Class XI Session 2025-26
Subject - Chemistry
Sample Question Paper - 4

Time Allowed: 3 hours **Maximum Marks: 70**

General Instructions:

1. There are 33 questions in this question paper with internal choice.
2. SECTION A consists of 16 multiple-choice questions carrying 1 mark each.
3. SECTION B consists of 5 very short answer questions carrying 2 marks each.
4. SECTION C consists of 7 short answer questions carrying 3 marks each.
5. SECTION D consists of 2 case-based questions carrying 4 marks each.
6. SECTION E consists of 3 long answer questions carrying 5 marks each.
7. All questions are compulsory.
8. The use of log tables and calculators is not allowed

Section A

1. 30 mg is the same mass as: **[1]**

   a) 300 decigrams b) 0.3 grams

   c) 0.0003 kg d) 0.03 g

2. Orbital angular momentum depends on _____. **[1]**

   a) l b) n and m

   c) m and s d) n and l

3. Cathode rays are deflected by: **[1]**

   a) thin metal foils only b) magnetic field only

   c) electric and magnetic fields d) electric field only

4. For a cyclic process, the change in internal energy of the system is_____. **[1]**

   a) zero b) always - ve

   c) One d) always + ve

5. The number of alkynes possible with molecular formula C_5H_8 is: **[1]**

   a) 5 b) 2

   c) 4 d) 3

6. The only series of lines appear in the visible region of the electromagnetic spectrum of hydrogen is **[1]**

   a) Balmer series b) Pfund series

   c) Paschen series d) Lyman series

7. Choose one of the following in the order of increasing radii: **[1]**

a) $I^+ < I^- < I$ b) $I < I^+ < I^-$

c) $I^- < I^+ < I$ d) $I^- > I > I^+$

8. $\Delta U^{\ominus}$ of combustion of methane is -X kJ mol^{-1}. The value of $\Delta H^{\ominus}$ is **[1]**

a) $= \Delta U^{\ominus}$ b) = 0

c) $> \Delta U^{\ominus}$ d) $< \Delta U^{\ominus}$

9. No work is done on the system, but q amount of heat is taken out from the system and given to the surrounding. The change in internal energy of a system is **[1]**

a) $\Delta U = W_{ad}$ b) ΔU = -q

c) ΔU = q - W d) ΔU = +q

10. The synthesis of 3-octyne is achieved by subsequent stepwise reactions of sodium amide with an alkyne, and a bromoalkane. The bromoalkane and the other alkyne respectively are: **[1]**

a) $BrCH_2CH_2CH_2CH_2CH_3$ and $CH_3CH_2C \equiv CH$ b) $BrCH_2CH_2CH_2CH_2CH_3$ and $CH_3C \equiv CH$

c) $BrCH_2CH_2CH_2CH_3$ and $CH_3CH_2C \equiv CH$ d) $BrCH_2CH_2CH_3$ and $CH_3CH_2CH_2C \equiv CH$

11. In Daniell cell, the direction of current is: **[1]**

a) opposite to the direction of electron flow. b) towards centre.

c) in the same direction of electron flow. d) towards anode.

12. In allene (C_3H_4), the type(s) ofhybridization of the carbon atoms is (are): **[1]**

a) sp^2 and sp^3 b) Only sp^2

c) sp^2 and sp d) sp and sp^3

13. **Assertion (A):** It is impossible to determine the exact position and exact momentum of an electron simultaneously. **[1]**

Reason (R): The path of an electron in an atom is clearly defined.

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

14. **Assertion (A):** Electron deficient species that can accept lone pair of electrons known as an electrophile. **[1]**

Reason (R): $\overset{\oplus}{N}H_4$ is an electrophile.

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.

15. **Assertion (A):** Molecular weight of a compound is 44 if its vapour density is 22. **[1]**

Reason (R): Vapour density $\times$ 2 = Molecular weight.

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.

16. **Assertion (A):** Ozonolysis of alkynes are faster than ozonolysis of alkenes. **[1]**

Reason (R): Reaction proceed by cyclic transition state are faster on alkynes.

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.

Section B

17. How many seconds are there in 2 days? **[2]**

18. A reaction between ammonia and boron trifluoride is given below: **[2]**

: $NH_3 + BF_3 \rightarrow H_3N : BF_3$

Identify the acid and base in this reaction. Which theory explains it? What is the hybridization of B and N in the reactants?

