n-hexane.

Solution:

(i) Isomer of hexane: 2-methylpentane.



21. Fill in the following blanks with suitable words:

- (a) The form of carbon which is known as black lead is ____.
- (b) The form of carbon which is used as a lubricant at high temperature is ____.
- (c) Compounds of carbon with hydrogen alone are called ____.
- (d) C_nH_{2n} is the general formula of ____ hydrocarbons.
- (e) Hydrocarbons having the general formula $\text{C}_n\text{H}_{2n-2}$ are called ____.
- (f) Ethene and ethyne are examples of ____ hydrocarbons.
- (g) Ethyne has ____ carbon-hydrogen single bonds.
- (h) Carbon compounds have usually ____ melting points and boiling points because they are ____ in nature.
- (i) The property of carbon atoms to form long chains in compounds is called ____.
- (j) The general formula C_nH_{2n} for cycloalkanes is the same as that of ____.
- (k) The IUPAC name of ethylene is ____.
- (l) The IUPAC name of acetylene is ____.

Solution:

- (a) Graphite
- (b) Graphite
- (c) Hydrocarbons
- (d) Alkene
- (e) Alkynes

- (f) Unsaturated
- (g) Two
- (h) Low; covalent
- (i) Catenation
- (j) Alkenes
- (k) Ethene
- (l) Ethyne

Short Answer Type Questions

22. (a) What is the atomic number of carbon. Write its electronic configuration.

(b) What type of chemical bonds are formed by carbon? Why?

(c) Name the three allotropic forms of carbon.

Solution:

- (a) (a) The atomic number of carbon is 6. Its electronic configuration is 2,4.
- (b) Carbon forms covalent bonds because it can achieve the inert gas electron arrangement only by sharing of electrons.
- (c) Diamond, graphite and buckminsterfullerene are the three allotropes of carbon.

23. (a) What is the general name of all the compounds made up of carbon and hydrogen?

(b) Why does carbon form compounds mainly by covalent bonding?

Solution:

- (a) Hydrocarbons is the general name of all compounds made up of carbon and hydrogen
- (b) Carbon forms compounds mainly by covalent bonding in order to achieve the inert gas configuration by sharing the electrons.

24. (a) What is meant by catenation? Name two elements which exhibit the property of catenation.

(b) Write the names and structural formulae of all the possible isomers of hexane.

Solution:

- (a) Catenation is the property of self-combination of carbon atoms to form long chain. Carbon and silicon exhibit the property of catenation.
- (b)

25. (a) What is buckminsterfullerene? How is it related to diamond and graphite?

(b) Why is diamond used for making cutting tools but graphite is not?

(c) Why is graphite used for making dry cell electrodes but diamond is not?

Solution:

(a) Buckminsterfullerene is an allotrope of carbon containing clusters of 60 carbon atoms joined together to form spherical molecules. It burns on heating to form carbon dioxide and nothing is left behind. This shows that it is made up of carbon only like diamond and graphite.

(b) Diamond used for making cutting tools but graphite is not because diamond is a very hard substance and graphite is a soft substance.

(c) Graphite is used for making dry cell electrodes but diamond is not because graphite is a good conductor of electricity whereas diamond is a bad conductor of electricity.

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26. (a) Give the general formula of an: (i) alkane, (ii) alkene and (iii) alkyne.

(b) Classify the following compounds as alkanes, alkenes and alkynes:

C_2H_4 , C_3H_4 , C_4H_8 , C_5H_{12} , C_5H_8 , C_3H_8 , C_6H_6 .

Solution:

(a) (i) C_nH_{2n+2} (ii) C_nH_{2n} (iii) C_nH_{2n-2}

(b) Alkanes: C_5H_{12} , C_5H_8

Alkenes: C_2H_4 , C_4H_8

Alkynes: C_3H_4 , C_5H_8

27. (a) Friedrich Wohler converted an inorganic compound into an organic compound in the laboratory.

(i) Give the name and formula of inorganic compound.

(ii) Write the name and formula of organic compound formed.

(b) Give the molecular formula of butane and mention the names of its two isomers. Name one fuel which contains both these isomers.

Solution:

(a) (i) Ammonium cyanate, NH_4CNO

(ii) Urea, $CO(NH_2)_2$

(b) The molecular formula of butane is C_4H_{10} ; Its isomers are n-butane and 2-methylpropane; LPG.

28. a) Give IUPAC names and formulae of an organic compound containing single bonds and the other containing a triple bond.

(b) Which of the following is the molecular formula of benzene?

C_6H_6 , C_6H_{10} , C_6H_{12} , C_6H_{14}

(c) Which of the two has a branched chain: isobutene or normal butane?

