Class XI Session 2025-26
Subject - Chemistry
Sample Question Paper - 1

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. Molecular mass is the **[1]**

   a) maximum of atomic masses of the elements present in a molecule

   b) sum of atomic masses of the elements present in a molecule

   c) average of atomic masses of the elements present in a molecule

   d) minimum of atomic masses of the elements present in a molecule

2. Give the name and atomic number of the inert gas atom in which the total number of d-electrons is equal to the difference between the numbers of total p and total s electrons. **[1]**

   a) As (atomic no.=36)

   b) Cl (atomic no.=36)

   c) Kr (atomic no.=36)

   d) Br (atomic no.=36)

3. Select the incorrect expression from the following. **[1]**

   a) $\Delta S_{surr} = \frac{\Delta H_{surr}}{T} = - \frac{\Delta H_{sys}}{T}$

   b) $\Delta S_{total} < 0$ (spontaneous process)

   c) $\Delta G = \Delta H - T\Delta S$

   d) $\Delta S_{total} = \Delta S_{system} + \Delta S_{surr}$

4. The electronic configuration $1s^2 2s^2 2p^1$ belongs to: **[1]**

   a) Beryllium

   b) lithium

   c) Boron

   d) carbon

5. For an isolated system, $\Delta U = 0$, what will be ΔS? **[1]**

   a) $\Delta S > 0$

   b) ΔS will increase for some time and then reduce

c) $\Delta S = 0$ d) $\Delta S < 0$

6. An atom of an element contains 29 electrons and 35 neutrons. The number of protons are: **[1]**

a) 30 b) 35

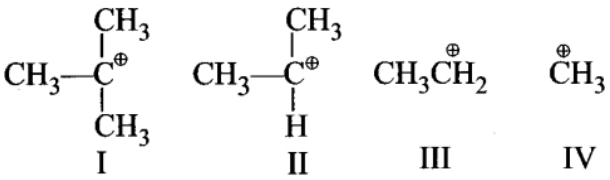
c) 32 d) 29

7. Formation of a coloured solution is possible when metal ion in the compound contains: **[1]**

a) Paired electrons b) Unpaired electrons

c) Negative ionic state d) Lone pair of electrons

8. Choose the correct order of stability of carbocation using the concept of hyperconjugation. **[1]**



I II III IV

a) II < III < I < IV b) I < II < III < IV

c) IV < III < II < I d) III < IV < II < I

9. Alkynes on reduction with sodium in liquid ammonia forms **[1]**

a) Both cis-alkene and trans-alkene b) trans-alkene

c) cis-alkene d) alkane

10. The electronic configuration for a noble gas is **[1]**

a) $1s^2\ 2s^2$ b) $1s^2\ 2s^2\ 2p^5$

c) $1s^2\ 2s^2\ 2p^6$ d) $1s^2\ 2s^2\ 2p^6\ 3p^6\ 4s^2$

11. The enthalpy change of a chemical reaction $\Delta_r H$ equals (a_i and b_i are stoichiometric coefficients)? **[1]**

a) $\sum_i a_i H_{products} \pm \sum_i b_i H_{reactants}$ b) $\sum_i a_i H_{products} + \sum_i b_i H_{reactants}$

c) $\sum_i a_i H_{products} - \sum_i b_i H_{reactants}$ d) $\sum_i a_i H_{products}$

12. The general formula of a cycloalkane with one benzene ring is _____. **[1]**

a) C_nH_{2n-2} b) C_nH_n

c) C_nH_{2n+2} d) C_nH_{2n}

13. **Assertion (A):** During digestion with concentrated H_2SO_4, nitrogen of the organic compound is converted into $(NH_4)_2SO_4$. **[1]**

Reason (R): $(NH_4)_2SO_4$ on heating with alkali liberates NH_3.

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):** Propene reacts with HBr in the presence of peroxides to give 1-bromopropane. **[1]**

Reason (R): Alkenes react with HBr in the presence of peroxides according to anti-Markovnikov's rule.

a) Both A and R are true and R is the correct b) Both A and R are true but R is not the

explanation of A.

correct explanation of A.

c) A is true but R is false.

d) A is false but R is true.