19. Why does the ionization enthalpy gradually decreases in a group? **[2]**

20. Arrange the three isomers of pentane in increasing order of their boiling points. **[2]**

OR

Alkynes on reduction with sodium in liquid ammonia form trans alkenes. Will the butene thus formed on the reduction of the 2-butyne show the geometrical isomerism?

21. Write the electronic configuration of the following ions: **[2]**

i. H^-

ii. Na^+

iii. O^{2-}

iv. F^-

Section C

22. Explain the structure of CO_3^{2-} ion in terms of resonance. **[3]**

23. Give the name and an atomic number of the inert gas atom in which the total number of d-electrons is equal to the difference in numbers of total p and s electrons. **[3]**

24. Consider the reactions : **[3]**

a. $6CO_2(g) + 6H_2O(I) \longrightarrow C_6H_{12}O_6(aq) + 6O_2(g)$

b. $O_3(g) + H_2O_2(I) \longrightarrow H_2O(I) + 2O_2(g)$

Why it is more appropriate to write these reactions as :

a. $6CO_2 + 12H_2O(I) \longrightarrow C_6H_{12}O_6(aq) + 6H_2O(I) + 6O_2(g)$

b. $O_3(g) + H_2O_2(I) \longrightarrow H_2O(I) + O_2(g) + O_2(g)$

Also suggest a technique to investigate the path of the above (a) and (b) redox reactions.

25. **Answer:** **[3]**

(a) What do you mean by entropy? **[1]**

(b) If enthalpy of fusion and enthalpy of vaporisation of sodium metals are 2.6 and 98.2 kJ mol^{-1} respectively, what is the enthalpy of sublimation of sodium? **[1]**

(c) Why in some reactions heat is evolved while some reactions take place only on the absorption of heat? **[1]**

26. Emission transitions in the Paschen series end at orbit n = 3 and start from orbit n and can be represeted as v = 3.29×10^{15} (Hz) [$1/3^2$ - $1/n^2$] Calculate the value of n if the transition is observed at 1285 nm. Find the region of the spectrum. **[3]**

27. Calculate the molecular mass of the following. **[3]**

i. H_2O

ii. CO_2

iii. CH_4

28. Assuming the water vapor to be a perfect gas, calculate the internal energy change when 1 mol of water at 100°C and 1 bar pressure is converted to the ice at 0°C. Given the enthalpy of fusion of ice is 6.00 kJ mol1 heat capacity of water is 4.2 J/g°C. **[3]**

Section D

29. **Read the text carefully and answer the questions:** **[4]**

Once an organic compound is extracted from a natural source or synthesised in the laboratory, it is essential to purify it. Various methods used for the purification of organic compounds are based on the nature of the compound and the impurity present in it. Finally, the purity of a compound is ascertained by determining its melting or boiling point. This is one of the most commonly used techniques for the purification of solid organic compounds. In crystallisation Impurities, which impart colour to the solution are removed by adsorbing over activated charcoal. In distillation Liquids having different boiling points vaporise at different temperatures. The vapours are cooled and the liquids so formed are collected separately. Steam Distillation is applied to separate substances which are steam volatile and are immiscible with water. Distillation under reduced pressure: This method is used to purify liquids having very high boiling points.

(a) Which method can be used to separate two compounds with different solubilities in a solvent?

OR

Distillation method is used to separate which type of substance?

(b) Which technique is used to separate aniline from aniline water mixture?

(c) Why chloroform and aniline are easily separated by the technique of distillation?

30. **Read the text carefully and answer the questions:** **[4]**

In order to explain the characteristic geometrical shapes of polyatomic molecules, Pauling introduced the concept of hybridisation. The orbitals undergoing hybridisation should have nearly the same energy. There are various type of hybridisations involving s, p and d-type of orbitals. The type of hybridisation gives the characteristic shape of the molecule or ion.

(a) Why all the orbitals in a set of hybridised orbitals have the same shape and energy?

(b) Out of XeF_2 and SF_2 which molecule has the same shape as NO_2^+ ion?

(c) Out of XeF_4 and XeF_2 which molecule doesn't have the same type of hybridisation as P(Phosphorus) has in PF_5?

OR

Unsaturated compounds undergo additional reactions. Why?

