RAMAKRISHNA MISSION VIDYAMANDIRA

(Residential Autonomous College affiliated to University of Calcutta)

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

FIRST YEAR [BATCH 2015-18]

Date : 16/12/2015 **CHEMISTRY [Hons]**

Time : 11 am – 1 pm **Paper : I [Group – C]** Full Marks : 25

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

Unit - I

1. a) "Fission reactions are different from nuclear spallation" —Explain with examples. [3]
   b) What do you mean by 'average life' of a radioelement? Establish its relation with half-life period of that radioelement. [1+2]
   c) One kilogram of an ocean sediment contains 1·50 g of U-238, 4·20 mg of Th-232 and 6×10^{-3} ml of helium. What is the age of the sediment? [3]
   d) Explain the term packing fraction and mass defect. Why packing fraction may be positive or negative whereas mass defect can not? [2+2]

2. a) Establish the de-Broglie wavelength (λ) of an electron, $\lambda = \frac{h}{\sqrt{2Vem}}$ (the terms have their usual significance). [2]
   b) What is carbon dating? Give its significance. [2]
   c) Two radioactive elements A and B are in equilibrium. The number of atoms of A is 10^9 times that of the other. If the half-life of A is 10^{10} years, what is the half-life of B? [2]
   d) Show that Bohr's postulate of quantised angular momentum for an electron moving in a circular orbit can be derived by the explanation of de-Broglie's hypothesis. [3]
   e) Suppose an electron is confined with in the nucleus of diameter 10^{-14} metre. Find the uncertainty in determination of its velocity. Hence show that an electron can never reside inside the nucleus. [2+2]

Unit - II

3. a) Define electronegativity of an element. Is it an inherent property of the free atom. Briefly state how the Pauling scale of electronegativity was formed. [1+1+2]
   b) Why Au^- is stable but Cu^- does not exist? [2]
   c) Calculate Z* for the valence electron of gold using Slater's rules. Again, assuming Allred-Rochow electronegativity of gold is 2·54, calculate Z* using Allred-Rochow electronegativity equation (covalent radius of gold is 140 pm) [2+2]
   d) Basicity of the following compounds : Me_3N > C_5H_5N > MeCN; Explain from the electronegativity point of view of Nitrogen atoms of the compounds. [2]

4. a) Find out the radius of Chlorine atom in HCl. (Given : $d_{H\text{-}Cl}$ = 128pm, $r_H = 37\,pm$, $\chi_H = 2\cdot1$, $\chi_{Cl} = 3\cdot0$] [2]
   b) It is difficult task to separate Zr and Hf from a mixture. —Why? [2]
   c) Justify the statements : [2+2]
      i) Although electron affinity of Fluorine atom is smaller than that of chlorine atom, F_2 is much more reactive than Cl_2.
      ii) Cu and Au should be included in the transitional series, although having d^{10} configuration.
   d) Comment on the stability of PbF_4 and $PbCl_4$. [2]
   e) Write down the IUPAC name of the elements having atomic no. 109 and 111. What would be their symbol? [2]

———— × ————