RAMAKRISHNA MISSION VIDYAMANDIRA

(Residential Autonomous College under University of Calcutta)

B.A./B.SC. FIRST SEMESTER EXAMINATION, DECEMBER 2013

FIRST YEAR

Date : 16/12/2013 **CHEMISTRY (Honours)**

Time : 11 am – 1 pm Paper : I Full Marks : 25

Group - C

[*Answer **one** question from each unit***]**

Unit - I

1. a) ^{18}F is found to undergo 90% radioactive decay in 366 min, what will be its half life? [2]
   b) i) State the uncertainty principle and explain uncertainties in energy and time situations.
   ii) What will be the uncertainty in the location of a photon of wavelength 5000Å, if the wave length is known to have accuracy of 1 part in a million? [1+2+2]
   c) Find the ground state term symbol for chromium atom. [2]
   d) $^{238}_{92}U$ by successive radioactive decays change to $^{206}_{82}Pb$. A sample of uranium ore was analysed and found to contain 1·0g of $^{238}_{92}U$ and 0·1g of $^{206}_{82}Pb$. Assuming that all $^{206}_{82}Pb$ had been formed due to decay of $^{238}_{92}U$ find the age of the uranium ore. Given $t_{½}$ of $^{238}_{92}U = 4{\cdot}5\times10^{9}$ years. [3]
   e) What do you mean by radioactive wastes? [1]

2. a) What do you mean by radial distribution function? Show diagramatically the variation of radial distribution function with 'r' for the orbitals 3s, 3p and 3d giving significance of each curve. [1+3]
   b) Justify the value of Ionisation energy of 13·6 ev for hydrogen atom. [1]
   c) What is nuclear isomerism? Give an example. [1]
   d) Show that the de Broglie wavelength, λ, of the electron wave in the nth orbit of hydrogen atom can be represented as $\lambda = 2\pi n a_0$ where a_0 is the radius of the first Bohr orbit in a hydrogen atom. [4]
   e) Explain the term 'Exchange Energy' on the basis of Hund's rule. Calculate the exchange energy for d^6 system. [1·5+1·5]

Unit - II

3. a) Although ionisation energy increases across any period, the first ionisation energy of B is smaller than that of Be. [2]
   b) Define Allred-Rochow electronegativity and state its relation with Pauling's electronegativity scale. [3]
   c) Lithium is sometime referred to as 'super alkali' metal and fluorine is referred to as 'super halogen' —Justify. [3]
   d) Explain the following : [2+2]
   i) Zr and Hf often coexist, however their separation is very difficult.
   ii) Amongst Cu, Ag and Au, formation of Auride is known.

4. a) 'There is a large decrease in electron affinity between Li and Be despite the increase in nuclear charge' —Explain. [2]
   b) Comment on the oxidation state of $T\ell$ in $T\ell I_3$. [1]
   c) Giving reasons, arrange the following ions in order of decreasing size : H^-, F^-, Cl^-, Br^- and I^-. [2]
   d) Calculate the Allred-Rochow electronegativity value of fluorine using Slater's rule. Given F-F bond distance is 1·413 Å. [2]
   e) Why do the transition metals show variable valency? [2]
   f) Write down the limitations of Slater's rule. [1]
   g) Write notes on Pauling's Univalent radii. [2]