Section E

31. **Attempt any five of the following:** **[5]**

(a) What effect does branching of an alkene chain has on its boiling point? **[1]**

(b) What are Arenes? **[1]**

(c) Write IUPAC name of the following: $CH_3\ (CH_2)_4\ CH\ (CH_2)_3\ CH_3CH_2 - CH\ (CH_3)_2$ **[1]**

(d) Why are alkanes called paraffins? **[1]**

(e) State Le chatelier's principle. **[1]**

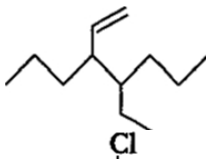
(f) What is decarboxylation? Give an example. **[1]**

(g) Arrange the following: HCl, HBr, Hl, HF in order of decreasing reactivity towards alkenes. **[1]**

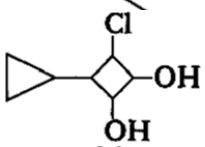
32. **Answer:** **[5]**

(a) i. Give IUPAC names of the following structures. **[2.5]**

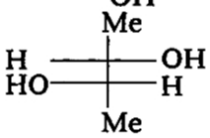
i.



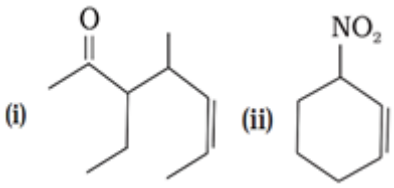
ii.



iii.



ii. Name the compounds: **[2.5]**



OR

i. Identify the pairs of compounds which are functional group isomers. **[2.5]**

I. $CH_3 - CH_2 - CH_2 - CH_2 - OH$

II. $CH_3 - CH_2 - \underset{\displaystyle OH}{\underset{|}{CH}} - CH_3$

III. $CH_3 - \underset{\displaystyle OH}{\underset{|}{\overset{\displaystyle CH_3}{\overset{|}{CH}}}} - CH_3$

IV. $CH_3 - \underset{\displaystyle CH_3}{\underset{|}{CH}} - CH_2 - OH$

V. $CH_3 - CH_2 - O - CH_2 - CH_3$

VI. $CH_3 - O - CH_2 - CH_2 - CH_3$

VII. $CH_3 - O - \underset{\displaystyle CH_3}{\underset{|}{CH}} - CH_3$

ii. Explain, how is the electronegativity of carbon atoms related to their state of hybridization in an organic compound. **[2.5]**

33. Write the expression for the equilibrium constant, K_c for each of the following reactions: **[5]**

a. $2NOCl\ (g) \rightleftharpoons 2NO\ (g) + Cl_2\ (g)$

b. $2Cu(NO_3)_2\ (s) \rightleftharpoons 2CuO\ (s) + 4NO_2\ (g) + O_2\ (g)$

c. $CH_3COOC_2H_5(aq) + H_2O(l) \rightleftharpoons CH_3COOH\ (aq) + C_2H_5OH\ (aq)$

d. $Fe^{3+}\ (aq) + 3OH^-\ (aq) \rightleftharpoons Fe(OH)_3\ (s)$

e. I_2 (s) + $5F_2 \rightleftharpoons 2IF_5$

OR

i. Describe the effect of

a. addition of H_2

b. addition of CH_3OH

c. removal of CO

d. removal of CH_3OH on the equilibrium of the reaction,

$2H_2(g) + CO(g) \rightleftharpoons CH_3OH(g)$

ii. What happens to an equilibrium in a reversible reaction if a catalyst is added to it?

Solution

Section A

1.

(d) 0.03 g

Explanation:

since 1000 mg = 1g

∴ 30 mg

= [(1/1000) × 30] g

= 0.03 g

2. **(a)** l

Explanation:

Azimuthal quantum number. 'I' also known as orbital angular momentum or subsidiary quantum number. It defines the three-dimensional shape of the orbital. For a given value of n,1 can have n values ranging from 0 to n-1, that is, for a given value of n, the possible values of 1 are: 1 = 0, 1, 2, ...(n - 1).

3.

(c) electric and magnetic fields

Explanation:

When an electric field is applied to a stream of cathode rays, they get deflected towards the positive plate. On the application of a magnetic field perpendicular to the path of the cathode rays, they get deflected in the direction expected of negative particles.

4. **(a)** zero

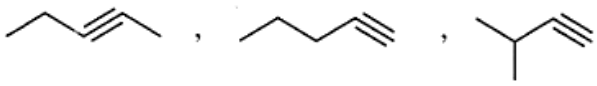
Explanation:

For a cyclic process, the initial state is the same as that of the final state. As internal energy is a state function, its value at the initial point is the same as that at the final point and enthalpy change is zero.