Solution:

(a) Methane (single bond): CH_4

Ethyne (triple bond): C_2H_2

(b) Benzene: C_6H_6

(c) Isobutene has a branched chain.

29. Catenation is the ability of an atom to form bonds with other atoms of the same element. It is exhibiting both carbon and silicon. Compare the ability of catenation of the two elements. Give reasons.

Solutions:

Catenation is the ability of an element to form bonds with other atoms of the same element. It is exhibited by both carbon and silicon. The ability of catenation in carbon is greater than in silicon. The nucleus of carbon exerts a greater force of attraction on the shared pair of electrons and holds them firmly to form covalent bonds. This is the reason behind the ability of carbon to hold a number of atoms.

30. (a) How can diamonds be made artificially? How do synthetic diamonds differ from natural ones?

(b) Give any two differences between the properties of diamond and graphite. What causes these differences?

Solution:

By subjecting the pure carbon to a very high pressure and temperature diamonds can be made artificially.

(b)(i) Diamond is hard in nature whereas graphite is soft.

(ii) Diamond can conduct electricity whereas graphite cannot it is a poor conductor of electricity.

The arrangement of carbon atom in these two are different, hence causes for the difference in properties.

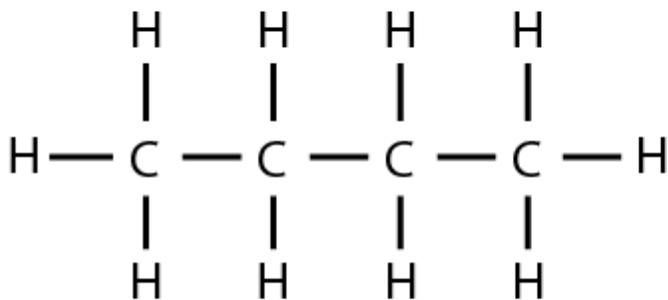
31. (a) Why does the element carbon form a large number of carbon compounds?

(b) Write down the structures and names of two isomers of butane (C_4H_{10}).

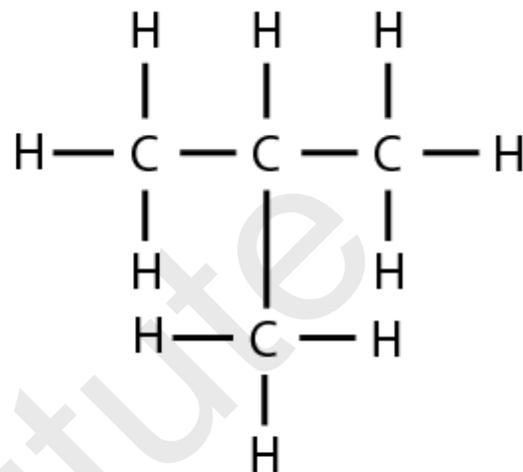
Solution:

(a) Carbon can link with one another by covalent bonding and forms large chains of carbon atom and that is why carbon form a large number of carbon compounds.

(b) Isomers of butane



Butane C_4H_{10}



Iso -Butane C_4H_{10}

32. (a) Give the name and structural formula of one member each of the following:

(i) alkane ; (ii) alkene ; (iii) alkyne ; (iv) cycloalkane.

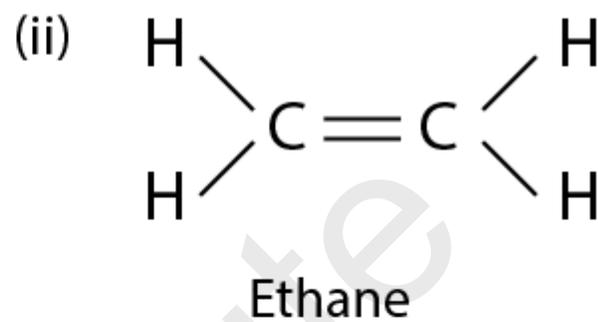
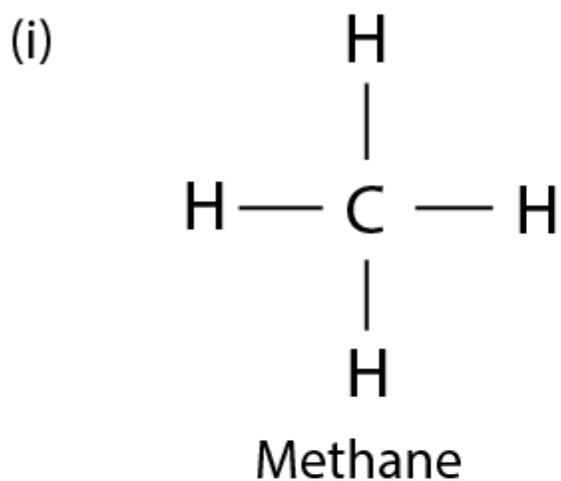
(b) Give the common name of (i) ethyne, and (ii) ethene.