15. **Assertion (A):** Ten distinct set of four quantum numbers are possible for d-subshell. **[1]**
Reason (R): d-subshell splits into five orbitals.

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):** Empirical formula of glucose is HCHO. **[1]**
Reason (R): Molecular formula of glucose will also be equal to HCHO.

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. What will be the pH of 0.1 M ammonium acetate solution? $pK_a = pK_b = 4.74$. **[2]**

OR

The solubility product of $BaSO_4$ at 25°C is 1.0×10^{-9}. What would be the concentration of H_2SO_4 necessary to precipitate $BaSO_4$ from a solution of 0.01 M Ba^{2+} ions?

18. Write IUPAC name of the products obtained by addition reactions of HBr to hex – 1 – ene: **[2]**

i. in the absence of peroxide, and

ii. in the presence of peroxide.

19. i. Write the electronic configurations of the elements given below. **[2]**
A (Atomic number = 11), B (Atomic number = 27),
C (Atomic number = 54), D (Atomic number = 60)

ii. Classify them as representative elem ents, noble gases, transistion and inner transition elements.

20. A sample of drinking water was found to be severely contaminated with chloroform $CHCl_3$ supposed to be a carcinogen in nature. The level of contamination was 15 ppm (by mass): **[2]**

i. Express this in percent by mass.

ii. Determine the molality of chloroform in the water sample.

21. Write the electronic configuration and number of unpaired electrons in Fe^{2+} ion. **[2]**

Section C

22. Define dipole moment. What are the units of dipole moment? **[3]**

23. **Answer:** **[3]**

(a) Air contains about 99% of N_2 and O_2 gases. Why they do not combine to form NO under the standard conditions? Standard Gibbs energy of formation of NO(g) is 86.7 kJ mol^{-1}. **[1]**

(b) Consider the same expansion, but this time against a constant external pressure of 1 atm. **[1]**

(c) Predict the change in internal energy for an isolated system at constant volume. **[1]**

24. Give reason for the following: **[3]**

i. Neither q nor w is a state function but q + w is a state function.

ii. A real crystal has more entropy than an ideal crystal.

25. Write correctly the balanced equations for the following redox reactions using half-reactions. **[3]**

i. $H_2S + Fe^{3+} \longrightarrow Fe^{2+} + S + H^+$

ii. $I^- + I0_3^- + H^+ \longrightarrow I_2 + H_2O$

iii. $Bi(s) + NO_3^- + H^+ \longrightarrow NO_2 + Bi^{3+} + H_2O$

State what is oxidised to what and what is reduced to what in the reactions expressed by the equations?

26. Which experiment led to the discovery of electrons and how? **[3]**

27. Write the name and deduce the atomic numbers of the following atoms: **[3]**

i. The third alkali metal

ii. Second transition element

iii. The fourth noble gas

iv. Fourth element in the second period

28. Copper oxide was prepared by the following methods. **[3]**

i. In one case, 1.75 g of the metal was dissolved in nitric acid and igniting the residual copper nitrate yielded 2.19 g of copper oxide.

ii. In the second case, 1.14 g of metal dissolved in nitric acid were precipitated as copper hydroxide by adding caustic alkali solution. The precipitated copper hydroxide after washing, drying and heating yielded 1.43 g of copper oxide.

iii. In the third case, 1.46 g of copper when strongly heated in a current of air yielded 1.83 g of copper oxide. Show that the given data illustrate the law of definite composition.

Section D

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

Chromatography is an important technique extensively used to separate mixtures into their components, purify compounds and also test the purity of compounds. Based on the principle involved, chromatography is classified into different categories. Two of these are Adsorption chromatography and Partition chromatography. Two main types of chromatographic techniques are based on the principle of differential adsorption column chromatography, and thin-layer chromatography. Adsorption chromatography is based on the fact that different compounds are adsorbed on an adsorbent to different degrees. Column chromatography involves the separation of a mixture over a column of adsorbent (stationary phase) packed in a glass tube. Thin-layer chromatography (TLC) is another type of adsorption chromatography, which involves the separation of substances of a mixture over a thin layer of an adsorbent coated on a glass plate. Partition chromatography is based on the continuous differential partitioning of components of a mixture between stationary and mobile phases.