5.

(d) 3

Explanation:



6. **(a)** Balmer series

Explanation:

Balmar series

7.

(d) $I^- > I > I^+$

Explanation:

The size of the anion is greater than the size of the parent atom and the size of the cation. As the –ve charge of anion increases ionic radii increases due to a decrease in the effective nuclear charge and vice versa.

8.

(d) $< \Delta U^{\ominus}$

Explanation:

$CH_{4\,(g)} + 2O_2\,(g) \rightarrow CO_{2\,(g)} + 2H_2O\,(l)$

We know, $\Delta H^{\ominus} = \Delta U^{\ominus} + \Delta n_g$ RT

Δn_g is negative as product water in combustion reaction is in liquid state.

$\Delta H^{\ominus} = \ -X - \ \Delta n_g RT$

This implies $\Delta H\ominus$ will be more negative than $\Delta U\ominus$

Hence, $\Delta H\ominus < \Delta U\ominus$

9.

(b) ΔU = -q

Explanation:

ΔU = -q

10.

(c) $BrCH_2CH_2CH_2CH_3$ and $CH_3CH_2C \equiv CH$

Explanation:

3 - Octyne can be synthesized as per the following stepwise conversion reactions:

Step 1. Formation of a Sodium alkynide, by the reaction of 1 -butyne with sodium amide

$CH_3CH_2C \equiv CH + NaNH_2 \rightarrow CH_3CH_2C \equiv CNa^+ + NH_3$

1-butyne sodium amide sodium butynide

Step 2. Reaction of the alkynide (sodium butynide) with 1 - bromobutane

$CH_3CH_2C \equiv CNa^+ + CH_3CH_2CH_2CH_2Br \rightarrow CH_3CH_2C \equiv CCH_2CH_2CH_2CH_3 + NaBr$

Sodium Butynide 1-bromobutane 3 - Octyne

11. **(a)** opposite to the direction of electron flow.

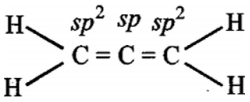
Explanation:

Current is taken at the direction in which positive charge is flowing, but electrons are negatively charged. So, the direction of current and the direction of electron flow is the opposite.

12.

(c) sp^2 and sp

Explanation:



13.

(c) A is true but R is false.

Explanation:

The effect of the Heisenberg Uncertainty Principle is significant only for the motion of microscopic objects and is negligible for that of macroscopic objects.

14.

(c) A is true but R is false.

Explanation:

A is true but R is false.

15. **(a)** Both A and R are true and R is the correct explanation of A.

Explanation:

This is vapour density method for determination of molecular weight.

16. **(a)** Both A and R are true and R is the correct explanation of A.

Explanation:

Both A and R are true and R is the correct explanation of A.

Section B

17. Here, we know 1 day = 24 hours (h)

or $\frac{1day}{24h} = 1 = \frac{24h}{1day}$

then, 1h = 60 min

or $\frac{1h}{60min} = 1 = \frac{60min}{1h}$

so, for converting 2 days to seconds,

i.e., 2 days _____ = _____ seconds

The unit factors can be multiplied in series in one step only as follows:

$2 \text{ day} \times \frac{24h}{1day} \times \frac{60min}{1h} \times \frac{60s}{1min}$

$= 2 \times 24 \times 60 \times 60 \text{ s}$

$= 172800 \text{ s}$

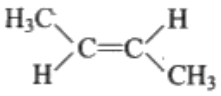
18. The acid is BF_3 and the base is NH_3. The Lewis theory of acids and bases explains it. The hybridization of B in BF_3 is sp^2 and the hybridization of N in NH_3 is sp^3.

19. Generally, in a group, atomic and ionic radii increases with increase in atomic number.
Ionization enthalpy is inversely proportional to atomic and ionic radii.
So, the ionization enthalpy gradually decreases in a group.

20. 2, 2-Dimethylpropane < 2-mehtylbutane < pentane.