(c) Write the molecular formula and structure of benzene.

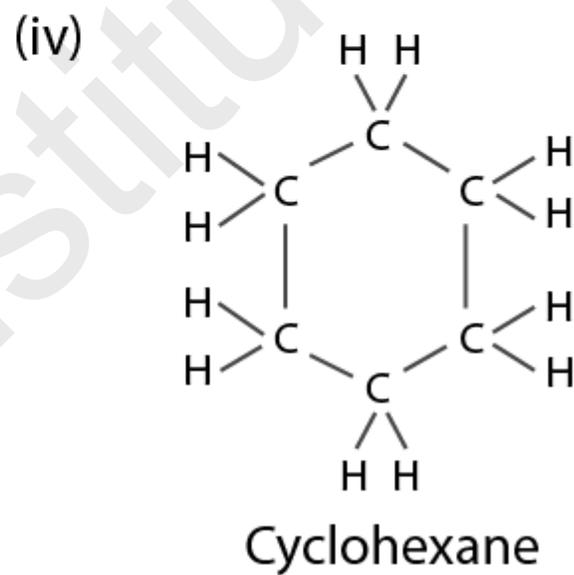
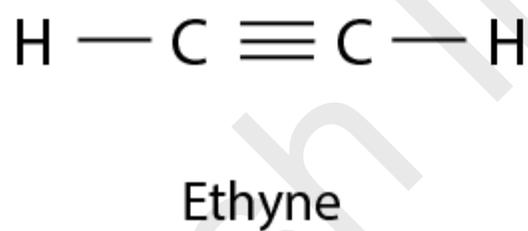
Solution:

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(i)

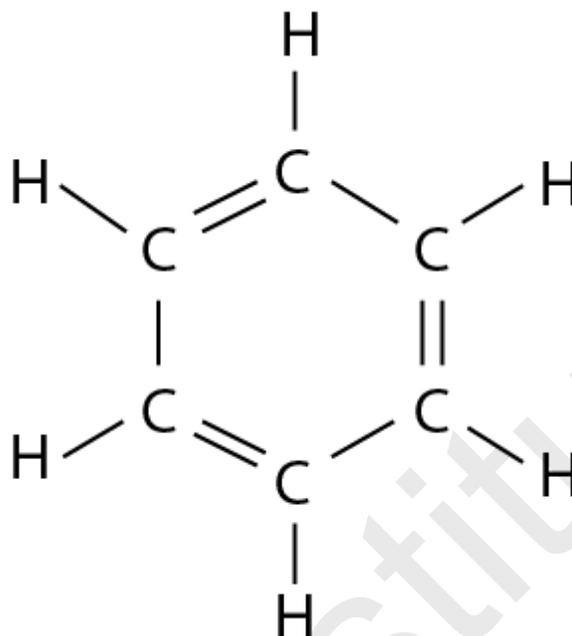


(iii)



(b) (i) Acetylene (ii) Ethylene

(c) C_6H_6



33. (a) What is the unique property of carbon atom? How is this property helpful to us?

(b) Explain why, diamond is hard while graphite is soft.

Solution:

(a) Carbon can form long chains by combining atoms to atoms. Catenation is the most unique property of a carbon atom. This gives a large number of carbon compounds or organic compounds.

(b) Diamond and graphite are made up of carbon. Diamond is hard and graphite is soft. Because the strong covalent bond between carbon forming a tetrahedron which is hard to break. Graphite is flat hexagonal ring forming layers of carbon atoms.

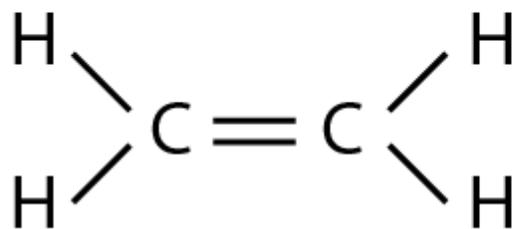
34. (a) Giving their structures, state the number of single bonds, double bonds and triple bonds(if any) following compounds:

(i) ethyne (ii) ethene (iii) benzene

(b) Write the molecular formula and structure of cyclohexane. How many covalent bonds are there in the molecule of cyclohexane?

