

RAMAKRISHNA MISSION VIDYAMANDIRA

(Residential Autonomous College under University of Calcutta)

B.A./B.SC. FIRST SEMESTER EXAMINATION, DECEMBER 2012

FIRST YEAR

CHEMISTRY (General)

Date : 21/12/2012

Time : 11.00 am – 12.00 noon

Paper : I

Full Marks : 25

Answer any one question from each Unit

Unit-I

1. a) Derive an expression for the Kinetic energy of an electron in a Bohr orbit. 3
b) Calculate the energy of an electron in the second Bohr orbit of the hydrogen atom. 2
c) Write down the symbols and names of the elements having atomic numbers 102 and 107 as recommended by IUPAC. 2
d) A sample of Uranium ($t_{1/2} = 4.5 \times 10^9$ years) ore is found to contain 11.9 g of Uranium-238 and 10.3 g of lead-206. Calculate the age of the ore. 3
e) Explain – "Zirconium (Z=40) and Hafnium (Z=72) has same atomic and ionic size". 3
2. a) Define mass defect. 2
b) Calculate binding energy per nucleon of He nucleus from the following data – 2
 mass of proton = 1.00728 amu
 mass of neutron = 1.00867 amu
 actual mass of He = 4.0015 amu
 mass of 1 amu = 931 Mev
c) Identify A, B, C, D and E in the following nuclear reactions – 2
 - i) ${}^{14}_7\text{N} + {}^4_2\text{He} \rightarrow {}^{17}_8\text{O} + \text{A}$
 - ii) ${}^1_1\text{H} + {}^7_3\text{Li} \rightarrow 2\text{B}$
 - iii) ${}^{10}_5\text{B} + {}^2_1\text{H} \rightarrow {}^{11}_6\text{C} + \text{D}$
 - iv) ${}^{35}_{17}\text{Cl} + {}^1_0\text{n} \rightarrow {}^{35}_{16}\text{S} + \text{E}$
- d) Give the values of four quantum numbers of the electrons in the p-orbitals of a Ne atom. 2
e) What do you mean by diagonal relationship? Give examples. 3
f) Which of the following orbitals are not possible: 1p, 2s, 2p, 3f. Give reasons. 2

Unit-II

3. a) Show and explain the geometry of the following compounds using VSEPR theory – 3
 - (i) H_2O (ii) SF_6
- b) Give the IUPAC names of the following – 2
 - (i) $[\text{Co}(\text{NH}_3)_5\text{Cl}]\text{Cl}_2$ (ii) $\text{Na}_2[\text{Fe}(\text{CN})_5\text{NO}]$
- c) What do you mean by chelating ligands? Give examples. 2
- d) Write down the Born-Landé equation for the lattice energy of a crystal lattice explaining the significance of the terms involved. 3
- e) Explain – "The dipole moment of NH_3 is greater than that of NF_3 ". 2

4. a) Using Born-Haber cycle, find out the lattice energy of CaF_2 from the following data – 3
- | | |
|--|-------|
| Sublimation energy of Calcium | 201 |
| First ionisation potential of Calcium | 590 |
| Second ionisation potential of Calcium | 1145 |
| Dissociation energy of fluorine | 159 |
| Electron affinity of fluorine | -335 |
| Heat of formation of CaF_2 | -1243 |
- (all the values are in kJmol^{-1})
- b) What do you mean by bond moment and dipole moment? Give examples. 3
- c) Find out the values of radius ratio for an ionic crystal having coordination number 6. 2
- d) On passing H_2S gas through a mixture of Cu^{2+} and Cd^{2+} in aqueous solution in presence of cyanide ion, only CdS is precipitated, but not CuS . Explain. 2
- e) Explain – the melting point of NaCl is higher than that of AlCl_3 . 2

