

CBSE

Class XII Chemistry (Theory)

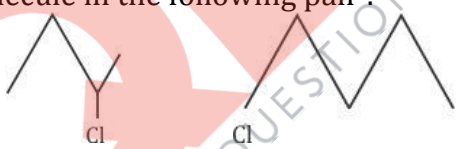
Board Question Paper 2014 – Set 1

Time: 3 hrs

Max. Marks: 70

General Instructions:

- (i) All questions are compulsory.
- (ii) Questions number 1 to 8 are very short-answer questions and carry 1 mark each.
- (iii) Questions number 9 to 18 are short-answer questions and carry 2 marks each
- (iv) Questions number 19 to 27 are also short-answer questions and carry 03 marks each.
- (v) Question number 28 to 30 are long-answer questions and carry 5 marks each.
Use Log Tables, if necessary. Use of calculators is not allowed

- 1. What is the effect of temperature on chemisorption? (1)
- 2. What is the role of zinc metal in the extraction of silver? (1)
- 3. What is the basicity of H_3PO_3 ? (1)
- 4. Identify the chiral molecule in the following pair : (1)

- 5. Which of the following is a natural polymer? (1)
Buna-S, Proteins, PVC
- 6. The conversion of primary aromatic amines into diazonium salts is known as _____ (1)
- 7. What are the products of hydrolysis of sucrose? (1)
- 8. Write the structure of p-methylbenzaldehyde. (1)
- 9. An element with density 2.8 g cm^{-3} forms a f.c.c. unit cell with edge length $4 \times 10^{-8} \text{ cm}$. Calculate the molar mass of the element. (Given : $N_A = 6.022 \times 10^{23} \text{ mol}^{-1}$) (2)
- 10. (i) What type of non-stoichiometric point defect is responsible for the pink colour of LiCl?
(ii) What type of stoichiometric defect is shown by NaCl? (2)

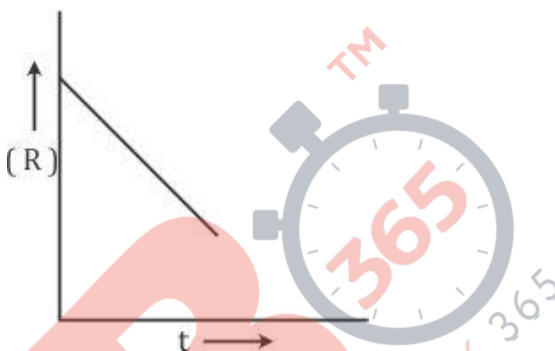
OR

How will you distinguish between the following pairs of terms:

- (i) Tetrahedral and octahedral voids
- (ii) Crystal lattice and unit cell (2)

11. State Kohlrausch law of independent migration of ions. Why does the conductivity of a solution decrease with dilution? (2)

12. For a chemical reaction $R \longrightarrow P$, the variation in the concentration (R) vs. time (t) plot is given as (2)



- (i) Predict the order of the reaction.
- (ii) What is the slope of the curve?

13. Explain the principle of the method of electrolytic refining of metals. Give one example. (2)

14. Complete the following equations : (2)

- (i) $P_4 + H_2O \longrightarrow$
- (ii) $XeF_4 + O_2F_2 \longrightarrow$

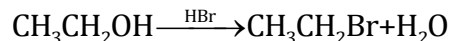
15. Draw the structures of the following : (2)

- (i) XeF_2
- (ii) BrF_3

16. Write the equations involved in the following reactions: (2)

- (i) Reimer - Tiemann reaction
- (ii) Williamson synthesis

17. Write the mechanism of the following reaction: (2)



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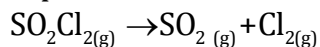
18. Write the name of monomers used for getting the following polymers: (2)
- Bakelite
 - Neoprene

19. (a) Calculate $\Delta_r G^0$ for the reaction
 $\text{Mg (s)} + \text{Cu}^{2+} (\text{aq}) \longrightarrow \text{Mg}^{2+} (\text{aq}) + \text{Cu (s)}$

Given: $E^0_{\text{cell}} = + 2.71 \text{ V}$, $1 \text{ F} = 96500 \text{ C mol}^{-1}$

- (b) Name the type of cell which was used in Apollo space programme for providing electrical power. (3)

20. The following data were obtained during the first order thermal decomposition of SO_2Cl_2 at a constant volume:



Experiment	Time/s ⁻¹	Total pressure/atm
1	0	0.4
2	100	0.7

Calculate the rate constant. (3)