Solution:

(i)(ii)

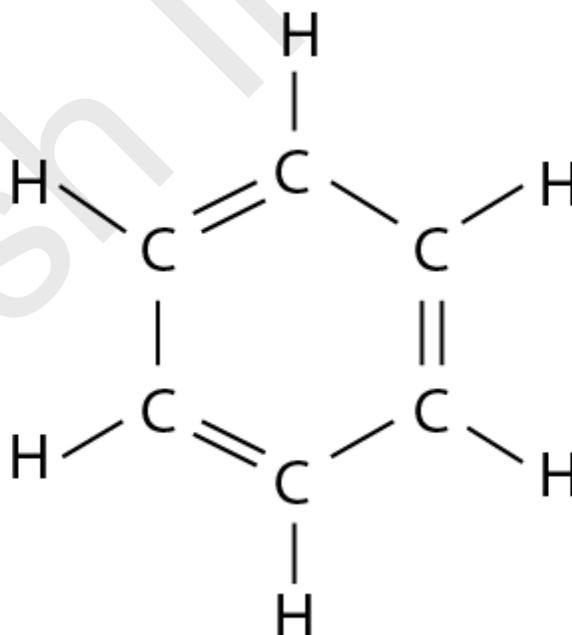


Ethene
(an alkene)



Ethyne
(an alkyne)

(iii)

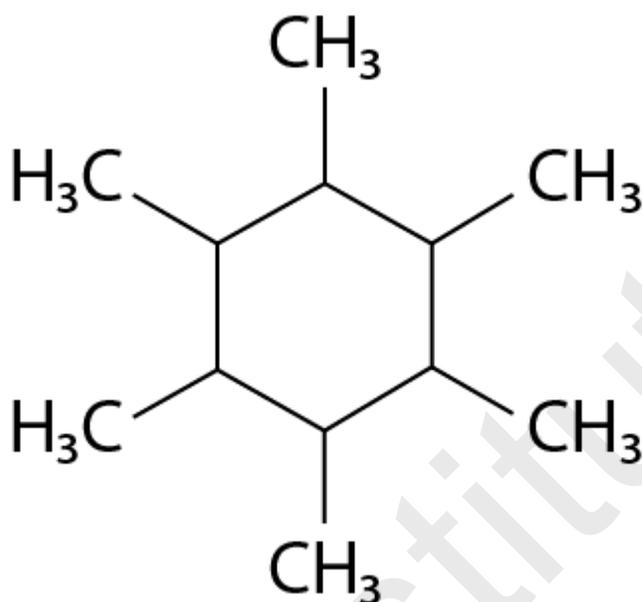


(i) Ethyne:- Single bonds: Two; Triple bond: One

(ii) Ethene:- Single bonds: Four; Double bond: One

(iii) Benzene: Single bonds C-C: Three; Single bond C-H: Six; Double bonds C=C: Three

(b) C_6H_{12} is cyclohexane.



- 35. (a) Write two points of difference in the structures of diamond and graphite.**
(b) Explain why, graphite can be used as a lubricant but diamond cannot.
(c) Explain why, diamond can be used in rock drilling equipment but graphite cannot.
(d) State one use of diamond which depends on its 'extraordinary brilliance' and one use of graphite that depends on its being 'black and quite soft'.

Solution:

- (a) (i) In diamond, carbon atoms are linked to four other carbon atoms
 In graphite, carbon atom is joined to only three other carbon atoms.
 (ii) In diamond, crystal has tetrahedral arrangement
 In graphite, crystal has a hexagonal ring structure.
- (b) Graphite can be used as lubricant because of its softness.
- (c) Diamond can be used as rock drilling equipment because of its hardness nature. It has a rigid structure.
- (d) Diamonds are used for making jewellery
 Graphite is used for making pencil leads.

Long Answer Type Questions

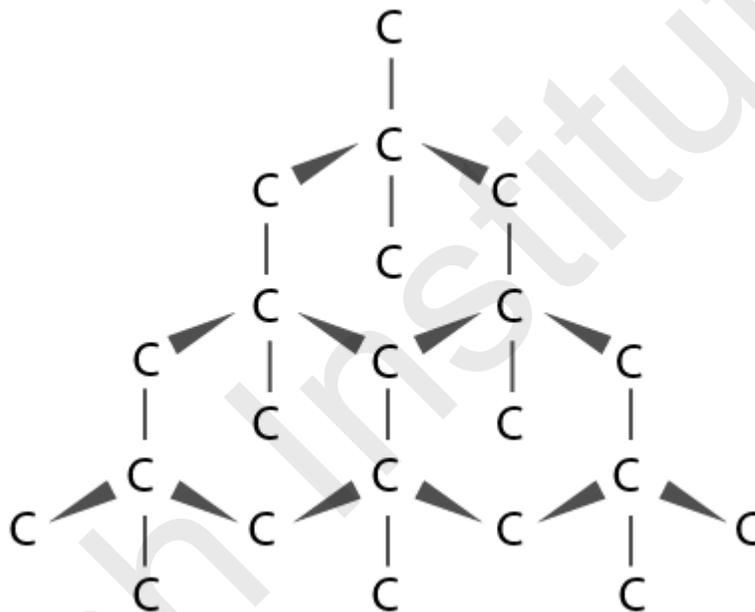
- 36. (a) What is diamond? Of what substance is diamond made?**
(b) Describe the structure of diamond. Draw a simple diagram to show the arrangement of carbon atoms in diamond.
(c) Explain why, diamond has a high melting point.

