RAMAKRISHNA MISSION VIDYAMANDIRA

(Residential Autonomous College affiliated to University of Calcutta)

B.A./B.Sc. SECOND SEMESTER EXAMINATION, MAY 2016

FIRST YEAR [BATCH 2015-18]

Date : 20/05/2016 **CHEMISTRY (Honours)**

Time : 11 am – 1 pm **Paper :** II (Gr-C) Full Marks : 25

[***Attempt <u>one question</u> from <u>each Unit</u>***]

<u>Unit – I</u>

1. a) Predict the shapes and indicate the state of hybridisation of the central atom for the following :
   i) XeF_5^- ii) ClO_3^- iii) $POCl_3$ [1+1+1]
   b) The estimated radius of NH_4^+ ion (148 pm) suggests a CsCl type structure for NH_4F. But NH_4F adopts the Wurtzite (ZnS) structure. —Comment. [3]
   c) Explain the solubility trends : $MgSO_4 > CaSO_4 > BaSO_4$. [1·5]
   d) The heat of formation of CaCl is –182 KJ/mole. Calculate the heat of formation of $CaCl_2$ from the given data and compare the stability of CaCl and $CaCl_2$. [3+1]

Heat of Sublimation of Ca	=	+201 KJ/mole
Heat of dissociation of Cl_2	=	+242 KJ/mole
$I.E_1$ of Ca	=	+590 KJ/mole
$I.E_2$ of Ca	=	+1146 KJ/mole
E.A of CI	=	– 349 KJ/mole
Lattice energy of $CaCl_2$	=	– 2280·4 KJ/mole

   e) $NaClO_4$ is about 1000 times as soluble as $KClO_4$ in water. Explain with reason. [1·5]

2. a) Define with example : (i) Schottky defect (ii) Frenkel defect. Mention the main differences between Schottky defect and Frankel defect. [2+2+2]
   b) Draw the possible resonance structure of ClO_4^- and predict the most stable one. [2]
   c) Inspite of the fact that the hypothetical $NaCl_2$ is expected to have higher lattice energy as compared to NaCl, it does not exist —Explain. [3]
   d) The dipole moment of a gas phase HBr molecule is 0·827 D. Determine the charge distribution in this diatomic molecule if the bond distance is 141·5 pm. (1D = $3{\cdot}336\times10^{-30}$ Cm) where Cm ≡ Coulomb meter. [2]

<u>Unit – II</u>

3. a) Compare the following with justification : [3×2]
   i) Reduction potential of $M^+_{(aq)} + e \rightarrow M_{(s)}$ (M = Li and Cs)
   ii) Hydrolytic behaviour of M_2O_2 and MO_2 (M = alkali metals)
   iii) Concentration dependent aqueous chemistry of $BeCl_2$ and $CaCl_2$.
   b) Compare Cu, Ag and Au with respect to their— [4]
   i) Variable Valency and
   ii) Complex forming ability
   c) What is Sorel's cement or Zyolith? Give one use of it? [2]

4. a) Complete the following reactions : [2]
   i) $Ag^+_{(aq)}(\text{excess}) + S_2O_3^{2-} \rightarrow$
   ii) $Ag^+_{(aq)} + S_2O_3^{2-}\ (\text{excess}) \rightarrow$
   b) Describe the disproportionation behaviours of $M^+_{(aq)}$ ion (M = Cu, Ag and Au). [3]

c) What is ‘cryptands’? How it forms ‘alkalides’? Give an examples. [3]
d) Hg is liquid but Zn is solid at room temperature. —Explain. [2]
e) How will you prepare ‘organoberyllium’ compounds (give one example with reaction). [2]

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