(Given: $\log 4 = 0.6021$, $\log 2 = 0.3010$)

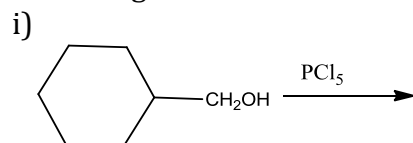
21. What are emulsions? What are their different types? Give one example of each type. (3)

22. Give reasons for the following: (3)

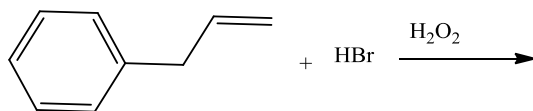
- $(\text{CH}_3)_3\text{P} = \text{O}$ exists but $(\text{CH}_3)_3\text{N} = \text{O}$ does not.
- Oxygen has less electron gain enthalpy with negative sign than sulphur.
- H_3PO_2 is a stronger reducing agent than H_3PO_3 .

23. (i) Write the IUPAC name of the complex $[\text{Cr}(\text{NH}_3)_4\text{Cl}_2]\text{Cl}$.
(ii) What type of isomerism is exhibited by the complex $[\text{Co}(\text{en})_3]^{3+}$?
(en = ethane-1,2-diamine)
(iii) Why is $[\text{NiCl}_4]^{2-}$ paramagnetic but $[\text{Ni}(\text{CO})_4]$ is diamagnetic?
(At. nos. : Cr = 24, Co = 27, Ni = 28) (3)

24. (a) Draw the structures of major monohalo products in each of the following reactions:



ii)



(b) Which halogen compound in each of the following pairs will react faster in $\text{S}_{\text{N}}2$ reaction :

(i) CH_3Br or CH_3I

(ii) $(\text{CH}_3)_3\text{C}-\text{Cl}$ or CH_3-Cl

25. Account for the following: (3)

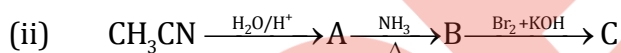
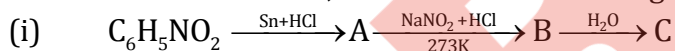
(i) Primary amines ($\text{R}-\text{NH}_2$) have higher boiling point than tertiary amines (R_3N).

(ii) Aniline does not undergo Friedel - Crafts reaction.

(iii) $(\text{CH}_3)_2\text{NH}$ is more basic than $(\text{CH}_3)_3\text{N}$ in an aqueous solution.

OR

Give the structures of A, B and C in the following reactions:



26. Define the following terms as related to proteins: (3)

(i) Peptide linkage

(ii) Primary structure

(iii) Denaturation

27. On the occasion of World Health Day, Dr. Satpal organized a 'health camp' for the poor farmers living in a nearby village. After check-up, he was shocked to see that most of the farmers suffered from cancer due to regular exposure to pesticides and many were diabetic. They distributed free medicines to them. Dr. Satpal immediately reported the matter to the National Human Rights Commission (NHRC). On the suggestions of NHRC, the government decided to provide medical care, financial assistance, setting up of super-specialty hospitals for treatment and prevention of the deadly disease in the affected villages all over India.

(i) Write the values shown by

(a) Dr. Satpal

(b) NHRC.

(ii) What type of analgesics are chiefly used for the relief of pains of terminal cancer?

(iii) Give an example of artificial sweetener that could have been recommended to diabetic patients. (3)

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28. (a) Define the following terms :
- (i) Molarity
 - (ii) Molal elevation constant (K_b)
- (b) A solution containing 15 g urea (molar mass = 60 g mol^{-1}) per litre of solution in water has the same osmotic pressure (Isotonic) as a solution of glucose (molar mass = 180 g mol^{-1}) in water. Calculate the mass of glucose present in one litre of its solution. (2,3)

OR

29. (a) What type of deviation is shown by a mixture of ethanol and acetone? Give reason.
- (b) A solution of glucose (molar mass = 180 g mol^{-1}) in water is labelled as 10% (by mass). What would be the molality and molarity of the solution?
(Density of solution = 1.2 g mL^{-1}) (2,3)
- (a) Complete the following equations :
- (i) $\text{Cr}_2\text{O}_7^{2-} + 2\text{OH}^- \rightarrow$
 - (ii) $\text{MnO}_4^- + 4\text{H}^+ + 3\text{e}^- \rightarrow$
- (b) Account for the following:
- (i) Zn is not considered as a transition element.
 - (ii) Transition metals form a large number of complexes.
 - (iii) The E^0 value for the $\text{Mn}^{3+}/\text{Mn}^{2+}$ couple is much more positive than that for $\text{Cr}^{3+}/\text{Cr}^{2+}$ couple. (2,3)