(d) State any two uses of diamond.

Solution:

(a) Diamond is a colourless transparent substance having extraordinary brilliance. It is made up of carbon.

(b) A diamond crystal is a giant molecule of carbon atoms. Each carbon atom in the diamond crystal is linked to four other carbon atoms by strong covalent bonds. The four surrounding carbon atoms are at the four vertices of a regular tetrahedron. This rigid structure of diamond makes it a very hard substance.



(c) It has high melting point and huge amount of energy is required to break the network of strong covalent bonds.

(d) (i) Used for making jewellery

(ii) Used for rock drilling

37. (a) What is graphite? Of what substance is graphite made?

(b) Describe the structure of graphite with the help of a labeled diagram.

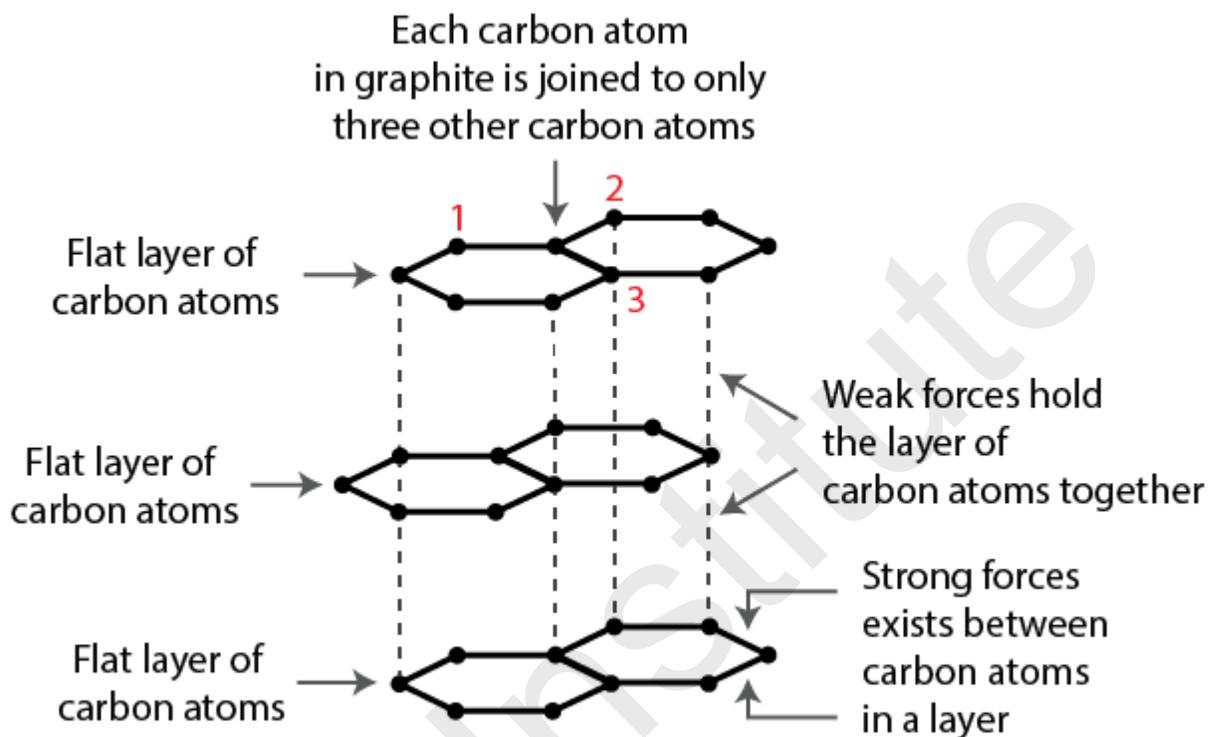
(c) Why is graphite a good conductor of electricity but diamond is a non-conductor of electricity?

