Class XI Session 2024-25
Subject - Chemistry
Sample Question Paper - 5

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. The collective study of separation, identification and quantitative determination of the composition of different substances is dealt under _____ chemistry. **[1]**

   a) analytical
   b) bio
   c) inorganic
   d) organic

2. An anion A^{3-} has 18 electrons. Write the atomic number of A. **[1]**

   a) 24
   b) 21
   c) 12
   d) 15

3. The bond dissociation energies of H_2, Cl_2 and HCl are 104, 58 and 103 kcal mol^{-1} respectively. The enthalpy of formation of HCl would be **[1]**

   a) +22 kcal mol^{-1}
   b) -44 kcal mol^{-1}
   c) +44 kcal mol^{-1}
   d) -22 kcal mol^{-1}

4. The formula $E = h\nu$ is used to calculate **[1]**

   a) wave number
   b) energy of the ejected electrons
   c) radiation emitted by a black body
   d) energy of quantum

5. Thermodynamics is not concerned about **[1]**

   a) energy changes involved in a chemical reaction.
   b) the rate at which a reaction proceeds.
   c) the feasibility of a chemical reaction.
   d) the extent to which a chemical reaction

proceeds.

6. Calculate the wavelength (in nanometer) associated with a proton moving at 1.0×10^3 ms^{-1} (Mass of proton = 1.67×10^{-27} kg and h = 6.63×10^{-34} Js) **[1]**

a) 0.40 nm
b) 0.032 nm
c) 14.0 nm
d) 2.5 nm

7. Zn^{2+}/Zn represents: **[1]**

a) the oxidation number of +2 of Zinc
b) the oxidised form of Zinc
c) redox couple
d) the reduced form of Zinc

8. How many metamers are possible for pentan-1-al? **[1]**

a) Two
b) Four
c) Three
d) Zero

9. Carbon-carbon double bond in alkenes consists of: **[1]**

a) one strong sigma (σ) bond due to head-on overlapping of sp^3 hybridised orbitals one weak pi (π) bond.
b) one strong sigma (σ) bond due to head-on overlapping of sp^2 hybridised orbitals one weak pi (π) bond.
c) one weak sigma (σ) bond due to head-on overlapping of sp^2 hybridised orbitals one weak pi (π) bond.
d) one weak sigma (σ) bond due to head-on overlapping of sp^3 hybridised orbitals one weak pi (π)bond.

10. d-Block Elements are characterized by the: **[1]**

a) inner d orbitals are not filled.
b) absence of d orbital electrons.
c) filling of outer d orbitals.
d) filling of inner d orbitals by electrons.

11. The correct equation for the change in enthalpy is: **[1]**

a) $\Delta H = \Delta U + p\Delta V$
b) $\Delta H = \Delta U + n\frac{p}{V}$
c) $\Delta H = \Delta U + \frac{p}{V}$
d) $\Delta H = \Delta U + T\Delta V$

12. The catalyst required for the given reaction is **[1]**

$$HC = CH + \text{dil. } H_2SO_4 \xrightarrow{\text{Catalyst}} CH_3CHO$$

a) Pd
b) $AlCl_3$
c) Pt
d) $HgSO_4$

13. **Assertion (A):** Sodium extract is made alkaline in the test of sulphur. **[1]**
Reason (R): On reacting with $FeCl_3$, alkaline sodium extract, gives red colour.

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) Both A and R are false.

14. **Assertion (A):** Overlapping in benzene is sp^2 - sp^2 type. **[1]**
Reason (R): C-C bond length in benzene is $1.3\overset{o}{A}$.

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):** In Sommerfeld's model, circular orbit is possible for the electron in K shell. **[1]**

Reason (R): Electron present in K shell corresponds to principal quantum number n = 1.

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):** 232.508 can be written as 2.32508×10^2 in scientific notation. **[1]**

Reason (R): While writing 2.32508×10^2, the decimal had to be moved to the left by two places and the same is the exponent (2) of 10 in the scientific notation.