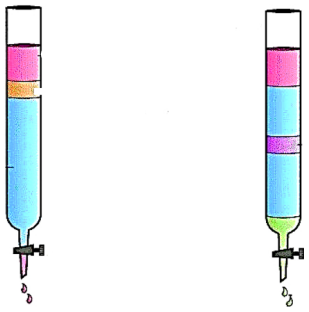
i. Which adsorbent is used in adsorption chromatography?

ii. How do you visualize colourless compounds after separation in Paper Chromatography?

iii. Why paper chromatography is a type of partition chromatography?

OR

Which chromatography is shown in following image?



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

The ionic character of metallic halides tends toward covalent nature as per Fajan's rule. Such covalent halides behave as non-metal in their higher oxidation states. The property to hydrolyse to give oxy-acids of the element and corresponding hydro halogen acid for most non-metallic elements proceeds exceptionally in the way, keeping oxidation number of element and halide sam in oxo-acids.

Non-polar halides are immiscible in water, as they do not show hydrolysis, but halides of some elements with empty d-orbital undergo hydrolysis. Stability of halides of the higher state is governed by the inert-pair effect.

i. How does halide undergo hydrolysis to give oxy-acids of underlined element PCl_3? (1)

ii. Out of NCl_3 and BCl_3 undergoes hydrolysis to form oxy-acids? Write the chemical reaction for the correct answer. (1)

iii. Out of $PbCl_4$, PbF_4, PbI_4 and $PbBr_4$ which one doesn't exist? (2)

OR

Non-Polar halides are immiscible in water. Why? (2)

Section E

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

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

(b) Convert 1-bromopropane to 2-bromopropane. **[1]**

(c) What is hydrogenation? **[1]**

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

(e) How will you distinguish between acetylene and ethylene? **[1]**

(f) How will you demonstrate that double bonds of benzene are somewhat different from that of olefines? **[1]**

(g) To which category of compounds does cyclohexane belong? **[1]**

32. Calculate the pH of a 0.10M ammonia solution. Calculate the pH after 50.0 mL of this solution is treated with 25.0 mL of 0.10M HCl. The dissociation constant of ammonia, $K_b = 1.77 \times 10^{-5}$ **[5]**

OR

What is the pH of 0.001 M aniline solution? The ionisation constant of aniline is 4.27×10^{-10}.

Calculate the degree of ionisation of aniline in the solution. Also calculate the ionisation constant of the conjugate acid of aniline.

33. **Answer:** **[5]**

(a) i. How does hybridization affect the electronegativity? **[2.5]**

ii. What is the general molecular formula of saturated monohydric alcohols? **[2.5]**

OR

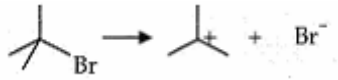
i. For the following bond cleavages, use curved arrows to show the electron flow and classify **[2.5]**

each as hemolysis or heterolysis. Identify reactive intermediate produced as free radical, carbocation and carbanion?

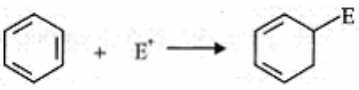
i. $CH_3O\text{-}OCH_3 \longrightarrow CH_3\dot{O} + \dot{O}CH_3$

ii.

iii.



iv.



ii. What are electrophiles and nucleophiles? Explain with examples. **[2.5]**

Solution

Section A

1.

(b) sum of atomic masses of the elements present in a molecule

Explanation:

Since the constituent particles in a molecule are atoms, hence its molecular mass is calculated by multiplying the atomic masses of each element by the number of atoms and adding them together.

2.

(c) Kr (atomic no.=36)

Explanation:

The first inert gas which contains d electrons is krypton. Its atomic number is 36 and its electronic configuration is $1s^2, 2s^2, 2p^6, 3s^2, 3p^6, 3d^{10}, 4s^2, 4p^6$

Total number of s electrons = 8 Total number of p electrons = 6 + 6 + 6 = 18 Total number of d electrons = 10 .

Differencein total number of p and s electrons = 18-8= 10

Thus, the inert gas is krypton.

3.