(d) State any two uses of graphite.

Solution:

(a) Graphite is an allotrope of carbon which is soft, greyish black and opaque substance made up of carbon atoms.

(b)



A graphite crystal consists of layers of carbon atoms or sheets of carbon atoms. Each carbon atom in a graphite layer is joined to other three carbon atoms by strong covalent bonds to form flat hexagonal rings. The various layers of carbon atoms in graphite are held together by weak Van der Waals forces. Due to this sheet like structure, graphite is a comparatively soft substance.

(c) In graphite crystal, each carbon atom is connected to only three other carbons. Therefore the fourth valence electron is free and are responsible for the conduction of electricity in graphite.

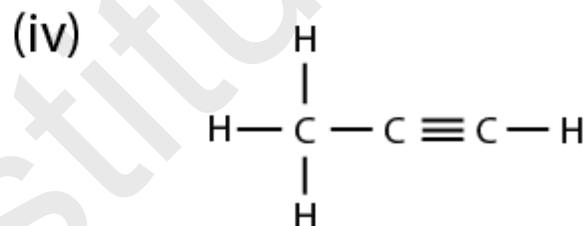
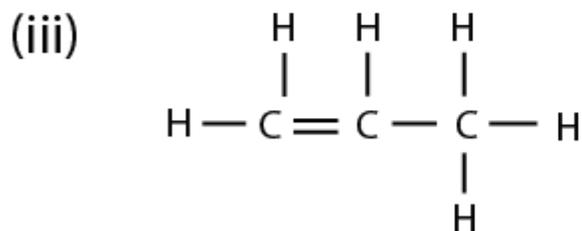
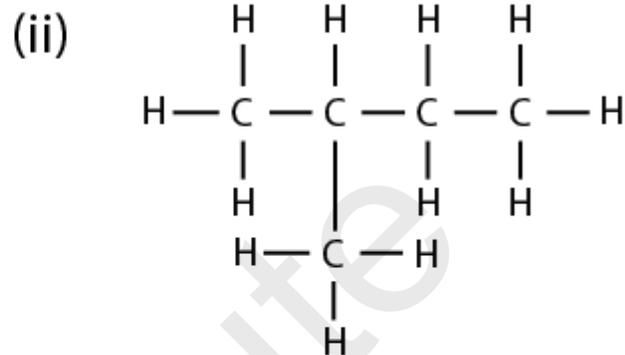
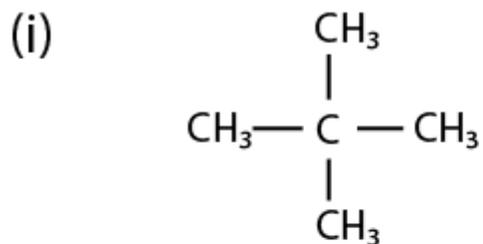
(d) Graphite is used as lubricant and used for making pencil leads

38. (a) Explain the term 'isomers'. Give one example of isomers.

(b) Write (i) structural formula, and (ii) electron-dot structure, of any one isomer of n-heptane.

(c) Write the IUPAC name of the compound having the formula $n\text{-C}_4\text{H}_{10}$.

(d) Write the IUPAC names for the following:

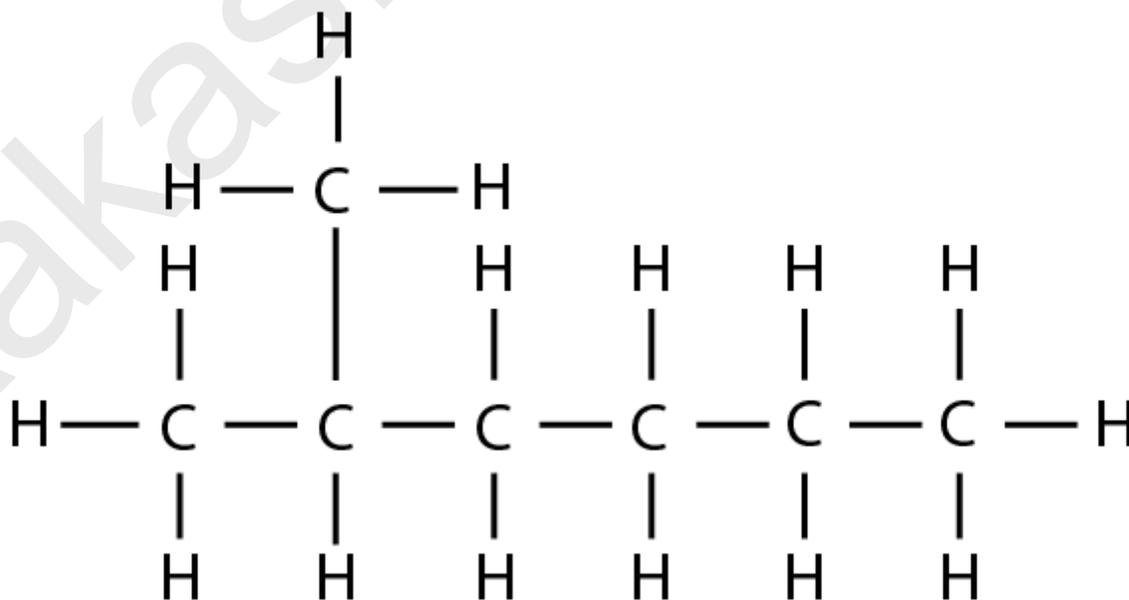


Solution:

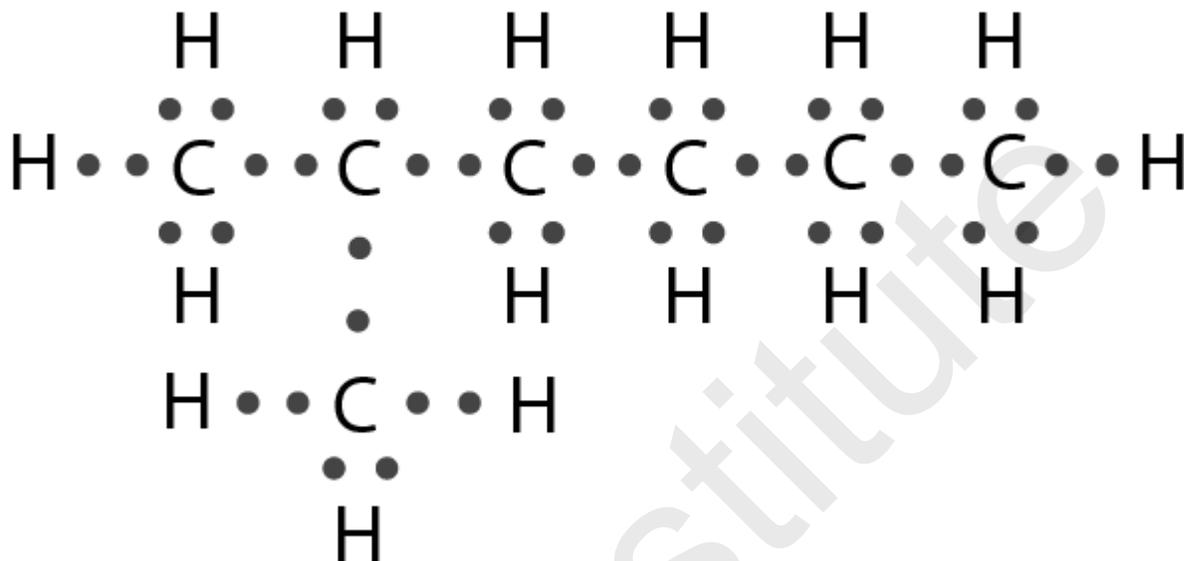
(a) The organic compounds having the same molecular formula but different structures are known as isomers for ex: n-butane and iso-butane are isomers.

(b) Isomer of n-heptane: 2-methylhexane.

(i)



(ii)



(c) Butane

(d) (i) 2-methylpropane

(ii) 2-methylbutane

(iii) Propene

(iv) Propyne

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39. (a) What are hydrocarbons? Explain with examples.

(b) Explain the meaning of saturated and unsaturated hydrocarbons with two examples each.

(c) Give the names and structural formulae of one saturated cyclic hydrocarbon and one unsaturated cyclic hydrocarbon.

(d) Give one example of a hydrocarbon, other than pentane, having more than three isomers.

(e) How many isomers of the following hydrocarbons are possible?

(i) C_3H_8 (ii) C_4H_{10} (iii) C_5H_{12} (iv) C_6H_{14}

Solution:

(a) A compound made up of hydrogen and carbon only is called a hydrocarbon. For example: methane (CH_4), ethane (C_2H_6), ethene (C_2H_4), and ethyne (C_2H_2), all are hydrocarbons as they are made up of only two elements: carbon and hydrogen.

(b) Saturated hydrocarbons are those which the carbon atoms are connected by single bonds and also called alkanes. Example: Methane and ethane

Unsaturated hydrocarbons are those which the two carbon atoms are connected by a double bond or a triple bond.

