RAMAKRISHNA MISSION VIDYAMANDIRA

(Residential Autonomous College affiliated to University of Calcutta)

SECOND YEAR [BATCH 2017-20] B.A./B.Sc. FOURTH SEMESTER (January – June) 2019 Mid-Semester Examination, March 2019

Date : 25/03/2019 Time : 2 pm - 4 pm

CHEMISTRY (Honours)

Paper : IV

Full Marks : 50

[1×4]

[2×2]

[Use a separate Answer Book <u>for each group</u>]

[Attempt one question from each unit]

<u>Group – A</u>	[16 marks]
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- <u>Unit I</u>
- 1. a) Predict the product of the following reactions.





b) Outline the synthesis of the following compounds as directed:



2. Give retrosynthetic analysis and an efficient synthesis of the following compounds from easily available starting materials. [2×4]



<u>Unit - II</u>

- 3. a) Beckmann reaction of oximes and Schmidt reaction of ketones are mechanically allied-Justify. [3]
 - b) What happened when PhCH₂COCl is treated with CH₂N₂ and the resultant product is allowed to react with Ag₂O in water. Given mechanism for the reaction. [2]
 - c) Outline the reactions for the conversion of RCO₂H in to RNH₂ and R-Br. Also give mechanism for both reactions.
 [3]
- 4. Give mechanism for each of the following reactions.



<u>Unit - III</u>

5. a) How would a titration curve of a sodium acetate solution with HCl solution look like? Provide explanation.

- b) Describe the calomel half-cell and write down its Nernst equation. [2]
- c) The mobility of the NH_4^+ ion is $7.623 \times 10^{-8} \text{ m}^2 \text{V}^{-1} \text{s}^{-1}$. Calculate [4]

i) The molar conductance $({\lambda_m}^0)$ of the ${NH_4}^+$ ion

ii) The velocity of the ion if 15.0 volts are applied across electrodes 25 cm apart.

iii) The transport number of the ions in NH₄OAc solution if the mobility of the OAc⁻¹ ion is $4.239 \times 10^{-8} \text{ m}^2 \text{V}^{-1} \text{s}^{-1}$.

- 6. a) At 291.5 K, the specific conductance of water saturated with CaF_2 is $3.86 \times 10^{-3}\Omega^{-1}m^{-1}$ and that of pure water used in the preparation of this solution is $0.15 \times 10^{-3}\Omega^{-1}m^{-1}$. The equivalent ionic conductance's at infinite dilution of Ca^{2+} and F^- ions are 5.1×10^{-3} and $4.7 \times 10^{-3}\Omega^{-1}m^{-2}$ g eq⁻¹ respectively at 291.5 K. Calculate the solubility in g/lit and K_{sp} of CaF₂ assuming only Ca²⁺ and F⁻ ions in solution.
 - b) The EMF of the cell $Pt|H_2(1atm)|H^+(1M)||KCl(saturated)|Hg_2Cl_2|Hg$ and $Zn|Zn^{2+}(0.1M)||KCl(saturated)|Hg_2Cl_2(s)|Hg$ are 0.242 V and 0.548 V respectively. What is the value of oxidation potential of $Zn|Zn^{2+}(0.1M)$ electrode? The activity coefficient of H⁺ ions in the first cell may be taken as unity.
 - c) How does Deby-Huckel theory explain the increase in equivalent conductance of a strong electrolyte on dilution?

[4]

[2]

[2]

[2×4]

<u>Unit - IV</u>

- 7. a) Show that the following functions is a solution of the Schrodinger equation for a simple harmonic oscillator $\Psi_3 = x \exp(-\beta x^2)$. Also find out the values of β and eigenvalue for this function. [5]
 - b) The frequency in wave numbers of C-H stretching vibration is obtained from IR spectra as 3100 cm⁻¹. What will be the effect on the frequency if the H atom is replaced by D? [3]
- 8. a) Give a qualitative pictorial representation of the Ψ and Ψ^2 for the 1st two excited state functions of quantum harmonic oscillator and comment on their nature w.r.t odd and even. [3]
 - b) Comment the ground state energy of the harmonic oscillator is a consequence of Heisenberg's uncertainly principle.
 [2]
 - c) Show the orientation of L and L_z for 1 = 2. Also find out the values of these vectors for this angular momentum quantum number. [3]

<u>Unit - V</u>

- 9. a) Explain the following observation: <u>(any two)</u>
 (i) Fluorine forces the elements to assume highest oxidation state.
 - (ii) All halogens are coloured.
 - (iii) Oxygen compounds of fluorine are relatively more explosive than other halogen oxides.
 - b) Why does iodine show basic properties? Give definite instances to show such properties of iodine. [3]
 - c) Justify the statement thiocyanogen is a pseudohalogen.
- 10. a) Given reason that led Bartlett to prepare noble gas compounds. [2]
 - b) How is barium perxenate obtained? Using VSEPR theory predict the structure of perxenate ion.
 Predict the structure of the compounds obtained by acidifying barium perxenate at 268 K. [1+1+1+1]
 - c) Explain the following observation:
 i) Helium and neon do not form Clatherates.
 ii) Isolation of noble gas compounds have helped us to modify our concept of bonding. [3]

<u>Unit - VI</u>

11.	a)	Compare the halides of Group 14 elements in the light of (i) stability and (ii) hydrolytic	
		behaviour. [2+	-2]
	b)	complete the reactions:	[3]
		i) Me ₃ SiCl + H ₂ O \rightarrow (ii) Au+H ₂ SeO ₄ \rightarrow	
	c)	$(CH_3)_3$ N and $(H_3Si)_3$ N have pyramidal and planar geometry, respectively, Explain the	
		anomaly.	[2]
12.	a)	Compare the hydrides of S, Se and Te in the light of (i) stability and (ii) acidity. [2+	-2]
	b)	What happens when	
(i) ferric chloride solutions is gradually added to sodium thioslphate			
		(ii) ammonium persulphate solution is added to manganese (II) sulphate solution in presence of	
		small amount silver sulphate in sulphuric acid medium.	[3]
	c)	Mechanistically show how is ozone layer depleted by CFC?	[2]

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[3]

[3]