(b) ΔS_{total} < 0 (spontaneous process)

Explanation:

For spontaneous process, ΔS_{total} > 0

$T\Delta S_{system}$ - ΔH_{system} > 0 - (ΔH_{system} - $T\Delta S_{system}$) > 0

4.

(c) Boron

Explanation:

Boron is a chemical element with symbol B and atomic number 5. So electronic configuration of boron is $1s^2 2s^2 2p^1$.

5. **(a)** ΔS > 0

Explanation:

$$\triangle U = 0$$

For an isolated system, and for a spontaneous process, Total entropy change must be positive.

$$\triangle S = \frac{q_{rev}}{T} = \frac{\triangle H}{T} = \frac{\triangle U + p\triangle V}{T} = \frac{0 + p\triangle V}{T}$$

$$i.e.\ T\triangle S > 0$$

Moreover, $Or \quad \triangle S > 0$

6.

(d) 29

Explanation:

In an atom no. of protons = no. of electrons i.e. P = E while this is not true in case of ions.

So the number of protons in the given atom is 29.

7.

(b) Unpaired electrons

Explanation:

For any salt or solution to exhibit any colour, the central atom of the compound should have at least an unpaired d electron in it. This unpaired d electron is responsible for its colour in the solutions and salts.

8. **(c)** IV < III < II < I

Explanation:

Greater the number of alkyl groups attached to a positively charged carbon atom, the greater is the hyperconjugation interaction and stabilisation of the cation. Thus, we have the following relative stability of carbonation:

$$CH_3-\underset{\underset{CH_3}{|}}{\overset{\overset{CH_3}{|}}{C^+}}+ > (CH_3)_2\overset{+}{C}H > CH_3\overset{+}{C}H_2 > \overset{+}{C}H_3$$

9. **(b)** trans-alkene

Explanation:

trans-alkene

10. **(c)** $1s^2\ 2s^2\ 2p^6$

Explanation:

Noble gas neon has configuration $1s^2\ 2s^2\ 2p^6$.

11. **(c)** $\sum_i a_i H_{products} - \sum_i b_i H_{reactants}$

Explanation:

The enthalpy of reaction ($\Delta_r H$) = (Sum of enthalpies of products)- (sum of enthalpies of reactants) = $\sum a_i H_{(product)} - \sum b_i H_{(reactant)}$

12. **(d)** C_nH_{2n}

Explanation:

Cycloalkane with one benzene ring has a formula C_6H_{12}.

∴ The formula becomes C_nH_{2n}

13. **(b)** Both A and R are true but R is not the correct explanation of A.

Explanation:

During digestion with concentrated H_2SO_4 N and H of the organic compound combine to form NH_3 which being basic dissolves in H_2SO_4 to form $(NH_4)_2SO_4$.

14. **(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.

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

Explanation:

For each subshell (2l + 1) orbitals are possible where l = azimuthal quantum number. I for d-orbital is 2;

∴ 2 × 2 + 1 = 5 orbitals are possible. Each orbital can accommodate two electrons and both electrons present in an orbital will have four different quantum numbers (Pauli exclusion principle). Thus in total ten distinct sets of four quantum numbers are possible.

16.

(c) A is true but R is false.

Explanation:

The molecular formula of glucose is $C_6H_{12}O_6$

This is $(HCHO)_6$

Therefore its empirical formula is HCHO.

Section B

17. For a salt of ammonium acetate,

$pH = \frac{1}{2}pK_w + \frac{1}{2}pK_a - \frac{1}{2}pK_b$

$= \frac{1}{2}(14) + \frac{1}{2}(4.74) - \frac{1}{2}(4.74) = 7$

OR

According to the question, the solubility product of $BaSO_4$ at 25°C is 1.0×10^{-9}.