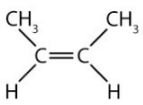
OR

Alkynes on reduction with sodium in liquid ammonia form trans alkenes

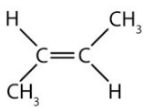
$H_3C - C \equiv C - CH_3 + H_2 \xrightarrow{Na/liq.NH_3}$ 

trans-But-2-ene

Yes, but - 2 - ene is capable of showing geometrical isomerism i.e cis and trans But-2-ene.



cis-2-butene

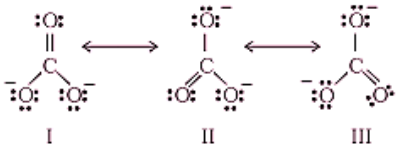


trans-2-butene

21. i. $1s^2$
ii. $1s^2\ 2s^2\ 2p^6$
iii. $1s^2\ 2s^2\ 2p^6$
iv. $1s^2\ 2s^2\ 2p^6$

Section C

22. The single Lewis structure based on the presence of two single bonds and one double bond between carbon and oxygen atoms is inadequate to represent the molecule accurately as it represents unequal bonds. According to the experimental findings, all carbon to oxygen bonds in CO_3^{2-} are equivalent. Therefore the carbonate ion is best described as a resonance hybrid of the canonical forms I, II, and III shown below.



I II III

Resonance in CO_3^{2-}, I, II and III represent the three canonical forms.

23. The Kr is the first Noble gas with atomic number 36 that contains electrons in d-orbit. The electronic configuration of Kr is: $1s^2$, $2s^2$, $2p^6$, $3s^2$, $3p^6$, $3d^{10}$, $4s^2$, $4p^6$
Total number of d-electrons = 10
Total number of p-electrons = 18
Total number of s-electrons = 8
∴ Difference in total number of p and s electrons =18 - 8 = 10
Thus, the inert gas is krypton.

24. It is believed that the photosynthesis reaction occurs in two steps. In the first step, H_2O decomposes to give H_2 and O_2 in the presence of chlorophyll and the H_2 produced reduces CO_2, to $C_6H_{12}O_6$ in the second step. During the second step, some H_2O molecules are also produced and therefore, the reaction occurs as:

a. i. $12H_2O\ (I) \longrightarrow 12H_2(g) + 6O_2\ (g)$

ii. $6CO_2(g) + 12H_2(g) \longrightarrow C_6H_{12}O_6\ (s) + 6H_2O(I)$

iii. $6CO_2(g) + 12H_2O(I) \longrightarrow C_6H_{12}O_6\ (s) + 6H_2O(I) + 6O_2(g)$

Therefore, it is more appropriate to write the reaction for photosynthesis as (III) because it means that 12 molecules of H_2O are used per molecule of carbohydrate and $6H_2O$ molecules are produced per molecule of carbohydrate during the process.

b. O_2 is written two times in the product which suggests that 0, is being obtained from the two reactants as:

$O_3\ (g) \longrightarrow O_2(g) + O\ (g)$

$$\frac{H_2O_2(l)+O(g)\longrightarrow H_2O(l)+O_2(g)}{O_3(g)+H_2O_2(l)\longrightarrow H_2O(l)+O_2(g)+O_2(g)}$$

The path of the reaction can be studied by using H_2O^{18} in reaction (a) or by using H_2O^{18} or $O_3{}^{18}$ in reaction (b).

25. Answer:

(i) Entropy is a measure of randomness of a system. The measure of the level of disorder in a closed but changing system, a system in which energy can only be transferred in one direction from an ordered state to a disordered state. Higher the entropy, higher the disorder and lower the availability of the system's energy to do useful work.

(ii) According to the question, enthalpy of fusion and enthalpy of vaporisation of sodium metal is 2.6 kJ mol^{-1} and 98.2 kJ mol^{-1}.

We know that, enthalpy of sublimation = $\Delta_{sub}H^\circ = \Delta_{fus}H^\circ + \Delta_{vap}H^\circ$

= 2.6 + 98.2

= 100.8 kJ mol^{-1}

(iii) Every substance has energy stored in it in the form of heat content.

If the heat content of reactants (H_R) is greater than that of products (H_P), heat is evolved.

If the heat content of reactants (H_R) is less than that of products (H_P), heat is absorbed.