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. A sample of HI (g) is placed in a flask at a pressure of 0.2 atm. At equilibrium partial pressure of HI (g) is 0.04 atm. What is K_p for the given equilibrium? **[2]**

$2HI(g) \rightleftharpoons H_2(g) + I_2(g)$

18. Would you expect the first ionization enthalpies of two isotopes of the same element to be the same or different? **[2]**

19. In three moles of ethane (C_2H_6), calculate the following: **[2]**

i. Number of moles of carbon atoms.

ii. Number of moles of hydrogen atoms.

iii. Number of molecules of ethane.

20. Write structural formulae of the following compounds. **[2]**

i. 3, 4, 4, 5-tetramethylheptane

ii. 2, 5-dimethylhexane

OR

Predict the major products of the following:

i. $CH_3\text{-}C \equiv C\text{-}Ph \xrightarrow[H_2O]{Hg^{2+}, H^+}$

ii. $PhCH = CH2 \xrightarrow{HBr}$

21. Which of the following are isoelectronic species i.e., those having the same number of electrons? **[2]**

Na^+, K^+, Mg^{2+}, Ca^{2+}, S^{2-}, Ar

Section C

22. Draw the resonating structure of **[3]**

i. ozone molecule

ii. nitrate ion

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

(a) Two ideal gases under the same pressure and temperature are allowed to mix in an isolated system. **[1]**

What will be the sign of entropy change?

(b) Water can be lifted into the water tank at the top of the house with the help of a pump. Then why is it not considered to be spontaneous? **[1]**

(c) What is the enthalpy change for an adiabatic process? **[1]**

24. Express the change in internal energy of a system when **[3]**

i. No heat is absorbed by the system from the surroundings, but work (w) is done on the system. What type of wall does the system have?

ii. No work is done on the system, but q amount of heat is taken out from the system and given to the surroundings. What type of wall does the system have?

iii. w amount of work is done by the system and q amount of heat is supplied to the system. What type of system would it be?

25. Which method can be used to find out the strength of reductant/oxidant in a solution? Explain with an example. **[3]**

26. In astronomical observations, signals observed from the distant starts are generally weak. If the photon detector receives a total of = 3.15×10^{-18} J from the radiations of 600 nm. Calculate the number of photons received by the detector. **[3]**

27. Define electron gain enthalpy. What are its units? **[3]**

28. Balance the following equation, **[3]**

$Fe + H_2O \longrightarrow Fe_3O_4 + H_2$

Section D

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

The existing large number of organic compounds and their ever-increasing numbers has made it necessary to classify them on the basis of their structures. Organic compounds are broadly classified as open-chain compounds which are also called aliphatic compounds. Aliphatic compounds further classified as homocyclic and heterocyclic compounds. Aromatic compounds are special types of compounds. Alicyclic compounds, aromatic compounds may also have heteroatom in the ring. Such compounds are called heterocyclic aromatic compounds. Organic compounds can also be classified on the basis of functional groups, into families or homologous series. The members of a homologous series can be represented by general molecular formula and the successive members differ from each other in a molecular formula by a $–CH_2$ unit.

i. The successive members of a homologous series differ by which mass of amu? (1)

ii. Does Pyridine, pyrrole, thiophene are all heteroaromatic compounds (1)

iii. Difference between heterocyclic and homocyclic compound. (2)

OR

Is tetrahydrofuran is aromatic compounds? (2)

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

When anions and cations approach each other, the valence shell of anions are pulled towards the cation nucleus and thus, the shape of the anion is deformed. The phenomenon of deformation of anion by a cation is known as polarization and the ability of the cation to polarize the anion is called as polarizing power of cation. Due to polarization, sharing of electrons occurs between two ions to some extent and the bond shows some covalent character.

The magnitude of polarization depends upon a number of factors.

i. Out of $AlCl_3$ and AlI_3 which halides show maximum polarization? (1)

ii. Out of $AlCl_3$ and $CaCl_2$ which one is more covalent in nature? (1)

iii. The non-aqueous solvent like ether is added to the mixture of LiCl, NaCl and KCl. Which will be extracted into the ether? (2)

OR

Out of CaF_2 and CaI_2 which one has a minimum melting point? (2)

Section E

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

(a) If Qc < Kc, when we continuously remove the product, what would be the direction of the reaction? **[1]**