Example: Ethene and ethyne

(c) Saturated cyclic hydrocarbon: Cyclohexane C_6H_{12}

Unsaturated Cyclic hydrocarbon: Benzene C_6H_6

(d) Hexane C_6H_{14}

(e) (i) No isomers

(ii) Two

(iii) Three

(iv) Five

Multiple Choice Questions (MCQ's)

40. Buckminsterfullerene is an allotropic form of the element:

(a) Phosphorus

(b) Fluorine

(c) Carbon

(d) Sulphur

Solution:

Option (c) is the answer.

41. Out of the following pairs of compounds, the unsaturated compounds are:

(a) C_2H_6 and C_4H_6

(b) C_6H_{12} and C_5H_{12}

(c) C_4H_6 and C_6H_{12}

(d) C_2H_6 and C_4H_{10}

Solution:

Option (c) is the answer.

42. The number of covalent bonds in pentane (molecular formula C_5H_{12}) is:

(a) 5

(b) 12

(c) 17

(d) 16

Solution:

Option (d) is the answer.

43. The property of self-combination of the atoms of the same element to form long chains is known as:

- (a) Protonation
- (b) Carbonation
- (c) Coronation
- (d) Catenation

Solution:

Option (d) is the answer.

44. A cyclic hydrocarbon having carbon-carbon single bonds as well as carbon-carbon double bonds in molecule is:

- (a) C_6H_{12}
- (b) C_6H_{14}
- (c) C_6H_6
- (d) C_6H_{10}

Solution:

Option (c) is the answer.

45. The hydrocarbon 2-methylbutane is an isomer of :

- (a) n-pentane
- (b) n-butane
- (c) Propane
- (d) Iso-butane

Solution:

Option (a) is the answer.

46. An unsaturated hydrocarbon having a triple bond has 50 hydrogen atoms in the molecule. The number of carbon atoms in its molecule will be:

- (a) 24
- (b) 25
- (c) 26
- (d) 28

Solution:

Option (c) is the answer.

47. An alkyne has seventy five carbon atoms in its molecule. The number of hydrogen atom in its molecule will be :

- (a) 150
- (b) 148
- (c) 152

(d) 146

Solution:

Option (b) is the answer.

48. A diamond-toothed saw is usually for cutting;

- (a) Steel girders
- (b) Logs of woods
- (c) Marble slabs
- (d) Asbestos sheets

Solution:

Option (c) is the answer.

49. The organic compound prepared by Wohler from an inorganic compound called ammonium cyanate was;

- (a) Glucose
- (b) Urea
- (c) Uric acid
- (d) Vinegar

Solution:

Option (b) is the answer.

50. One of the following is not an allotrope of carbon. This is:

- (a) Diamond
- (b) Graphite
- (c) Cumene
- (d) Buckminsterfullerene

Solution:

Option (c) is the answer.

51. The number of carbon atoms in the organic compound named as 2,2-dimethylpropane is:

- (a) Two
- (b) Five
- (c) Three
- (d) Four

Solution:

Option (b) is the answer.

52. The pair of elements which exhibits the property of catenation is :

- (a) Sodium and silicon
- (b) Chlorine and carbon
- (c) Carbon and sodium
- (d) Silicon and carbon

Solution:

Option (d) is the answer.

53. A saturated hydrocarbon has fifty hydrogen atom in its molecule. The number of carbon atom in its molecule will be:

- (a) Twenty five
- (b) Twenty four
- (c) Twenty six
- (d) Twenty seven

Solution:

Option (b) is the answer.

54. A hydrocarbon having one double bond has 100 carbon atom in its molecule. The number of hydrogen atoms in its molecule will be:

- (a) 200
- (b) 198
- (c) 202
- (d) 196

Solution:

Option (a) is the answer.

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55. The hydrocarbon which has alternate single and double bonds arranged in the form of a ring is:

- (a) Cyclobutane
- (b) Benzene
- (c) Butene
- (d) Hexene

Solution:

Option (b) is the answer.

56. Which of the following cannot exhibit isomerism?

- (a) C_4H_{10}
- (b) C_5H_{12}

(c) C_3H_8

(d) C_6H_{14}

Solution:

Option (c) is the answer.

57. The pencil leads are made of mainly:

(a) Lithium

(b) Charcoal

(c) Lead

(d) Graphite

Solution:

Option (d) is the answer.

58. The number of isomers formed by the hydrocarbon with molecular formula C_5H_{12} is:

(a) 2

(b) 5

(c) 3

(d) 4

Solution:

Option (c) is the answer.

59. The number of carbon atoms joined in a spherical molecule of buckminsterfullerene is:

(a) Fifty

(b) Sixty

(c) Seventy

(d) Ninety

Option (b) is the answer.