26. v = $(3.29 \times 10^{15}\ Hz)\left(\frac{1}{3^2} - \frac{1}{n^2}\right)$

λ = 1285 nm = 1285 $\times$ 10^{-9} m = 1.285 $\times 10^{-6}$ m

$v = \frac{c}{\lambda} = \frac{(3\times10^8 ms^{-1})}{(1.285\times10^{-6} m)}$ = 2.3346 $\times$ $10^{14} s^{-1}$

$2.3346 \times 10^{14} = 3.29 \times 10^{15}\left[\frac{1}{3^2} - \frac{1}{n^2}\right]$

$\frac{2.3346}{32.9} = \frac{1}{3^2} - \frac{1}{n^2}$ or $0.71 = \frac{1}{9} - \frac{1}{n^2}$

$\frac{1}{n^2} = \frac{1}{9}$ - 0.071 = 0.111 - 0.071 = 0.04

$n^2 = \frac{1}{0.04}$ = 25 or n = 5

Paschen series lies in infrared region of the spectrum.

27. i. Molecular mass of H_2O = 2 $\times$H + 1 $\times$ O = 2 $\times$ 1.0079u + 1 $\times$ 16.00u = 18.0158 u

ii. Molecular mass of CO_2 =1$\times$ C + 2 $\times$ O = 1 $\times$12.01 u + 2$\times$ 16.22 u = 44.01 u

iii. Molecular mass of CH_4 = 1 $\times$ C+ 4 $\times$ H = 1 $\times$12.01 u + 4 $\times$ 1.0079 u = 16.0416 u

28. The change take place as follows:

Step - 1: 1 mol H_2O (1, 100°C) $\longrightarrow$ 1 mol (1, 0°C) Enthalpy change ΔH_1

Step - 2: 1 mol H_2O (1, 0°C) $\longrightarrow$ 1 mol H_2O(S, 0°C) Enthalpy change ΔH_2

Total enthalpy change will be -

$\Delta H = \Delta H_1 + \Delta H_2$

ΔH_1 = - (18 $\times$ 4.2 $\times$ 100) J mol^{-1}

= - 7560 J mol^{-1} = - 7.56 k J mol^{-1}

ΔH_2 = - 6.00 kJ mol^{-1}

Therefore,

ΔH = - 7.56 kJ mol^{-1} + (-6.00 kJ mol^{-1})

= -13.56 kJ mol^{-1}

There is negligible change in the volume during the change form liquid to solid state.

Therefore, $p\Delta v = \Delta ng\ RT = 0$

$\Delta H = \Delta U = -13.56 kJ\ mol^{-1}$

Section D

29. **Read the text carefully and answer the questions:**

Once an organic compound is extracted from a natural source or synthesised in the laboratory, it is essential to purify it. Various methods used for the purification of organic compounds are based on the nature of the compound and the impurity present in it. Finally, the purity of a compound is ascertained by determining its melting or boiling point. This is one of the most commonly used techniques for the purification of solid organic compounds. In crystallisation Impurities, which impart colour to the solution are removed by adsorbing over activated charcoal. In distillation Liquids having different boiling points vaporise at different temperatures. The vapours are cooled and the liquids so formed are collected separately. Steam Distillation is applied to separate substances which are steam volatile and are immiscible with water. Distillation under reduced pressure: This method is used to purify liquids having very high boiling points.

(i) Fractional crystallizationis used to separate two compounds with different solubilities in a solvent.

OR

- volatile liquids from nonvolatile impurities.
- the liquids having sufficient difference in their boiling points.

(ii) Aniline is separated from aniline water mixture by steam distillation as one of the substances in the mixture is water and the other, a water insoluble substance.

(iii) Chloroform and aniline are easily separated by the technique of distillation because chloroform and aniline have sufficient difference in their boiling points.

30. **Read the text carefully and answer the questions:**

In order to explain the characteristic geometrical shapes of polyatomic molecules, Pauling introduced the concept of hybridisation. The orbitals undergoing hybridisation should have nearly the same energy. There are various type of hybridisations involving s, p and d-type of orbitals. The type of hybridisation gives the characteristic shape of the molecule or ion.

(i) Hybrid orbitals are formed after combining atomic orbitals and have the equivalent shape and energy in the given set of hybridised orbitals.

(ii) XeF_2 molecule has the same shape as NO_2^+ ion.

(iii) XeF_4 molecule doesn't have the same type of hybridisation as P(Phosphorus) has in PF_5.

OR

Unsaturated hydrocarbon molecules include two- or three-fold bonds of carbon. The π -bond is a multiple bond, which becomes unstable and hence adds across numerous bonds.