Precipitation will take place when, ionic product > solubility product

Reaction:

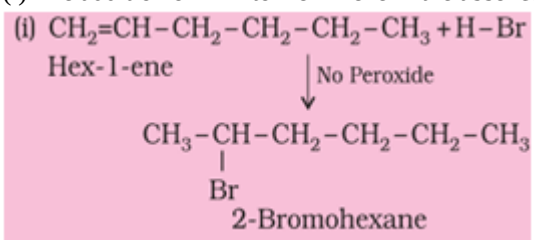
$BaSO_4 \rightleftharpoons Ba^{2+} + SO_4^{2-}$

$K_{sp} = [Ba^{2+}][SO_4^{2-}]$

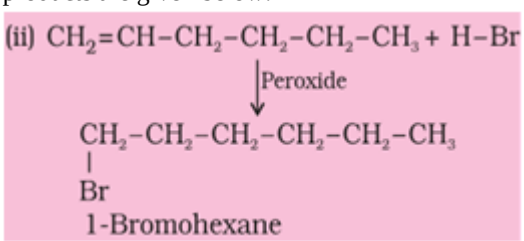
$\therefore S = \frac{1.0\times10^{-9}}{0.01}$

$= 10^{-7}$ mol/L

18. (i) The addition of HBr to Hex-1-ene in the absence of peroxide follows Markovnikov Rule. The products are given below:



(ii) The addition of HBr to Hex-1-ene (unsymmetrical alkene) in the presence of peroxide follows Anti-Markovnikov Rule. The products are given below:



19. i. Electronic configurations of the elements A, B, C, D and E are as follows.

Element	Atomic number	Electronic Configuration
A	11	$1s^2 2s^2 2p^6 3s^1$
B	27	$1s^2 2s^2 2p^6 3s^2 3p^6 4s^2 3d^7$
C	54	$1s^2 2s^2 2p^6 3s^2 3p^6 3d^{10} 4s^2 4p^6 4d^{10} 5s^2 5p^6$
D	58	$1s^2 2s^2 2p^6 3s^2 3p^6 3d^{10} 4s^2 4p^6 4d^{10} 5s^2 5p^6 6s^2 5d^1 4f^1$

ii. Element A is a representative element since its last electron enters in s orbital

Element B is a transition element since it receives its last electron in the d -orbital.

Element C is a p -block element with completely filled p - orbital of the valence shell. Such type of p -block element is called a noble gas

Element D is an inner tansition element since it receives its last electron in the f - orbital.

20. i. 15 ppm (by mass) means 15 parts per million (10^6) of the solution.

Therefore, percent by mass = $\frac{15}{10^6} \times 100\%$

$= 1.5 \times 10^{-3}$ %

ii. Molar mass of chloroform ($CHCl_3$) = $1 \times 12 + 1 \times 1 + 3 \times 35.5$

= 119.5 g mol^{-1}

Now, according to the question,

15 g of chloroform is present in 10^6 g of the solution.

i.e., 15 g of chloroform is present in 10^6 g of water.

Therefore, Molality of the solution = $\frac{\frac{15}{119.5} mol}{10^6 \times 10^{-3} Kg}$

= 1.26×10^{-4} m

21. Fe (Z = 26) : $[Ar]^{18}\ 3d^6 4s^2$

Fe^{2+} ion : $[Ar]^{18}\ 3d^6$

No. of unpaired electron = 4

Section C

22. Dipole moment: In a polar molecule, one end bears a positive charge and the other has a negative charge. Thus the molecule has two poles with equal magnitude of the charges. The molecule is known as a dipolar molecule and possesses a dipole moment. It is defined as the product of the magnitude of the positive or negative charge and the distance between the charges.

μ(dipole moment) = q $\times$ d

SI unit of dipole moment is coulomb meter (m) or Debye.

23. Answer:

(i) According to the question, Standard Gibbs energy of formation of NO(g) is 86.7 kJ mol^{-1}.

As the standard Gibbs energy of formation is +ve, the reaction is non-spontaneous.

Hence, N_2 and O_2 do not combine to form NO.

(ii) We have q = -w = p_{ex} (8) = 8 litre-atm

(iii) For an isolated system at constant volume, there is no transfer of energy in the form of heat or work.

So, $\Delta U = q + W$

$\Rightarrow \Delta U = 0 + 0$

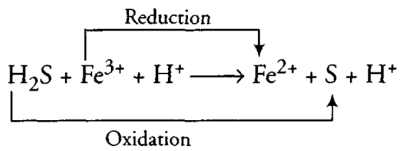
$\Rightarrow \Delta U = 0$

24. i. q + w = Δu

As Δu is a state function hence q + w is a stable function.

ii. A real crystal has some disorder due to the presence of defects in their structural arrangements whereas ideal crystal does not have any disorder. Hence a real crystal has more entropy than ideal crystal.

