Carbon and its Compounds

Case Study Based Questions

Case Study 1

Diamond, graphite and fullerenes (such as buckminsterfullerene) are three allotropes of pure carbon. In all three allotropes, the carbon atoms are joined by strong covalent bonds, but in such different arrangements that the properties of the allotropes are very different. Diamond is the hardest substance known in which each carbon atom is bonded to four other carbon atoms forming a rigid three-dimensional structure. Graphite is smooth and slippery and also a very good conductor of electricity. Graphite structure is formed by the hexagonal arrays being placed in layers one above the other.

Read the above passage carefully and give the answer of the following questions:

Q1. Which of the following is buckminsterfullerene?

a. C-40
b. C-50
c. C-60
d. C-70

Q2. What type of bonding is present in diamond?

a. Ionic
b. Metallic
c. van der Waals
d. Covalent

Q3. In graphite, the carbon atoms are arranged in layers of:

a. hexagonal arrays
b. pentagonal arrays
c. heptagonal arrays
d. octagonal arrays

Q4. Which among the following is not a property of diamond?

(i) It is the hardest substance known

(ii) It is smooth and slippery
(iii) It is a poor conductor of electricity
(iv) It is used as a lubricant
a. (iii) and (iv)
b. (ii) and (iv)
c. (i) and (iv)
d. (ii), (iii) and (iv)

Q5. Why is graphite soft and slippery?
a. Because of its layer-like structure
b. Because it is made of carbon
c. Because of its stronger tetrahedron pattern
d. Because it has free electrons
1. (c) C-60
2. (d) Covalent

Answers

3. (a) hexagonal arrays
4. (b) (ii) and (iv)
5. (a) Because of its layer-like structure

Case Study 2

Homologous series is a series of compounds with similar chemical properties and same functional group differing from the successive member by -CH_2 or 14 mass units. Members of a homologous series show a gradual change in the physical properties (such as melting point, boiling point. etc.) with the increase in molecular formula in the series.

Read the above passage carefully and give the answer of the following questions:

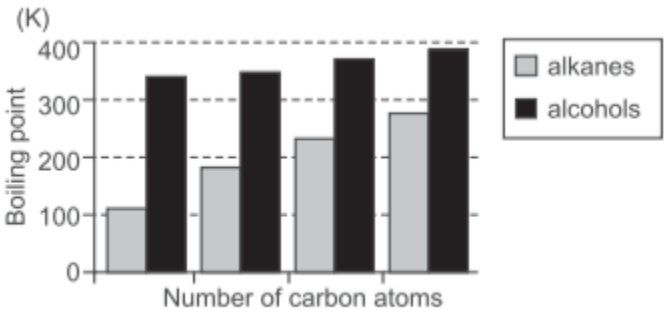
Q1. What is the difference between two consecutive members in a homologous series in alkanes in terms of:
(i) Molecular mass
(ii) Number of atoms of elements?

Q2. Write the formula and IUPAC name of the next homologue of CH_3CH_2OH.

Q3. To which homologous series the compound
$CH_3CH_2COCH_2\ CH_3$ belongs?

Q4. Which two of the following organic compounds belong to the same homologous series?
$C2H_6$, C_2H_6O, $C_2H_6O_2$, CH_{40}

Q5. Study the graph given given below that represents the boiling points of alcohols compared with alkanes.



What do you depict from the given graph?

Answers

1. (i) Molecular mass = 14 u
(ii) Number of atoms of elements = CH_2

2. Formula: $CH_3CH_2CH_2OH$
IUPAC name: Propan-1-ol

3. The compound $CH_3CH_2COCH_2CH_3$ belongs to Ketone homologous series.

4. C_2HO and CH_2O belongs to the same homologous series.

5. From the graph, we depict that alcohols possess higher boiling points as compared to those of corresponding alkanes.

Case Study 3

Chemistry in Automobiles:

For an internal combustion engine to move a vehicle down the road, it must convert the energy stored in the fuel into mechanical energy to drive the wheels. In your car, the distributor and battery provide this starting energy by creating an electrical "spark",

which helps in combustion of fuels like gasoline. Below is the reaction depicting complete combustion of gasoline in full supply of air:

$$2C_8H_{18}(l) + 25O_2(g) \longrightarrow 16\ 'X' + 18\ 'Y'$$

Read the above passage carefully and give the answer of the following questions:

Q1. Which of the following are the products obtained from the reaction mentioned in the above case?