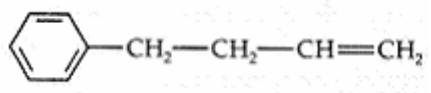
(b) Explain the reason for the extraordinary stability of benzene in spite of the presence of three double bonds in it. **[1]**

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

(d) Write the IUPAC name:  **[1]**

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

(f) Why do alkynes not show geometrical isomerism? **[1]**

(g) Write an IUPAC name:  **[1]**

32. The value of K_p for the reaction, **[5]**

$CO_2(g) + C(s) \rightleftharpoons 2CO\ (g)$

is 3.0 at 1000 K. If initially, P_{CO_2} = 0.48 bar and P_{CO} = 0 bar and pure graphite is present, calculate the equilibrium partial pressures of CO and CO_2.

OR

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, $K_b = 1.77 \times 10^{-5}$

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

(a) i. Write all structural isomers of molecular formula C_3H_6O **[2.5]**

ii. Write resonance structures of CH_3COO^- and show the movement of electrons by curved arrows. **[2.5]**

OR

i. Suggest a method to purify **[2.5]**

i. a liquid which decomposes at its boiling point.

ii. kerosene oil containing water.

iii. camphor containing traces of common salt.

ii. Giving justification, categorise the following molecules/ions as nucleophile or electrophile: **[2.5]**

HS^-, BF_3, $C_2H_5O^-$, $(CH_3)_3$ N:,

$\overset{+}{C}l, CH_3 - \overset{+}{C} = O, H_2N\overset{-}{:}, \overset{+}{N}O_2$

Solution

Section A

1. **(a)** analytical
   Explanation: analytical

2. **(d)** 15
   Explanation: A^{3-} means it has got an additional 3 electrons. The atomic number is the number of electrons in a neutral atom. Therefore atomic number=18-3 =15.

3. **(d)** -22 kcal mol^{-1}
   Explanation: -22 kcal mol^{-1}

4. **(d)** energy of quantum
   Explanation: Max Planck theorized that energy was transferred in chunks known as quanta, equal to $h\nu$. The variable h is a constant equal to 6.63×10^{-34} J·s and the variable νrepresents the frequency in 1/s.
   This equation allows us to calculate the energy of photons, given their frequency.
   If the wavelength is given, the energy can be determined by first using the wave equation $(c = \lambda \times \nu)$ to find the frequency, then using Planck's equation to calculate energy.

5. **(b)** the rate at which a reaction proceeds.
   Explanation: Thermodynamics tells whether a reaction will take place or not. It doesn't tell about the rate (speed) of reaction.

6. **(a)** 0.40 nm
   Explanation: $\lambda = \frac{h}{mv} = \frac{6.63 \times 10^{-34}}{1.67 \times 10^{-27} \times 1 \times 10^{3}}$
   $= 3.97 \times 10^{-10}$ m $\approx$ 0.40 nm

7. **(c)** redox couple
   Explanation: This is a redox couple where the following reaction takes place:
   $Zn^{2+} + 2e^{-} \rightarrow Zn$

8. **(d)** Zero
   Explanation: $\underset{\text{Pentan-1-al}}{CH_3 - CH_2 - CH_2 - CH_2 - \overset{O}{\overset{\|}{C}} - H}$
   Here the functional group is aldehyde (- CHO) which is a terminal functional group and hence no metamers are possible.

9. **(b)** one strong sigma (σ) bond due to head-on overlapping of sp^2 hybridised orbitals one weak pi (π) bond.
   Explanation: Sigma bond is formed by the head-on overlap of sp^2 hybridized orbitals while the pi bond is formed by lateral or sideways overlapping of the two 2p-orbitals of the two carbon atoms. Alkenes contain 1 weak pi bond and 1 strong sigma bond.

10. **(d)** filling of inner d orbitals by electrons.
    Explanation: d-Block elements also known as transition elements are characterized by the filling of inner d orbitals by electrons before the valence-shell s orbital.

11. **(a)** $\Delta H = \Delta U + p\Delta V$
    Explanation: Enthalpy is a thermodynamic quantity equivalent to the total heat content of a system. It is equal to the internal

energy of the system plus the product of pressure and volume.