25. i.

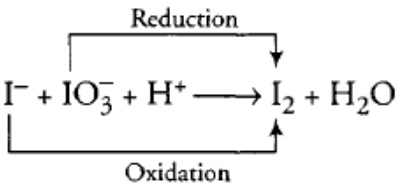


Here, oxidation state of S gets changed from -2 (H_2S) to 0 (S), and Fe^{3+} changed to Fe^{2+}. So oxidation of Sulphur atom takes place while Fe get reduced.

The balanced reaction is:

$2Fe^{3+} + H_2S \longrightarrow 2Fe^{2+} + S + 2H^+$

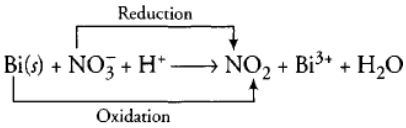
ii.



Here, oxidation state of I^- changes from -1 to 0 in I_2 and IO_3^- is reduced to I_2 . On solving, we get following balanced equations

$2IO_3^- + 12\ I^- + 12H^+ \longrightarrow 7I_2 + 6H_2O$

iii.

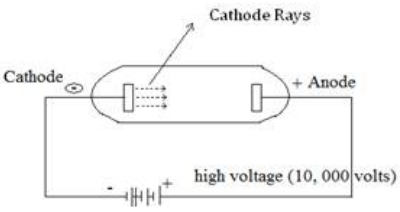


Here, Bi(s) is oxidised to Bi^{3+} while NO_3^- is reduced to NO_2. The balanced reaction is:

$Bi(s) + 3NO_3^- + 6H^+ \longrightarrow 3NO_2 + Bi^{3+} + 3H_2O$

26. The cathode ray discharge tube experiment performed by J.J. Thomson led to the discovery of negatively charged particles called electron.

A cathode-ray tube is made of glass containing two thin pieces of metal, called electrodes, sealed in it. The electrical discharge through the gases could be observed only at very low pressures and at very high voltages. The pressure of different gases could be adjusted by evacuation. When sufficiently high voltage is applied across the electrodes, current starts flowing through a stream of particles moving in the tube from the negative electrode (cathode) to the positive electrode (anode). These were called cathode rays or cathode ray particles. When these rays, after passing through the anode, strike the zinc sulphide coating, a bright spot on the coating is developed. In the presence of the electrical or magnetic field, the behaviour of cathode rays is similar to that expected from negatively charged particles, suggesting that the cathode rays consist of negatively charged particles, called electrons.



27. i. K, 19
    ii. Ti, 22
    iii. Kr, 36
    iv. C, 6

28. **Step I** and II In the first experiment,

2.19 g of copper oxide contained 1.75 g of Cu.

∴ 100 g of copper oxide contained

Cu = $\frac{1.75}{2.19} \times 100 = 79.91$g

i.e.% of Cu = 79.91

In the second experiment, 1.43 g of copper oxide contained 1.14 g of copper

∴ 100 g of copper oxide contained

Cu = $\frac{1.14}{1.43} \times 100 = 79.72$ g,

i.e. % of Cu = 79.72

In the third experiment,

1.83 g of copper oxide contained 1.46 g of copper

∴ 100 g of copper oxide contained

Cu = $\frac{1.46}{1.83} \times 100 = 79.78$ g,

i.e. % of Cu = 79.78

Step IIII The percentage of copper in copper oxide derived from all the three experiments is nearly the same.

Hence, the above data illustrate the law of definite composition.

Section D

29. i. In column chromatography adsorbent is silica gel or alumina while in paper chromatography adsorbent is cellulose.
    ii. In paper chromatography the spots of the separated colourless components may be observed either under ultra-violet light or by the use of an appropriate spraying agent.
    iii. Partition chromatography is based on continuous differential partitioning of components of a mixture between stationary and mobile phases as doner in paper chromatography.

    OR

    Column chromatography.

30. i. $PCl_3 + 3H_2O \rightarrow H_3PO_3 + 3HCl$

ii. BCl_3 undergoes hydrolysis to form oxy-acids. The chemical reaction is as follows:

$BCl_3 + 3H_2O \rightarrow H_3BO_3 + 3HCl$

iii. PBI_4 doesn't exist because Pb^{4+} is strong oxidant, where as I^- is strong reductant.