Q2. Identify the types of chemical reaction occurring during the combustion of fuel:
a. oxidation and endothermic reaction
b. decomposition and exothermic reaction
c. oxidation and exothermic reaction
d. combination and endothermic reaction

Q3. On the basis of evolution/absorption of energy, which of the following processes are similar to combustion of fuel?
(i) Photosynthesis in plants
(ii) Respiration in the human body
(iii) Decomposition of vegetable matter
(iv) Decomposition of ferrous sulphate.
a. (ii) and (iii)
b. (i) and (ii)
c. (iii) and (iv)
d. (ii) and (i)

Q4. 'A student while walking on the road observed that a cloud of black smoke belched out from the exhaust stack of moving trucks on the road. Choose the correct reason for the production of black smoke:
a. Limited supply of air leads to incomplete combustion of fuel.
b. Rich supply of air leads to complete combustion of fuel.
c. Rich supply of air leads to a combination reaction.
d. Limited supply of air leads to complete combustion of fuel.

Q5. Although nitrogen is the most abundant gas in the atmosphere, it does not take part in combustion'. Identify the correct reason for this statement.

a. Nitrogen is a reactive gas
b. Nitrogen is an inert gas
c. Nitrogen is an explosive gas
d. Only hydrocarbons can take part in combustion

Answers

1. (d) X-CO_2, Y-H_2O
2. (c) oxidation and exothermic reaction
3. (a) (ii) and (iii)
4. (a) Limited supply of air leads to incomplete combustion of fuel.
5. (b) Nitrogen is an inert gas

Case Study 4

The table given below shows the hints given by the quiz master in a quiz.

S.No.	Hint
(i)	Substance 'C' is used as a preservative.
(ii)	'C' has two carbon atoms; 'C' is obtained by the reaction of 'A' in presence of alkaline Potassium permanganate followed by acidification.
(iii)	Misuse of 'A' in industries is prevented by adding Methanol, Benzene and Pyridine to 'A'.
(iv)	'F' is formed on heating 'A' in presence of conc. sulphuric acid.
(v)	'F' reacts with hydrogen gas in presence of Nickel and Palladium catalyst.

Based on the given hints answer of the following questions:

Q1. Give the IUPAC names of A and F.

Q2. Illustrate with the help of chemical equations the changes taking place. (A→ C and A → F)

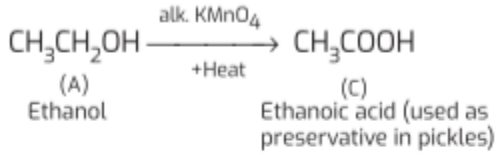
Or

Name the chemical reactions which occur in steps 2 and 5. Identify the compounds formed in these steps if 'A' is replaced with its next homologue. (CBSE SQP 2023-24)

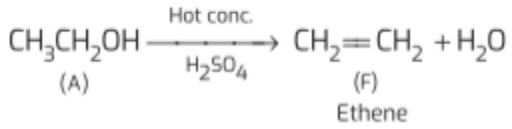
Answers

1. A is Ethanol and F is Ethene.

2. A→ C:

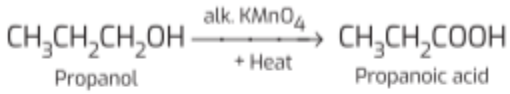


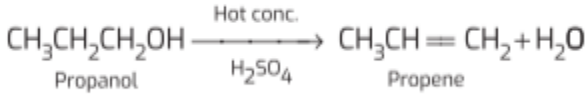
A → F :



Or

Oxidation reaction occurs in step 2. Addition reaction occurs in step 5.
Next homologue of 'A' (ethanol) is propanol. ($CH_3CH_2CH_2OH$).