OR

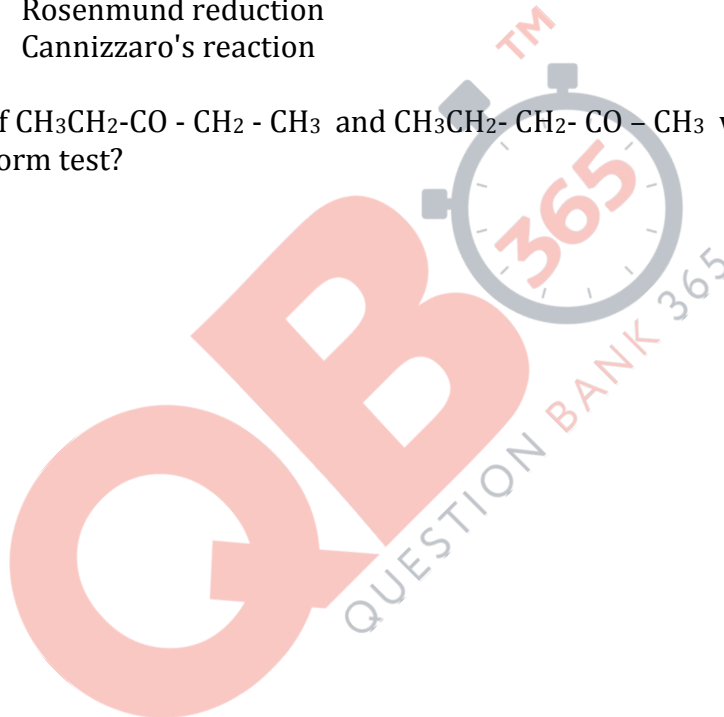
- (i) With reference to structural variability and chemical reactivity, write the differences between lanthanoids and actinoids.
 - (ii) Name a member of the lanthanoid series which is well known to exhibit +4 oxidation state.
 - (iii) Complete the following equation:
 $\text{MnO}_4^- + 8\text{H}^+ + 5\text{e}^- \rightarrow$
 - (iv) Out of Mn^{3+} and Cr^{3+} , which is more paramagnetic and why?
(Atomic nos. : Mn = 25, Cr = 24) (5)
30. (a) Write the products formed when CH_3CHO reacts with the following reagents:
- (i) HCN
 - (ii) $\text{H}_2\text{N} - \text{OH}$
 - (iii) CH_3CHO in the presence of dilute NaOH

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- (b) Give simple chemical tests to distinguish between the following pairs of compounds:
- (i) Benzoic acid and Phenol
 - (ii) Propanal and Propanone
- (2,3)

OR

- (a) Account for the following:
- (i) Cl - CH₂COOH is a stronger acid than CH₃COOH.
 - (ii) Carboxylic acids do not give reactions of carbonyl group.
- (b) Write the chemical equations to illustrate the following name reactions:
- (i) Rosenmund reduction
 - (ii) Cannizzaro's reaction
- (c) Out of CH₃CH₂-CO - CH₂ - CH₃ and CH₃CH₂- CH₂- CO - CH₃ which gives iodoform test?
- (2,2,1)

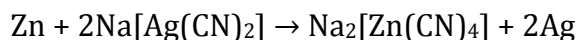


**CBSE
Class XII Chemistry
Board Paper 2014 – Set 1 Solution**

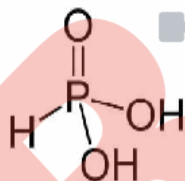
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Total Marks: 70

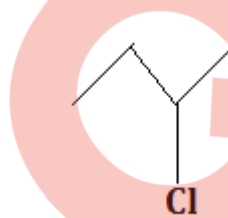
1. High temperature is favourable for adsorption, which increases with an increase in temperature.
2. In the extraction of silver, zinc functions as a reducing agent.



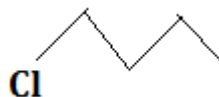
3. Basicity of H_3PO_3 is two as there are two replaceable hydrogen atoms. The structure of H_3PO_3 is as follows:



4. The two structures given are as follows:

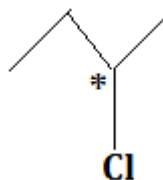


2-chlorobutane



1-chlorobutane

Between the two given compounds, 2-chlorobutane contains one carbon atom which is attached to four entities such as methyl group, chlorine atom, hydrogen atom and ethyl group.