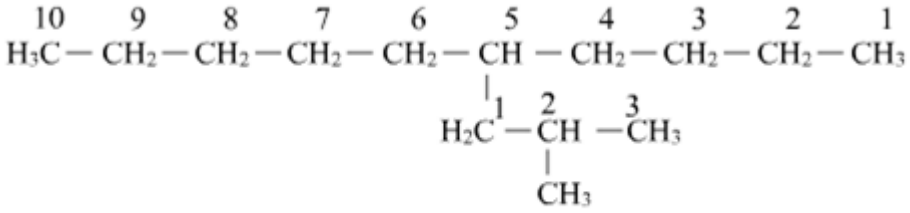
OR

The non-polar halides are immiscible in water because it doesn't show hydrolysis but halides of some element with empty d-orbital undergo hydrolysis.

Section E

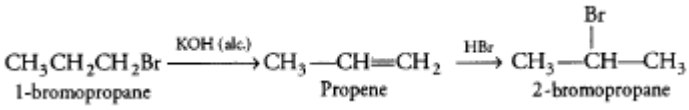
31. Attempt any five of the following:

(i) The IUPAC name of given compound is:



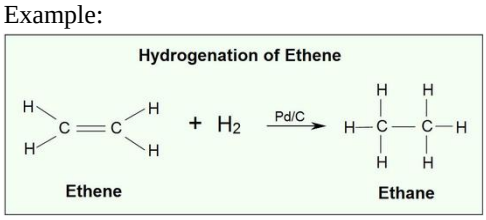
5—[2—Methylpropyl] - decane

(ii) We can convert 1-Bromopropne into 2-Bromopropane in two steps. In the first step, the dehydrohalogenation of 1-bromo propane with alcoholic KOH gives propene which on reacting with HBr gives 2-bromo propane due to Markovnikov's rule for addition.



(iii) **Hydrogenation:** Addition of hydrogen to alkenes and alkenes in the presence of finely divided catalysts like Pt, Pd or Ni to form alkanes is known as hydrogenation.

Example:



(iv) 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.

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

(v) Acetylene forms precipitate with ammoniacal silver nitrate solution, ethylene does not react with these reagents.

(vi) The double bonds of benzene are different from that of olefines as the double bonds of olefines decolourise Br_2 in CCl_4 and discharge the pink colour of Baeyer's reagent with simultaneous formation of a brown ppt. of MnO_2 while those of benzene do not.

(vii) Cyclohexane belongs to saturated alicyclic hydrocarbons.

32. $NH_3 + H_2O \longrightarrow NH_4^+ + OH^-$

$Kb = [NH_4^+][OH^-] / [NH_3] = 1.77 \times 10^{-5}$

Before neutralization,

$[NH_3] = 0.10 - x = 0.10$

$x^2 / 0.10 = 1.77 \times 10^{-5}$

Thus, $x = 1.33 \times 10^{-3} = [OH^-]$

Therefore,

$[H^+] = K_w/[OH^-] = 10^{-14} / (1.33 \times 10^{-3}) = 7.51 \times 10^{-12}$

$pH = -\log(7.5 \times 10^{-12}) = 11.12$

On addition of 25 mL of 0.1M HCl solution (i.e., 2.5 mmol of HCl) to 50 mL of 0.1M ammonia solution (i.e., 5 mmol of NH_3), 2.5 mmol of ammonia molecules are neutralized. The resulting 75 mL solution contains the remaining unneutralized 2.5 mmol of

NH_3 molecules and 2.5 mmol of NH_4^+

NH_3	+	HCl	→	NH_4^+	+	Cl^-
2.5		2.5		0		0
At equilibrium						
0		0		2.5		2.5

The resulting 75 mL of solution contains 2.5 mmol of NH_4^+ ions (i.e., 0.033 M) and 2.5 mmol (i.e., 0.033 M) of neutralised NH_3 molecules. This NH_3 exists in the following equilibrium:

NH_4OH	$\rightleftharpoons$	NH_4^+	+	OH^-
0.033M – y		y		y

where, $y = [OH^-] = [NH_4^+]$

The final 75 mL solution after neutralization already contains 2.5 m mol NH_4^+ ions (i.e. 0.033M), thus total concentration of NH_4^+ ions is given as:

$[NH_4^+] = 0.033 + y$

As y is small, $[NH_4OH] \simeq 0.033$ M and $[NH_4^+] \simeq 0.033$M.