∴ Propanoic acid and propene are formed in the given reactions.

Solutions for Questions 5 to 14 are Given Below

Case Study 5

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

A series of organic compounds having same functional group, with similar or almost identical chemical characteristics in which all the members can be represented by the same general formula and the two consecutive members of the series differ by —CH_2 group or 14 mass unit in their molecular formulae is called a homologous series. For example, all the members of alcohol family can be represented by the general formula, $C_nH_{2n+1}OH$ 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 or descending the series.

(i) 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.

(ii) 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}

(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 $-CH_3$ 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.

(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.

(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) (I), (II), (III) and (IV)

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

First member of the homologous series	$CH_3—O—CH_3$
Second member of the homologous series	$CH_3CH_2—O—CH_3$
Third member of the homologous series	$CH_3CH_2CH_2—O—CH_3$

What is the general formula of this series?

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

Case Study 6

Read the following and answer any four questions from 2(i) to 2(v).

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.

(i) Substance *X* is a moderate conductor of electricity. Substance *X* has the structure shown below :

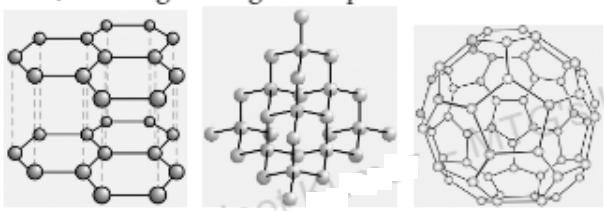
Which statements about substance *X* are correct?

(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)

(ii) 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.

(iii) 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

(iv) Identify the incorrect statement(s).

(I) Diamond is the hardest substance known while graphite is smooth and slippery.

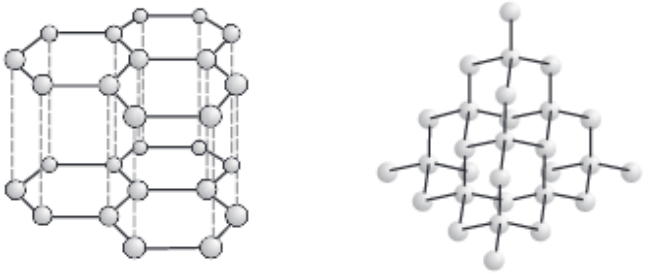
(II) Diamond is made up of billions of carbon atoms. Each carbon atom is bonded to four other carbon atoms in a tetrahedral manner to form a giant lattice. All carbon atoms are bonded by strong covalent bonds.

(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)

(v) Structures of two different forms of carbon are given below :



I II

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

Case Study 7

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

As neutral atom carbon has electronic configuration $\underset{2,}{K}\ \underset{4}{L}$. To gain inert gas configuration carbon can either donate 4 valence electrons (helium gas configuration) or gain 4 electrons (neon gas configuration), but it cannot do so. To acquire inert gas configuration carbon can only share its 4 valence electrons with other atoms forming covalent bonds. A covalent bond can be defined as a chemical bond formed between two atoms by mutual sharing of valence electrons so that each atom acquires the stable electronic configuration of the nearest noble gas. The concept of covalent bonds was given by Langmuir and Lewis to explain bonding in non-ionic

compounds. The covalent bonds are of three types. If each atom contributes one electron, the covalent bond formed is called a single covalent bond and is represented by a single line (–) and if each atom contributes two electrons, the covalent bond formed is called a double bond and is represented by a double line (=) and if each atom contributes three electrons, the covalent bond formed is called a triple bond and is represented by a triple line (≡).

(i) Which of the following do not contain a double bond?

I. SO_2 II. NH_3 III. HCl IV. O_2

(a) I and II only (b) II and III only (c) III and IV only (d) I and IV only

(ii) Which of the following contains a triple bond?