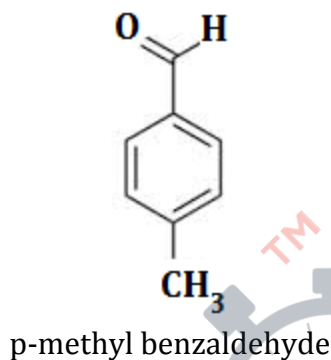


2-chlorobutane with chiral centre

But in 1-chlorobutane, no carbon atom is attached to four atoms or groups. Hence, the chiral compound is 2-chlorobutane.

5. Proteins are natural polymers.
Buna-S and PVC are synthetic polymers.

6. Conversion of primary aromatic amines to diazonium salts is known as **diazotisation**.
7. Sucrose on hydrolysis gives one molecule each of glucose and fructose.
8. Structure of p-methyl benzaldehyde:



9. Given:
Density of f.c.c. unit cell = 2.8 g cm^{-3}
Edge length of f.c.c unit cell = $4 \times 10^{-8} \text{ cm}$
 $N_A = 6.022 \times 10^{23} \text{ mol}^{-1}$
Molar mass of the element = ?

For f.c.c. unit cell, $Z = 4$

Substituting the values in the equation:

$$\rho = \frac{Z \times M}{a^3 \times N_0}$$

$$2.8 \text{ g cm}^{-3} = \frac{4 \times M}{(4 \times 10^{-8} \text{ cm})^3 \times 6.022 \times 10^{23} \text{ mol}^{-1}}$$

$$M = \frac{2.8 \text{ g cm}^{-3} \times (4 \times 10^{-8} \text{ cm})^3 \times 6.022 \times 10^{23} \text{ mol}^{-1}}{4}$$

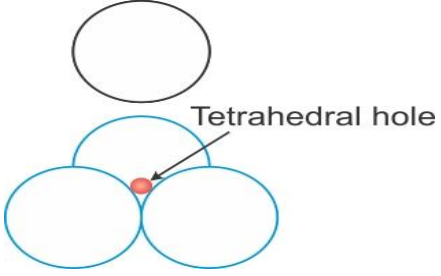
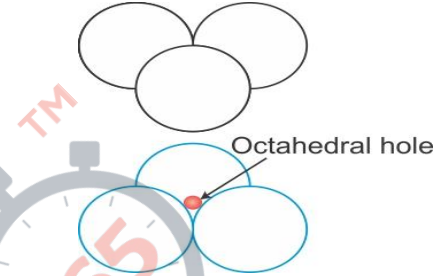
$$M = 26.98 \text{ g mol}^{-1}$$

Therefore, the molar mass of the element is 26.98 g mol^{-1} .

- 10.
- (i) The metal excess defect due to anionic vacancies makes LiCl crystals pink.
- (ii) NaCl exhibits Schottky defect. In this type of defect, in an ionic crystal such as NaCl, equal number of cations and anions are missing from their lattice sites so that the electrical neutrality is maintained. This is a vacancy defect.

OR

(i) Difference between tetrahedral and octahedral voids:

Tetrahedral void	Octahedral void
<p>Tetrahedral void is a vacant space formed by touching of four spheres.</p> 	<p>Octahedral void is formed by a combination of voids of two triangular layers of atoms when one triangular layer is placed above another.</p> 

(ii) Difference between crystal lattice and unit cell:

Crystal lattice	Unit cell
<p>The crystal lattice is a symmetrical three-dimensional arrangement of atoms inside a crystal.</p>	<p>The unit cell is the smallest portion of crystal lattice which when repeated in different directions generates an entire lattice.</p>

11. Kohlrausch law: The limiting molar conductivity of an electrolyte (i.e. molar conductivity at infinite dilution) is the sum of the limiting ionic conductivities of the cation and the anion each multiplied with the number of ions present in one formula unit of the electrolyte.

On dilution, the volume of the solution increases, but the number of ions which carry a charge in a solution remains the same. Hence, the number of ions per unit volume which carry a charge in a solution decreases. Conductivity through a solution is due to the presence of these ions. Therefore, the more salt or ions dissolved in solution, the higher the conductivity (within limits). In a dilute solution, the concentration of ions goes down, and the ability to pass a current is diminished.