We know,

$K_b = [NH_4^+][OH]/[NH_4OH]$

$= y(0.033)/(0.033) = 1.77 \times 10^{-5}$ M

Thus, $y = 1.77 \times 10^{-5} = [OH^-]$

$[H^+] = 10^{-14}/1.77 \times 10^{-5} = 0.56 \times 10^{-9}$

Hence, pH = 9.24

OR

$C_6H_5NH_2 + H_2O \rightleftharpoons C_6H_5NH_3^+ + OH^-$

$K_b = \frac{[C_6H_5NH_3^+][OH^-]}{[C_6H_5NH_2]}$

$= \frac{[OH^-]^2}{[C_6H_5NH_2]}$

$[OH^-] = \sqrt{K_b \cdot C} = \sqrt{4.27 \times 10^{-10} \times 0.001}$

$[OH^-] = 6.534 \times 10^{-7}$

$pOH = -\log[OH^-] = -\log[6.534 \times 10^{-7}]$

pOH = -0.8152 + 7 = 6.18

From, pH + pOH = 14

pH = 14 - 6.18 = 7.82

	$C_6H_5NH_2 + H_2O \rightleftharpoons$	$C_6H_5NH_3^+ + OH^-$	
Initial conc.	C	0	0
Equili. conc.	$C - C\alpha$	$C\alpha$	$C\alpha$

$K_b = \frac{C\alpha \cdot C\alpha}{C(1-\alpha)}$ $[(1-\alpha) \approx 1$ for weak base]

$K_b = C\alpha^2 = \alpha = \sqrt{\frac{K_b}{C}}$

Degree of ionisation,

$\alpha = \sqrt{\frac{4.27 \times 10^{-10}}{0.001}} = 6.53 \times 10^{-4}$

K_a of conjugate acid of aniline,

$K_a = \frac{K_w}{K_b}$

$= \frac{10^{-14}}{4.27 \times 10^{-10}} = 2.34 \times 10^{-5}$

33. Answer:

(i) i. s-orbitals lie closer to the nucleus. So, greater the s - character of the hybrid orbital's, the greater is the electro negativity.

ii. Monohydric alcohols are the compounds derived from an alkane by replacing one H by - OH group.

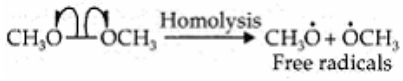
Example:

$\underset{\text{Methane}}{CH_4} \xrightarrow{replacing\ H\ with\ OH} \underset{\text{Methanol}}{CH_3 - OH}$

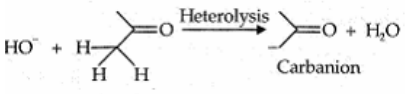
Therefore, the general molecular formula of saturated monohydric alcohols is $C_nH_{2n+1}OH$.

OR

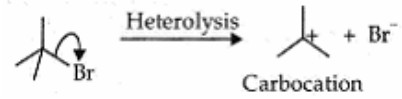
i. i.



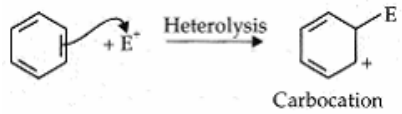
ii.



iii.



iv.



ii. **Electrophiles:** The name electrophiles means electron loving. Electrophiles are electron defficient. They may be positive ions or neutral molecules.

Ex: $H^+, Cl^+, Br^+, NO_2^+, R_3C^+, RN_2^+, AlCl_3, BF_3$

Nucleophiles: The name nucleophiles means 'nucleus loving' and indicates that it attacks the region of low electron density (positive centres) in a subtracts molecule. They are electron rich they may be negative ions or neutral molecules.

Ex: $Cl^-, Br^-, CN^-, OH^-, RCH_2^-, NH_3, RNH_2, H_2O, ROH$ etc.