RAMAKRISHNA MISSION VIDYAMANDIRA

(Residential Autonomous College under University of Calcutta)

B.A./B.Sc. FIRST SEMESTER EXAMINATION, JANUARY 2015

FIRST YEAR

Date : 07/01/2015 **CHEMISTRY(Honours)**

Time : 11 am – 12 noon **Paper :** I (Gr. C) Full Marks : 25

(*Answer <u>one</u> question from <u>each Unit</u>*)

<u>Unit – I</u>

[1×13]

1. a) What do you understand by "magic numbers"? Cite evidence in its favour from the "Binding Energy" curve.. [2+1]

   b) Explain the term Exchange energy as the basis of Hund's rule. Calculate the Exchange energy for d^6 system. [1·5+1·5]

   c) Determine the possible energy states for d^3 configuration and thereby predict the ground state term with proper reason. [2]

   d) A sample of $^{90}Sr_{38}$ ($t_{½}$ = 19·9 years) originally had an activity of 0·5 millicurie. Calculate the—

      i) specific activity of the sample and

      ii) activity of the sample after 30 years. [2+2]

   e) Energy of 4S-orbital is lower than that of 3d-orbital— why? [1]

2. a) What do you mean by 'radial distribution function'? Draw and explain the nature of 'radial probability distribution function for 3s, 3p and 3d orbitals of the H-atom. Discuss also the extent of penetration of these orbitals. [1+3]

   b) An old piece of a wooden sample has a disintegration rate, which is 30% of the disintegration rate shown by an equal weight of a new piece of wood. Find the age of the wooden sample given that $t_{½}$ for ^{14}C = 5740 years. [3]

   c) Find out the radius of second orbit of Be^{3+} ion. Given : Radius of H atom = 52·9 pm. [2·5]

   d) Give the significance of 'Azimuthal Quantum number'. [2]

   e) When an element $_{92}X$ is bombarded with slow neutron, radioactive Y is produced, which decays by beta emission to an element Z. Identify X, Y, Z. [1·5]

<u>Unit – II</u>

[1×12]

3. a) Compare and contrast between—

      i) Inert pair effect and Relativistic effect

      ii) Beryllium and Aluminium [2+2]

   b) Explain the following: [2×2]

      i) Lithium is sometimes referred to as super alkali metal and fluorine is sometimes referred to as superhalogen.

      ii) It is hard to separate Zirconium and Hafnium from their mixture.

   c) Calculate the electronegativity value of $^{33}As(III)$. Given : $r_{cov}(As^{III})$ = 120 pm. [3]

   d) Give the IUPAC naming of the element having atomic number 102. [1]

4. a) i) What do mean by 'group electronegativity'?

      ii) Which one has higher electron affinity: Li and Be? Justify your answer. [2+2]

   b) Many salts of lithium and magnesium are soluble in organic solvent—why? [2]

   c) Hg(I) exists as Hg_2^{2+} but analogous species of the lighter congeners Cd_2^{2+} and Zn_2^{2+} are not known. Explain. [2]

d) $C^{+} \rightarrow C^{2+} + e^{-}$, $B \rightarrow B^{+} + e^{-}$

Which one of the above two reactions will have higher ionisation energy value? Justify your answer. [2]

e) Amongst Mn^{3+} and Fe^{3+} which one has higher enthalpy of electron attachment and why? [2]

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