12. For a chemical reaction $R \rightarrow P$, the variation in the concentration (R) vs. time (t) plot is given as follows:

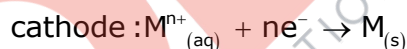
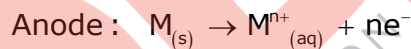


- (i) It is a zero-order reaction.
(ii) Slope = $-k$

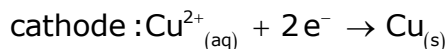
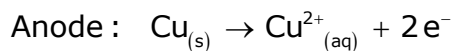
13. Electrolytic refining:

Principle:

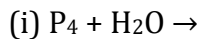
When electric current is passed, metal ions from electrolyte are deposited at the cathode in the form of pure metal, while metal from the anode goes into the electrolyte solution as metal ions.



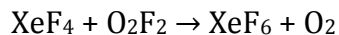
Example: In case of electrolytic refining of copper, crude copper metal acts as the anode, while a thin sheet of pure copper acts as the cathode. The electrolyte is copper sulphate solution acidified with sulphuric acid.



- 14.

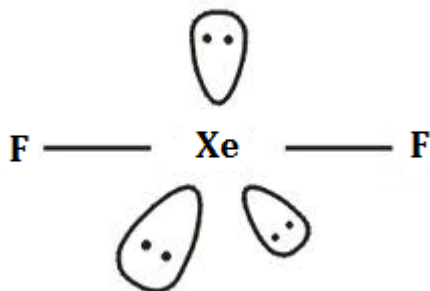


- (ii) XeF_6 can be prepared by the interaction of XeF_4 and O_2F_2 at 143 K.

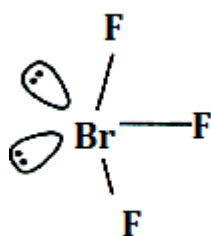


15.

(i) XeF₂ (linear)

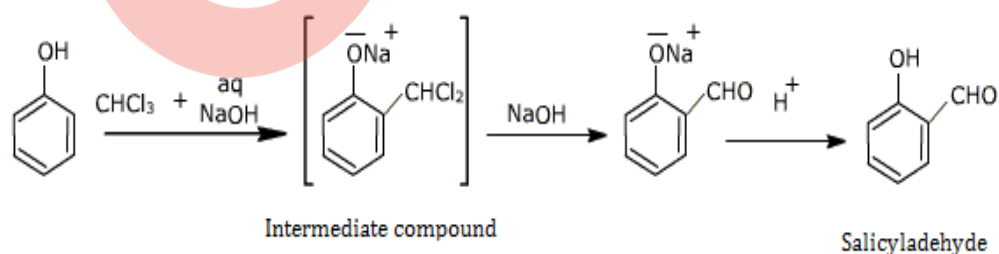


(ii) BrF₃ (bent T-shaped)

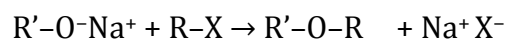
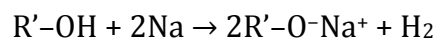


16.

(i) Reimer-Tiemann reaction: Treatment of phenol with chloroform in the presence of aqueous sodium or potassium hydroxide at 340 K, followed by hydrolysis of the resulting product gives 2-hydroxybenzaldehyde or salicylaldehyde as the major product. This reaction is called the Reimer-Tiemann formylation reaction.



(ii) Williamson synthesis: It involves the treatment of an alkyl halide with a suitable sodium alkoxide. The sodium alkoxide needed for the purpose is prepared by the action of sodium on a suitable alcohol. The reaction involves the nucleophilic displacement (substitution) of the halide ion from the alkyl halide by the alkoxide ion by the S_N2 mechanism.

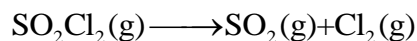


Ether

The second reaction is the substitution nucleophilic bimolecular (S_N2) reaction. **QB365-Question Bank Software**

(b) A fuel cell was used in the Apollo space programme for providing electrical power.

20. The given reaction is as follows:



Also given:

Experiment	Time s ⁻¹	Total pressure/atm
1	0	0.4
2	100	0.7

The rate constant k can be calculated as follows:

$$k = \frac{2.303}{t} \log \frac{P_0}{2P_0 - P_t}$$

when $t = 100\text{s}$,

$$k = \frac{2.303}{100} \log \frac{0.4}{(2 \times 0.4) - 0.7}$$

$$k = \frac{2.303}{100} \log \frac{0.4}{0.1}$$

$$k = \frac{2.303}{100} \log 4$$

$$k = \frac{2.303}{100} \times 0.6021$$

$$k = 1.39 \times 10^{-2} \text{s}^{-1}$$

Therefore, the rate constant is $1.39 \times 10^{-2} \text{s}^{-1}$.