(a) N_2 (b) O_2 (c) CO_2 (d) H_2

(iii) The shared pair of electrons is said to constitute a _____ bond between two hydrogen atoms.

(a) single (b) double (c) triple (d) ionic

(iv) 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

(v) Chlorine forms a diatomic molecule, Cl_2. The electron dot structure for this molecule is

(a)  (b)  (c)  (d) 

Case Study 8

Read the following and answer any four questions from 4(i) to 4(v).

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.

(i) Which of the following is a good conductor of heat and electricity?

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

(ii) 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.

(iii) Which of the following types of binding forces is present in the structure of diamond?

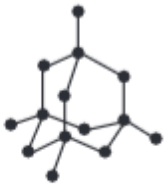
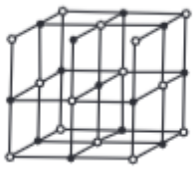
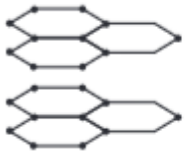
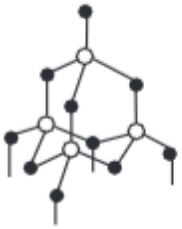
(a) Ionic (b) van der Waals' (c) Covalent (d) None of these

(iv) 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.

(v) Which of the following is the structure of diamond?

(a)  (b)  (c)  (d) 

Case Study 9

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

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

Case Study 10

Read the following and answer any four questions from 6(i) to 6(v).

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

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

(i) *A*, *B* and *C* are classified as hydrocarbons because

(a) they contain hydrogen
(b) they contain carbon
(c) they contain both carbon and hydrogen
(d) none of these.

(ii) Which of these organic compounds is an alkyne?

(a) *A* (b) *B* (c) *C* (d) All of these

(iii) C_5H_{10} belongs to

(a) C_nH_{2n+2} series
(b) C_nH_{2n} series
(c) C_nH_{2n-2} series
(d) none of these.

(iv) Identify the incorrect statement about these three hydrocarbons.

(a) All have different general formula. (b) *A* and *B* differ by $-CH_2$ unit.

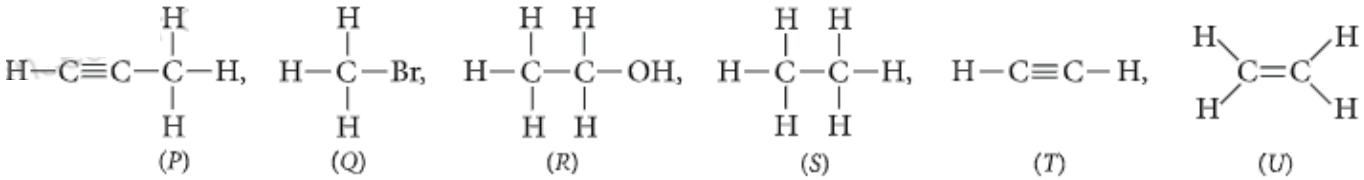
(c) *C* is an alkyne. (d) *B* is an alkene.

(v) General formula for alkane is

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

Case Study 11

Read the following and answer any four questions from 7(i) to 7(v).



(i) 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*.

(ii) The functional group of compound (*R*) is

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

(iii) Compound (*T*) belongs to homologous series of

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

(iv) Which of the following compounds is unsaturated hydrocarbon?

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

(v) Which of the following compounds belongs to alkane series?

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

Case Study 12

Read the following and answer any four questions from 8(i) to 8(v).

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}

(i) 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*

(ii) Which of the following is the member of the same homologous series as *E*?

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

(iii) 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.

(iv) Compound *B* is

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

(v) 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 Study 13

Read the following and answer any four questions from 9(i) to 9(v).

A hydrocarbon (*P*) has the molecular formula $C_{10}H_{22}$. A hydrocarbon (*Q*) has two carbon atoms less than (*P*) and belong to the same homologous series. A hydrocarbon (*R*) has two carbon atoms more than (*P*) and belong to the same homologous series.