12. **(d)** $HgSO_4$

Explanation: Alkynes are not readily hydrated due to their low reactivity towards electrophilic addition reactions.Further dilute H_2SO_4 has no effect on carbon carbon triple bond.In the presence of HgSO4 as catalyst,hydration occurs readily.

13. **(d)** Both A and R are false.

Explanation: In the Lassaigne's test for sulphur, sodium extract is made acidic before the addition of lead acetate, because the black precipitate of lead sulphide is insoluble in acidic medium.

14. **(c)** A is true but R is false.

Explanation: C-C bond length in benzene is 1.39 $\overset{o}{A}$ which is greater than C=C bond length of 1.34$\overset{o}{A}$ and less than C-C bond length of 1.54$\overset{o}{A}$.

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

Explanation: Sommerfeld's model is an extension of Bohr's model. Electrons in an atom revolve around the nuclei in elliptical orbit. The circular path is a special case of the elliptical orbit. The Association of elliptical orbit with circular orbit explains the fine line spectrum of atoms.

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

Explanation: 232.508 can be written as 2.32508×10^2 in scientific notation. While writing it, the decimal had to be moved to the left by two places and the same is the exponent (2) of 10 in the scientific notation.

Section B

17. Here, p(HI)= 0.04 atm, $P(H_2)$ = 0.08 atm $p(I_2)$ = 0.08 atm.

Therefore, $K_p = \frac{P_{H_2} \times P_{I_2}}{(P_{HI})^2} = \frac{(0.08\ atm) \times (0.08\ atm)}{(0.04\ atm)^2} = 4.0$

18. Isotopes are elements with the same atomic number but different mass numbers. It implies that all isotopes of the same atom have the same electronic configurations; hence the same ionization enthalpies.

19. i. 1 mole of C_2H_6 contains 2 moles of carbon atoms

$\therefore$ 3 moles of C_2H_6 will C-atoms = $2 \times 3 = 6$ moles

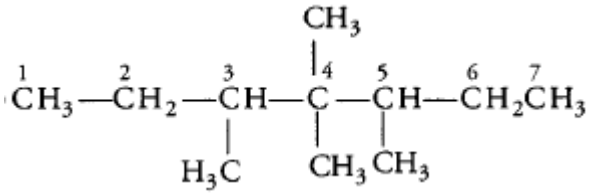
ii. 1 mole of C_2H_6 contains 6 moles of hydrogen atoms

$\therefore$ 3 moles of C_2H_6 will contain H-atoms = $3 \times 6 = 18$ moles

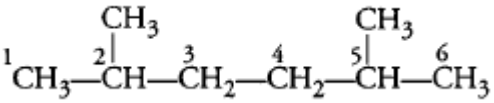
iii. 1 mole of C_2H_6 contains Avogadro's no., i.e. 6.02×10^{23} molecules of ethane

$\therefore$ 3 moles of C_2H_6 will contain ethane molecules = $3 \times 6.02 \times 10^{23} = 18.06 \times 10^{23}$

20. i. Structural formula of 3, 4, 4, 5-tetra methyl heptane is:



ii. Structural formula of 2, 5-dimethyl hexane is:



OR

i. $CH_3\text{-}C \equiv C\text{-}Ph \xrightarrow[H_2O]{Hg^{2+},\ H^+} CH_3 - CH = \underset{OH}{\overset{|}{C}} - Ph \rightleftharpoons CH_3CH_2 - \underset{O}{\overset{||}{C}} - Ph$

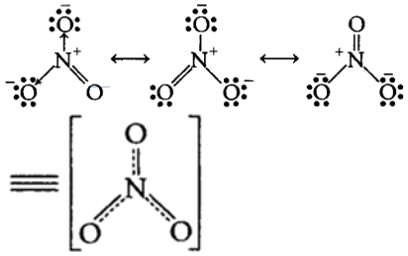
ii. $PhCH = CH2 \xrightarrow{HBr} Ph\underset{Br}{\overset{|}{C}}H - CH_3$

21. Na^+ and Mg^{2+} are iso-electronic species (have 10 electrons) K^+, Ca^{2+}, S^{2-} are iso- electronic species (have 18 electrons).