21. An emulsion is a colloidal dispersion in which both dispersed phase and dispersion medium are liquids, and the two liquids involved are otherwise immiscible.

Types of emulsions are as follows:

a) Oil in water, in which oil is the dispersed phase and water is the dispersion medium.

Example: Milk is an emulsion of liquid fat dispersed in water.

b) Water in oil, in which water is the dispersed phase and oil is the dispersion medium.

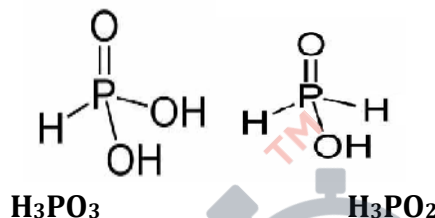
Example: Cod liver oil is an emulsion of water in oil in which water is the dispersed phase and oil is the dispersion medium.

22.

(i) N, due to the absence of d-orbitals, cannot form p Π -d Π multiple bonds. As a result, N cannot expand its covalency beyond four, but in $\text{R}_3\text{N}=\text{O}$, N has a covalency of 5. Therefore, the compound $\text{R}_3\text{N}=\text{O}$ does not exist. In contrast, P, due to the presence of d-orbitals, forms p Π -d Π multiple bonds and hence

can expand its covalency beyond 4. Therefore, P forms $R_3P=O$, in which the covalency of P is 5.

- (ii) Due to the small size and compact nature of oxygen, the incoming electrons are not accepted with ease. Hence, the electron gain enthalpy of oxygen is negative.
- (iii) In the case of H_3PO_3 , there is only one P-H bond, while in the case of H_3PO_2 , there are two P-H bonds. Hence, H_3PO_2 is a better reducing agent than H_3PO_3 .



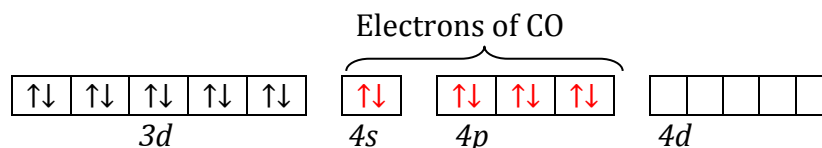
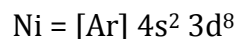
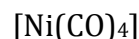
23.

- (i) The IUPAC name of the complex $[\text{Cr}(\text{NH}_3)_4 \text{Cl}_2] \text{Cl}$ is Tetraamminedichlorochromium (III) chloride.
- (ii) Optical isomerism is exhibited by the complex $[\text{Co}(\text{en})_3]^{3+}$.
- (iii) Both $[\text{NiCl}_4]^{2-}$ and $[\text{Ni}(\text{CO})_4]$ are tetrahedral, but their magnetic characters are different. This is due to the difference in the nature of ligands.



Ni^{+2} has 2 unpaired electrons; hence, this complex is paramagnetic.

In $\text{Ni}(\text{CO})_4$, Ni is in the zero oxidation state, i.e. it has a configuration of $3d^8 4s^2$.

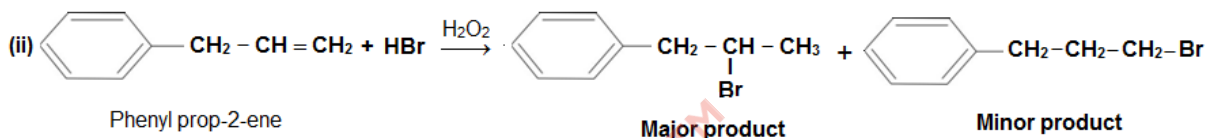
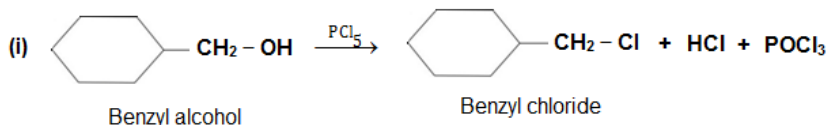


But CO is a strong field ligand. Therefore, it causes the pairing of unpaired 3d electrons. Also it causes the 4s electrons to shift to the 3d orbital, thereby

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giving rise to sp^3 hybridisation. Since no unpaired electrons are present in this case, $[\text{Ni}(\text{CO})_4]$ is diamagnetic.

