RAMAKRISHNA MISSION VIDYAMANDIRA

(Residential Autonomous College affiliated to University of Calcutta)

B.A./B.Sc. FIRST SEMESTER EXAMINATION, DECEMBER 2018

FIRST YEAR (BATCH 2018-21)

Date : 17/12/2018 **CHEMISTRY (Honours)**

Time : 11.00 am – 1.00 pm Paper : I [Gr-B] Full Marks : 35

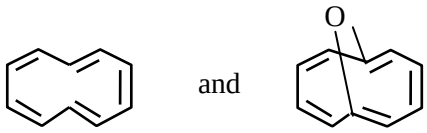
[Use one Answer Book for Unit I and another Answer Book for Unit II, III & IV]

(Attempt one question from each Unit)

Unit I

[10 marks]

1. a) Which of the following two compounds has greater stability and why? [2]



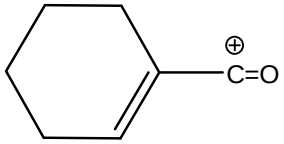
and

b) Show relative energies of π Mo's for cycloheptatrienyl cation using frost's diagram and predict whether the species is aromatic or not. [2]

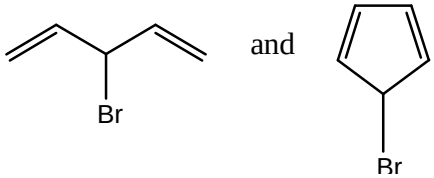
c) Compare the dipole moments of p-chloroaniline and p-fluoroaniline with reasons. [2]

d) Tropylium bromide is an ionic compound. Explain [2]

e) Draw the canonical forms of the following and indicate the most contributory from with reason. [2]



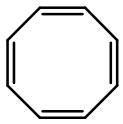
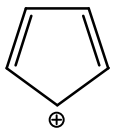
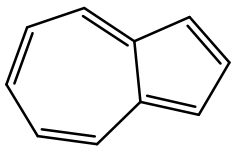
2. a) Which of the following two bromo compounds would undergo silver ion assisted hydrolysis at faster rate and why? [2]



b) Between toluene and t-butylbenzene which compound will have higher electron density at the para carbon atom.— Explain. [2]

c) Draw the π- orbital picture of HC ≡ C-CHO and indicate the states of hybridisation of each constituent atoms. [3]

d) Assign the following systems as aromatic, non-aromatic or antiaromatic with reason. [3]

i)  ii)  iii) 

Unit II

[9 marks]

3. a) What is the wavelength of light for a line in the atomic spectrum of H for which n_1=2 and n_2=4? which part of the electromagnetic spectrum does this belong to? [3]

b) How do the shapes of s and p orbitals can be obtained from angular functions? Give reasons. [3]

c) From the angle of Zeeman effect, explain why 1s→2p transition is associated with three spectral line [1.5]

d) Find out the ground state term symbol of the atom having atomic number 26(twenty six). [1.5]

4. a) Discuss the origin and physical significance of magnetic quantum number. [3]

b) Calculate the speed of an electron in the first Bohr orbit of the H atom and corresponding de-Broglies wavelength of the electron. (a_o=52.9 pm, $m_e = 9.1\times10^{-31}$ kg) [3]

c) Sc has an electronic configuration of $[Ar]3d^14s^2$ and not $[Ar]3d^3$, why? [1.5]

d) Show the radial probability distribution function diagram of the orbitals of 3s and 3p for a hydrogen atom. Give the interpretation of your diagram. [1.5]

Unit III [8 marks]

5. a) Give reasonable explanations of the following facts:

(i) First ionisation potentials of coinage metals fall in the order Cu > Ag < Au.

(ii) Electron affinity of SF_5 is among the highest known but that of SF_6 is quite modest. [2+2]

b) What is the basis of Allred-Rochow electronegativity? Interatomic distance in chlorine is 1.98 Å. Calculate the Allred-Rochow electronegativity of chlorine atom using Slater's rules. [3]

c) Explain group electronegativity with suitable examples. [1]

6. a) Calculate the electronegativity of chlorine in both Pauling's and Mulliken's scale. Given, EA(Cl) = 4.0 eV/atom and IE(Cl) = 13.0 eV/atom. [3]

b) Explain:-

(i) Electronegativity of Ge is higher than that of Si and Sn.

(ii) Be and Al have similar in properties although they belongs to different groups of periodic table. [2+2]

c) What is meant by ionic radii? [1]

Unit-IV [8 marks]

7. a) PbI_4 is non-existant whereas PbF_4 is a stable compound — Why? [2]

b) What happen when sodium vapour is passing through NaCl crystals? Explain in terms of crystals defect. [2]

c) Why sodium bismuthate act as a strong oxidising agent? Give one example with balance chemical equation where sodium bismuthate as an oxidising ageng. [2+2]

8. a) Discuss the trend in the solubility of $MClO_4$ (M=Li, Na,K). [2]

b) Explain Schöttky and Frenkel defects with example. [1.5+1.5]

c) i) Why is the melting point of CuCl (422^{o}C) much lower than that of KCl (776^{o}C). [2]

ii) Calculate the formal change of 'Cl' in Clo^-_4 [1]

———— × ————