Section C

22. i. The resonating structures of O_3 are shown below:

ii. Nitrate ion, NO_3^-



23. Answer:

(i) When two ideal gases at the same pressure and temperature are allowed to mix in an isolated system, the entropy change is positive because degrees of freedom increases on mixing the gases.

(ii) A spontaneous process should occur continuously by itself after initiation. But this is not so in the given case because water will go up so long as the pump is working.
So, this process is not considered as a spontaneous process.

(iii) For an adiabatic process,
$\Delta H = 0$

24. i. Δ U = w_{ad}, wall is adiabatic

ii. Δ U = – q, thermally conducting walls

iii. Δ U = q – w, closed system.

25. The redox system is used. In redox systems, the titration method can be adapted to determine the strength of a reductant/oxidant using a redox-sensitive indicator. The usage of indicators in redox titration is illustrated below:
In one situation, the reagent itself is intensely coloured, e.g. permanganate ion MnO_4^-. Here, MnO_4^- acts as the self indicator. The visible endpoint, in this case, is achieved after the last of the reductant (Fe_2^+ or $C_2O_4^{2-}$) is oxidised and the first lasting tinge of pink colour appears at MnO^-_4 concentration as low as 10^{-6} mol dm^{-3} and (10^{-6} mol L^{-1}). This ensures a minimal 'overshoot' in colour beyond the equivalence point, the point where the reductant and the oxidant are equal in terms of their mole stoichiometry.

26. Total energy received = 3.15×10^{-18}

λ = 600 nm = 600×10^{-9} m = 6×10^{-7} m

The energy of one photon, E = $\frac{hc}{\lambda} = \frac{(6.626\times10^{-34}\text{Js})\times(3\times10^{8}\text{ms}^{-1})}{(6\times10^{-7}\text{m})}$

= 3.3125×10^{-19} J

$\therefore$ No. of photons = $\frac{3.15\times10^{-18}\text{J}}{3.3125\times10^{-19}\text{J}}$ = 10

27. The energy which is released by an isoated gaseous atom in gaining an electron from outside atom or ion to form negative ion (or anion) is called electron gain enthalpy (ΔegH). Unit of electron gain enthalpy is kJ / mol.
In some cases like in noble gas atoms do not have any attraction to gain an electron in that case energy has to be supplied.
For example
$Ne(g) + e^- \rightarrow Ne^-(g)$
$\Delta eg\ H = +116\ kJ\ mol^{-1}$

28. **Step (i) :** Write the skeleton of equation :$Fe + H_2O \longrightarrow Fe_3O_4 + H_2$
Step (ii) : Changing the H_2 to its nascent form 2[H].
$Fe + H_2O \longrightarrow Fe_3O_4 + 2H$
Step (iii) : Fe_3O_4 has the largest number of atoms. The balance this, multiply H_2O by 4 to balance oxygen atoms. In 4 molecules of H_2O, there are 8 atoms of H which are balanced by multiplying H on the RHS by 8.
$3Fe + 4H_2O \longrightarrow Fe_3O_4 + 8H$
Step (iv) : Converting [H] to its molecule form H_2.

$3Fe + 4H_2O \longrightarrow Fe_3O_4 + 4H_2$

The equation obtained is a balanced chemical equation.

Section D

29. i. The successive members of a homologous series are differ by a -CH_2 group. The molecular mass of a -CH_2 group is 14 amu. Hence, each successive homologue of a homologous series differ by a mass of 14 amu.

ii. Heterocyclic compounds are a major class of organic compounds characterized by the fact that some or all of the atoms in their molecules are joined in rings containing at least one atom of an element other than carbon and follow Huckels rule, the most common heterocycles are those having five or six-membered rings and containing hetero members of Nitrogen, oxygen, sulphur. Pyridine, pyrrole, thiophene are all heteroaromatic compounds

iii. A cyclic compound in which the ring includes at least one atom of an element different from the rest is called heterocyclic compound. A homocyclic compound is a cyclic compound in which all the ring atoms are the same.

OR

Tetrahydrofuran is non-aromatic, due to absence of conjugation in π electrons, and it does not follow Huckel's rule.

30. i. AlI_3 halides show maximum polarization. The most covalent halide is AlI_3.