24.



Addition in the presence of peroxide yields a product according to anti-Markovnikov rule of addition.

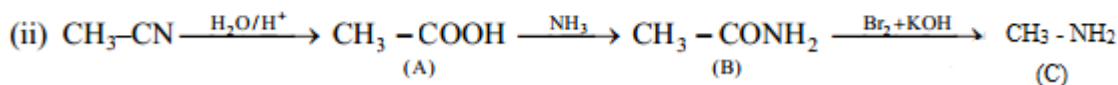
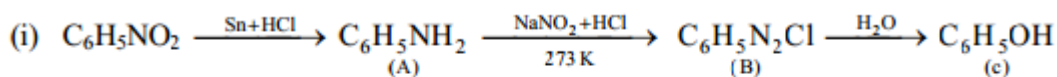
(b)

- (i) CH_3I
- (ii) CH_3Cl

25.

- (i) Due to maximum intermolecular hydrogen bonding in primary amines (i.e. due to the presence of more number of H atoms), primary amines have a high boiling point in comparison to tertiary amines.
- (ii) Aniline does not undergo Friedel-Crafts reaction due to the acid-base reaction between basic compounds. Aniline and Lewis acid/Protic acid are used in the Friedel-Crafts reaction.
- (iii) In $(\text{CH}_3)_3\text{N}$, there is maximum steric hindrance and least solvation, but in $(\text{CH}_3)_2\text{NH}$, solvation is more and steric hindrance is less, lesser than in $(\text{CH}_3)_3\text{N}$. Although +I effect is less since there are two methyl groups, dimethyl amine is still a stronger base than tri-methyl amine.

OR



26.

(i) Peptide linkage:

A peptide bond or peptide linkage is an amide formed between the $-\text{COOH}$ and NH_2 groups by the elimination of a water molecule. The peptide bond or

linkage is $-\overset{\text{O}}{\parallel}{\text{C}}-\text{NH}$

(ii) Primary structure:

The primary structure of proteins refers to the sequence of amino acids held together by peptide bonds.

(iii) Denaturation:

It is a process in which proteins get easily precipitated and the change is irreversible.

27.

(i)

(a) Dr Satpal distributed free medicines. He shows concern for welfare of others.

(b) NHRC take responsibility and did its duty properly.

(ii) Aspirin

(iii) Aspartame

28.

(a) (i) Molarity (M): Molarity is the number of moles of solute dissolved per litre of solution.

$$\text{Molarity } M = \frac{\text{Moles of solute}}{\text{Vol. of solution (litre)}}$$

(ii) Molal elevation constant (K_b):

The elevation in boiling point of 1 molal solution is called the molal elevation constant.

(b) For isotonic solution

$$\pi_1 = \pi_2$$

$$C_1 = C_2 \text{ (at same temperature)}$$

$$\text{or } n_1 = n_2 \text{ (is the same volume)}$$

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$$\frac{15}{60} = \frac{x}{180}$$

x = 45 g, mass of glucose per litre of solution.

OR

- (a) Ethanol and acetone show positive deviation because both are non-polar compounds. After mixing, the force of attraction decreases.

Like particle force of attraction > Unlike particle force of attraction

(b)

$$\text{Molarity } M = \frac{\% \text{Mass} \times 10 \times \text{density}}{\text{Mol. mass of solute}}$$

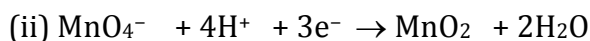
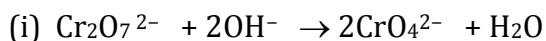
$$= \frac{10 \times 10 \times 1.2}{180} = 0.66 \text{ M}$$

$$\text{Molality} = \frac{\% \text{Mass}}{\text{Mol. mass of solute}} \times \frac{1000}{100 - \% \text{Mass}}$$

$$= \frac{10}{180} \times \frac{1000}{90} = 0.617 \text{ m}$$

29.

(a)



(b)

- (i) Zinc is not considered a transition element because it does not have partly filled (or incomplete) d-subshell. It has a fully filled 3d-subshell.

- (ii) Transition elements form complexes because of the following reasons:

- Comparitively smaller size of their metal ions.
- Their high ionic charges.
- Availability of vacant d-orbitals so that these orbitals can accept a lone pair of electrons donated by the ligands.