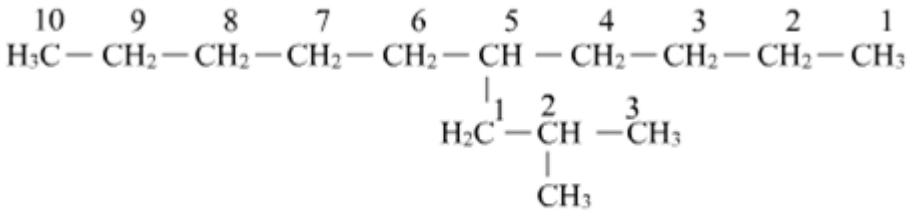
Section E

31. Attempt any five of the following:

(i) Branching of carbon atom chain decreases the boiling point of alkane.

(ii) Arenes are aromatic hydrocarbons

(iii) The IUPAC name of given compound is:



5—[2—Methylpropyl] - decane

(iv) Paraffins means little affinity. Alkanes due to strong **C-C** and **C-H** bonds are relatively chemically inert.

(v) **Le chatelier's principle:** If a system at equilibrium is subjected to change in the temperature, pressure or concentration of the reactants or the products that govern the equilibrium, then the equilibrium shifts in that direction in which this change is reduced or nullified.

(vi) The process by which carbon dioxide is removed from sodium acetate (or any sodium salt of acid) with the help of sodalime is called decarboxylation.

$CH_3COONa + NaOH \xrightarrow{heat} CH_4 + Na_2CO_3$

(vii) HI > HBr > HCl > HF

32. Answer:

(i) i. i. 4-ethyl-3-propylhept-1-ene
ii. 3-chloro-4-cyclopropyl-1,2 cyclobutandiol
iii. Butan-2,3-diol

ii. i. 3-ethyl, 4-methylhept-5-en-2-one.
ii. 3-nitrocyclohex-1-ene.

OR

i. All the seven compounds given have the same molecular formula, so each alcohol is a functional group isomer of each ether given and visa-versa. Functional group isomers are a type of structural isomers having the same molecular formula but different functional groups. In the given structures, I, II, III, IV represent alcohols and V, VI, VII are ethers. Hence, I and V, I and VI, I and VII, II and V, II and VI, II and VII, III and V, III and VI, etc.

ii. If C is sp hybridized then S character is 50%.

If C is sp^2 hybridized then S character is 33%.

If C is sp^3 hybridized then S character is 25%.

Electronegativity of carbon is directly proportional to 's' character.

Hence, sp hybridized carbon has strong S character.

We know that, s electrons are more strongly attracted by nucleus than p-electrons as they lie closer to nucleus..

Thus, electronegativity of carbon increases with increase in 's' character.

33. a. The expression for the equilibrium constant is $K_c = \frac{[NO(g)]^2[Cl_2(g)]}{[NOCl(g)]^2}$

b. The expression for the equilibrium constant is $K_c = \frac{[CuO(g)]^2[NO_2(g)]^4[O_2(g)]}{[Cu(NO_3)_2(s)]^2} = [NO_2(g)]^4\,[O_2(g)]$

c. The expression for the equilibrium constant is $K_c = \frac{[CH_3COOH(aq)][C_2H_5OH(aq)]}{[CH_3COOC_2H_5(aq)][H_2O(l)]} = \frac{[CH_3COOH(aq)][C_2H_5OH(aq)]}{[CH_3COOC_2H_5(aq)]}$

d. The expression for the equilibrium constant is $K_c = \frac{[Fe(OH)_3(s)]}{[Fe^{3+}(aq)]\,[OH^-(aq)]^3} = \frac{1}{[Fe^{3+}(aq)]\,[OH^-(aq)]^3}$

e. The expression for the equilibrium constant is $K_c = \frac{[IF_5(l)]^2}{[1_2(s)][F_2(g)]^5} = \frac{[IF_5(l)]^2}{[F_2(g)]^5}$

OR

i. $2H_2(g) + CO(g) \rightleftharpoons CH_3OH(g)$

According to Le-Chatelier's principle,

a. addition of H_2 (increase in concentration of reactants) shifts the equilibrium in forward direction (more product is formed).

b. addition of CH_3OH (increase in concentration of product) shifts the equilibrium in backward direction.

c. removal of CO also shifts the equilibrium in backward direction.

d. removal of CH_3OH shifts the equilibrium in forward direction.

ii. When catalyst is added, the state of equilibrium is not disturbed but equilibrium is attained quickly. This is because the catalyst increases the rate of forward and backward reaction to the same extent.