Since lesser, the electronegativity difference, the more covalent is the aluminum halide.

ii. $AlCl_3$ is more covalent in nature.

iii. LiCl will be extracted into the ether.

iv. CaI_2 has a minimum melting point.

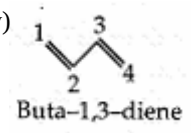
Section E

31. Attempt any five of the following:

(i) Continuous removal of a product maintains Qc at a value less than Kc and reaction continues to move in the forward direction.

(ii) Due to resonance, and delocalisation of electrons benzene is more stable.

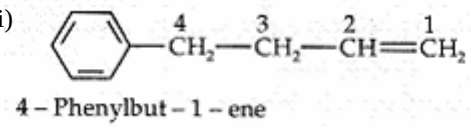
(iii) Branching of carbon atom chain decreases the boiling point of alkane.

(iv) 

Buta–1,3–diene

(v) 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.

(vi) Alkynes have a linear structure. Alkynes have triple bond. So, rotation is not possible. Hence, alkynes cannot show geometrical isomerism.

(vii) 

4 – Phenylbut – 1 – ene

32. For the reaction,

let 'x' be the decrease in pressure of CO_2, then

$CO_2(g) + C(s) \rightleftharpoons 2CO(g)$

Initial

pressure: 0.48 bar 0

At equilibrium: (0.48 – x)bar 2x bar

$K_p = \frac{p_{CO}^2}{p_{CO_2}}$

$K_p = (2x)^2/(0.48 - x) = 3$

$4x^2 = 3(0.48 - x)$

$4x^2 = 1.44 - x$

$4x^2 + 3x - 1.44 = 0$

a = 4, b = 3, c = –1.44

$x = \frac{(-b \pm \sqrt{b^2 - 4ac})}{2a}$

$x = \frac{-3 \pm \sqrt{3^2 - 4(4)(-1.44)}}{2(4)}$

= (–3 ± 5.66)/8

= (–3 + 5.66)/8 (as value of x cannot be negative hence we neglect that value)

x = 2.66/8 = 0.33

The equilibrium partial pressures are,

P_{CO_2} = 2x = 2 × 0.33 = 0.66 bar

P_{CO_2} = 0.48 – x = 0.48 – 0.33 = 0.15 bar

OR

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

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

Before neutralization,

$[NH_3] = 0.10 - x = 0.10$

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

Thus, x = 1.33×10^{-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	⇌	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,

$K_b = \left[NH_4^+\right][OH] / [NH_4OH]$

= y(0.033)/(0.033) = 1.77×10^{-5} M

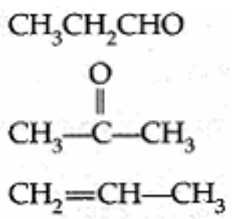
Thus, y = 1.77×10^{-5} = $[OH^-]$

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

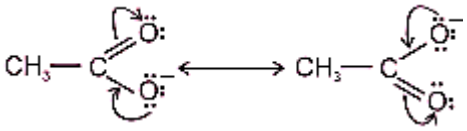
Hence, pH = 9.24

33. Answer:

(i)

i. 

ii. First, write the structure and put unshared pairs of valence electrons on appropriate atoms. Then draw the arrows(half headed curved arrow) one at a time moving the electrons to get the other structures.



OR

i. i. Distillation under reduced pressure.

ii. Since the two liquids are immiscible, the technique of solvent extraction with a separating funnel is used.
Kerosene being lighter than water forms the upper layer while water forms the lower layer.
The lower water layer is run off when kerosene oil is obtained. It is dried over anhydrous $CaCl_2$ or M_gSO_4 and then distilled to give pure kerosene oil.

iii. Sublimation Camphor sublimes while common salt remains as residue in the China dish.

ii. Nucleophiles(reagent that brings electron pair): HS^-, $C_2H_5O^-$, $(CH_3)_3N$:, $H_2N:^-$

These species have unshared pair of electrons, which can be donated and shared with an electrophile.

Electrophiles(reagent which takes away electron pair): $BF_3, \overset{+}{C}l, CH_3 - \overset{+}{C} = O, \overset{+}{N}O_2$

Reactive sites have only six valence electrons; can accept electron pair from a nucleophile.