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- (iv) In Mn, the '+2' oxidation state is more stable than the '+3' oxidation state. In Cr, the '+3' oxidation state is more stable than the '+2' oxidation state.

OR

(i)

Lanthanoids	Actinoids
Their magnetic properties can be explained easily.	Their magnetic properties cannot be explained easily, as they are more complex.
Except promethium, they are non-radioactive.	They are radioactive.
Besides the +3 oxidation state, they show +2 and +4 oxidation states only in few cases.	Besides the +3 oxidation state, they also show higher oxidation states of +4, +5, +6 and +7.
Lanthanoid compounds are less basic.	Actinoid compounds are more basic.

(ii) Ce

(iii) $\text{MnO}_4^- + 8\text{H}^+ + 5\text{e}^- \rightarrow \text{Mn}^{2+} + 4\text{H}_2\text{O}$

(iv) $\text{Mn}^{3+} = [\text{Ar}] 4s^0 3d^4$ (4 unpaired e-)
 $\text{Cr}^{3+} = [\text{Ar}] 4s^0 3d^3$ (3 unpaired e-)
 Mn^{3+} has more number of unpaired e- than Cr^{3+} .

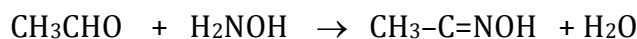
30.

(a)

(i) Acetaldehyde reacts with hydrogen cyanide to form hydroxypropanenitrile

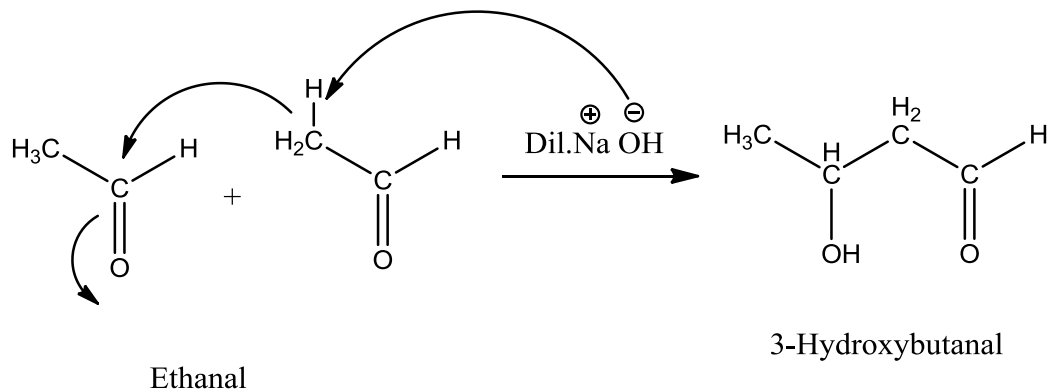


(ii) Ethanal reacts with hydroxylamine to form ethanal oxime.



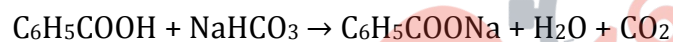
Ethanal oxime

(iii) Two molecules of ethanal condense in the presence of dilute NaOH to form 3-hydroxybutanal.



(b)

- (i) When treated with sodium bicarbonate, benzoic acid gives brisk effervescence due to the evolution of carbon dioxide gas. No reaction takes place when phenol is treated with NaHCO_3 .



- (ii) Propanal gives a positive Tollens' test, while propanone does not give a positive Tollens' test.



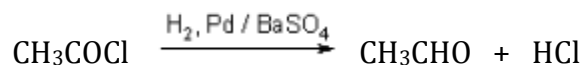
OR

(a)

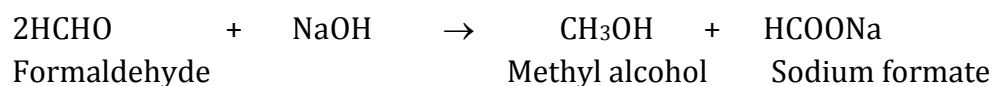
- (i) Monochloroacetic acid is stronger than acetic acid. This is due to $-\text{Cl}$ as a $-I$ group.
- (ii) Carboxylic acids do not give reactions of the carbonyl group because the lone pairs on oxygen attached to hydrogen in the $-\text{COOH}$ group are involved in resonance which makes the carbon atom less electrophilic.

(b)

- (i) Rosemund reaction:



- (ii) Cannizzaro's reaction:



- (c) $\text{CH}_3\text{CH}_2 - \text{CH}_2 - \text{CO} - \text{CH}_3$