(i) What is the molecular formula of (*Q*)?

(a) $C_{12}H_{26}$ (b) C_8H_{16} (c) C_8H_{18} (d) C_8H_{14}

(ii) To which homologous series do the compound (*P*), (*Q*) and (*R*) belong?

(a) C_nH_{2n} (b) C_2H_{2n-2} (c) C_nH_{2n+2} (d) C_nH_{2n+1}

(iii) What is the molecular formula of (*R*)?

(a) $C_{12}H_{26}$ (b) $C_{12}H_{24}$ (c) $C_{12}H_{22}$ (d) $C_{12}H_{28}$

(iv) Identify the correct statement about compounds (*P*), (*Q*) and (*R*).

(a) They have same melting and boiling points. (b) They have same chemical properties.

(c) They have different general formula. (d) They differ by $—CH_2$ unit.

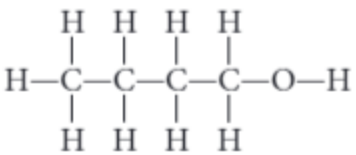
(v) Compounds (*P*), (*Q*) and (*R*) are

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

Case Study 14

Read the following and answer any four questions from 10(i) to 10(v).

An organic molecule has the following structure :



(i) To which homologous series does this molecule belong?

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

(ii) 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) $C_nH_{2n+1}CHO$

(iii) Which is the next member of this series?

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

(**iv**) Which is the third member of this series?

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

(**v**) Which is the second member of this series?

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

5. **(i) (a):** All the members of homologous series show similar chemical properties.

(ii) (c): Alkynes have the general formula C_nH_{2n-2}, *e.g.*, Ethyne (C_2H_2), Propyne (C_3H_4), Butyne (C_4H_6).

(iii) (b): Two consecutive members of a homologous series differ by a $-CH_2$ group

(iv) (c): The melting and boiling points increase with increasing molecular mass.

(v) (b): Molecular formula of first member : C_2H_6O
Molecular formula of second member : C_3H_8O
Molecular formula of third member : $C_4H_{10}O$
Thus, the general formula of the homologous series is $C_nH_{2n+2}O$.

6. **(i) (c):** Each atom is covalently bonded to four other atoms, which in turn, are bonded to four more atoms. Thus, *X* is a giant molecule and has a structure similar to that of diamond. Substance *X* is not a compound as it consists of only one type of atoms. Thus, *X* is an element. Graphite has layers of carbon atoms.

(ii) (a) **(iii)** (d)

(iv) (b): In graphite only three valence electrons are used for bond formation and hence fourth electron is free to move which makes it a good conductor of electricity.

(v) (b): Given structures are of graphite and diamond and these are allotropes of carbon.

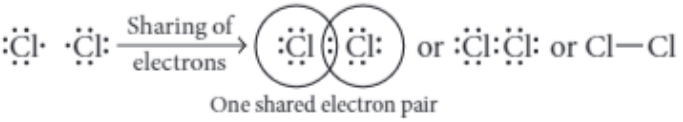
7. **(i) (b):** Both NH_3 and HCl have single bonds.

(ii) (a): $N \equiv N$

(iii) (a)

(iv) (c): $O=C=O$

(v) (c): In chlorine molecule, both chlorine atoms contribute one electron and thus share single electron pair to form single covalent bond. As shared pair is shared by both atoms, they acquire inert gas configuration of argon atom in valence shell.



8. **(i) (d)** **(ii) (a)**

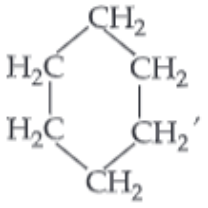
(iii) (c)

(iv) (d): In diamond, one carbon is attached to four other carbon atoms hence it has no free electron.

