

First Year Test Exam, 2018
Ramsaday College, Amta, Howrah
Subject: Chemistry Honours
Paper-IIA
Full Marks: 50 Time: 2 hrs
CHT-11a
Unit-I

Answer any three questions

- 1.a. Mention the limitations of Bohr's theory of atomic structure and discuss the Sommerfield's extension on it. 3
- b. Explain the significance of different m_l values corresponding to $l = 1$. 2
- 2.a. The average nuclear binding energy in $^{235}_{92}\text{U}$ and its fission products are 7.6 MeV and 8.5 MeV respectively. Calculate the energy liberated in the fission of 0.5 kg of $^{235}_{92}\text{U}$. 3
- b. Determine the ground state term symbol of Co^{2+} . 2.
- 3.a. Explain the shapes of s and p orbitals in light of their angular functions. 3
- b. Give two examples of the application of radioactive isotopes in the study of structure determination and medical diagnosis. 2
- 4.a. Calculate the maximum kinetic energy of the β^- particle emitted in the radioactive decay of ^6He . Assume that the β^- has its maximum energy when no other emission accompanies the process. 3
- (Given: mass of electron = 0.00055 a.m.u, nuclidic mass of ^6He and ^6Li are 6.01889 and 6.01512 a.m.u respectively.)
- b. The slow neutrons are better projectiles compared to the fast neutrons in the nuclear fission of $^{235}_{92}\text{U}$ -why?
- 5.a. Find out the radii of first and second Bohr Orbits of Be^{3+} ion. (Given: Radius of H atom is 0.529 Å). 3
- b. State Hund's rule of maximum multiplicity. Calculate the exchange energy for d^6 system. 2

Unit-II

Answer any two questions

- 6.a. Electronegativity varies with hybridization of orbitals and oxidation number of the elements- explain with examples. 3
- b. Account for the trend in melting points ($^{\circ}\text{C}$):
 $\text{Zn}(419.5)$, $\text{Cd}(320.8)$, $\text{Hg}(-38.9)$. 2

7.a. Justify the following data : 3

Elements	1 st Ionization energy (kJ mol ⁻¹)	2 nd Ionization energy(kJ mol ⁻¹)
N	1403	2856
O	1314	3388

b. Account for the electron affinity (eV) change in the following pair:

C(1.26), N(-0.07). 2

8.a. During Mn²⁺ formation from Mn electron loss takes place from 4s orbital rather 3d orbital –Explain. 3

b. Atomic radii of Nb and Ta are almost identical but that of Cs is larger than Rb-Explain. 2

CHT-11b

Unit-I

Answer any three questions

9.a. Differentiate between equivalent and non-equivalent hybrid orbitals with specific examples of each. 3

b. Arrange and explain the solubility order of silver halides in aqueous solution. 2

10.a. Using VSEPR theory, establish the shape of the following:

i) IOF₃ ii) XeF₅⁺ iii) ICl₄⁺ 3

b. Explain the trend of thermal stability of alkaline earth metal sulphates with the help of thermochemical cycle. 2

11.a. In spite of the fact that the hypothetical NaCl₂ is expected to have higher lattice energy as compared to NaCl, it does not exist-Explain. 3

b. Draw the possible resonance structure of ClO₄⁻ and predict the most stable one. 2

12.a. Derive Born-Landé expression for Lattice energy of NaCl crystal. 3

b. Dipole moment of HBr is 2.60 x 10⁻³⁰ C.m and interatomic distance is 1.41 Å. Calculate the partial charge on the bonded atoms and find out percent ionic character. [e = 1.60 x 10⁻¹⁹ C] 2

13.a. What are the stoichiometric defects found in ionic crystals? Explain with examples. How do such defects affect the density of the crystals? 3

b. Give reasons why ZnCl₂ is soluble in organic solvents while MgCl₂ is not soluble. 2

Unit-II

Answer any two questions

14.a. Comment (with reason) on the change in acidity by adding 3

i) SbF_5 in anhydrous HF. ii) BiN in liquid NH_3 iii) CuSO_4 in aqueous solution of $(\text{NH}_4)_2\text{SO}_4$.

b. Calculate pK_a values of H_3PO_3 and HClO_4 using Pauling rule. 2

15.a. What are super acids? How is the acidity of such solutions measured? Explain with an example. 3

b. What do you mean by acid-base indicator? Elucidate with phenolphthalein. 2

16.a. Show the Lewis acidity order of the compounds BX_3 and SiX_4 ($\text{X} = \text{F}, \text{Cl}, \text{Br}$). Give reasons. 3

b. Why do Ca, Al, Ni are found as carbonate, oxide and sulphide respectively in nature? 2