(v) (a)

9. **(i) (d):** $CH_3CH_2CH_2CH_3$, $CH_3CH(CH_3)$

(Butane and *iso*-Butane-C_4H_{10})



$CH_3CH_2CH_2CH_2CH=CH_2$

(Cyclohexane and hexene-C_6H_{12})
CH_3CH_2CHO, CH_3COCH_3
(Propanal and propanone-C_3H_6O)

(ii) (a)

(iii) (d): $CH_3CH_2CH_2CH_3$ and $CH_3CH(CH_3)$ have different structural formulas and same molecular formula.

(iv) (c): *neo*-Pentane :

$H_3C-\overset{\overset{CH_3}{|}}{C}-CH_3$ (3 carbon atoms)
$\quad\quad\;\; |$
$\quad\quad CH_3$

iso-Pentane :

$H_3\overset{1}{C}-\overset{2}{C}H-\overset{3}{C}H_2-\overset{4}{C}H_3$ (4 carbon atoms)
$\quad\quad\quad\;\; |$
$\quad\quad\quad CH_3$

2-Methylpentane :

$\overset{1}{C}H_3-\overset{2}{C}H-\overset{3}{C}H_2-\overset{4}{C}H_2-\overset{5}{C}H_3$ (5 carbon atoms)
$\quad\quad\quad\;\; |$
$\quad\quad\quad CH_3$

2,2-Dimethylbutane :

$\overset{1}{C}H_3-\overset{\overset{CH_3}{|}}{\overset{2}{C}}-\overset{3}{C}H_2-\overset{4}{C}H_3$ (4 carbon atoms)
$\quad\quad\quad\;\; |$
$\quad\quad\quad CH_3$

Hence, 2-methylpentane has the longest carbon chain.

(v) (b): Pentane (C_5H_{12}) has three structural isomers :

$CH_3-CH_2-CH_2-CH_2-CH_3$

n-Pentane

$CH_3-CH(CH_3)-CH_2-CH_3$

iso-Pentane

$CH_3-C(CH_3)_2-CH_3$

neo-Pentane

10. (i) (c) : *A*, *B* and *C* are classified as hydrocarbons because these compounds are made up of carbon and hydrogen only.

(ii) (c) : *C* is an alkyne.

(iii) (b): C_5H_{10} is an alkene having a general formula C_nH_{2n}.

(iv) (b): *A* and *B* do not belong to same homologous series. *A* is an alkane while *B* is an alkene.

(v) (b)

11. (i) (d): (*P*) and (*T*) are alkynes.

(ii) (a): Alcohol (–OH).

(iii) (a): (*T*) is an alkyne having general formula of C_nH_{2n-2}.

(iv) (c) : (*U*) is an alkene.

(v) (b)

12. (i) (d): *A* and *F* are alkanes ; *B* and *E* are alkenes ; *C* and *D* are alkynes.

(ii) (d): *B* is an alkene having general formula C_nH_{2n}, the homologous series to which *E* belongs.

(iii) (a) : *C* and *D* belong to a homologous series having general formula C_nH_{2n-2}. *B* and *E* are alkenes. All the compounds have different physical and chemical properties.

(iv) (b): (*B*) is alkene.

(v) (d): (*F*) is an alkane.

13. (i) (c) : Molecular formula of (*Q*) is C_8H_{18} as it has two carbon atoms less than (*P*).

(ii) (c) : Compounds (*P*), (*Q*) and (*R*) are alkanes having general formula C_nH_{2n+2}.

(iii) (a) : Molecular formula of (*R*) is $C_{12}H_{26}$ as it has two carbon atoms more than (*P*).

(iv) (b): Compound (*P*), (*Q*) and (*R*) belong to same homologous series so they have different physical properties but similar chemical properties. They have same general formula C_nH_{2n+2}. They differ by 2 carbon atoms and 4 hydrogen atoms.

(v) (a)

14. (i) (c) : Alcohol (—OH).

(ii) (a) : $C_nH_{2n+1}OH$ is the general formula of the homologous series of alcohol.

(iii) (c) (iv) (a)

(v) (a) : Ethanol ; C_2H_5OH is the second member of this series.