* R E - 3 5 5 9 - 6 0 / 1 0 0 *

RE-3559-60

M. Sc. (Part - II) Examination

April / May – 2010

Inorganic Chemistry : Paper - I

Time : **3** Hours] [Total Marks : **70**

Instructions :

(1)

નીચે દર્શાવેલ ☛ નિશાનીવાળી વિગતો ઉત્તરવહી પર અવશ્ય લખવી.
Fillup strictly the details of ☛ signs on your answer book.

Name of the Examination :

☛ **M. SC. (PART - 2)**

Name of the Subject :

☛ **INORGANIC CHEMISTRY - 1**

☛ Subject Code No. : **3 5 5 9** ☛ Section No. (1, 2,.....) : **NIL**

Seat No. :

Student's Signature

(2) Answer all questions.

(3) Figures to the right hand side of each question indicate full marks.

(4) Give neat and clean diagram whenever applicable.

1 (a) Discuss the theory of NMR spectroscopy. Derive equation $\gamma = w/H_0$. How spin-spin splitting differs in NMR and ESR spectroscopy? **4**

(b) Explain zerofield splitting and Kramer's degeneracy. **4**

(c) The C=O bond vibrates with a wave number of 1731 cm^{-1}. Calculate the value of the force constant for this pair of atom.
[Mass of Hydrogen mH = 1.67339×10^{-24} g). **4**

OR

1 (a) Derive the number of normal modes of vibration in carbon dioxide and ammonia molecules. **4**

(b) Define vibrational spectroscopy. Derive the energy expression for vibrational spectroscopy. What is zero field energy? **4**

(c) How infrared spectral studies can be useful to study the linkage isomerism in coordination complexes? **4**

2 (a) How NMR spectrocopy can be applied to study geometrical isomerism in metal chelates. 4

(b) Why is tetramethyl silane used as internal standard reference? How chemical shift is measured relative to TMS? 4

(c) How can intramolecular and inter-molecular hydrogen bonding be distinguished by NMR technique? 4

OR

2 (a) What do you mean by 'hyperfine' and 'super hyperfine' interactions and explain the mechanism of both type of interactions in ESR spectrum of big (salicylaldimine) copper (II). What conclusion can be drawn from this example? 9

(b) An ESR spectrometer operates at a frequency of 9.5 GHz. Calculate the strength of the applied magnetic field needed for the excitation and the energy for the excitation process. 3
[g = 2.066 and 1 GHz = 10^9 Hz)

3 (a) What is inorganic benzene? Show chemical properties of benzene and borazene are quite different. 4

(b) Explain the bonding in noble gas fluorides. 4

(c) Give brief account of clath rates of noble gases. 4

OR

3 (a) Using homogeneous catalysts discuss the following reactions. 4
(i) Oxidative addition
(ii) Reductive elimination

(b) Explain the 'synergetic effect' in metal carbonyl with suitable illustrations. 4

(c) What are metallocenes? Discuss structure and bonding in dicyclopentadynyls iron (II). 4

4 (a) Discuss synthetic reactions of high temperature species with suitable examples. 4

(b) What is metal clusters? Discuss the chemistry of binuclear metal clusters. 4

(c) What is catenation? Explain how halogens are known to form stable chain in polyhalide anaions. 4

OR

4 (a) Why is HF called acid solvent? Give photonation and self ionization reactions in HF. 4

(b) Discuss what will happen if CH_3COOH is dissolved in liquid ammonia. What ions will be formed? Give appropriate equations. 4

(c) 'Liquid ammonia is a waterlike solvent'. Justify with reference to different types of reactions studies in liquid ammonia. 4

5 (a) Show how free radicals are useful in the study of photochemical kinetics. 4

(b) Explain photophysical process in detail. 3

(c) Organic molecule has an absorption band with $\lambda_{max} = 365\,nm$. Calculate the amount of energy absorbed to promote one mole of organic molecule to the first excited state. 3

OR

5 (a) What is Frank-Condon Principle? Explain primary and secondary process in photochemical reactions. 3

(b) What is photochemistry? State and explain the laws of photochemistry. 4

(c) What is life time of excited state? Discuss the kinetic aspects of photochemical process. 3

6 Write notes on (any three) 12

(i) Schielding mechanism in NMR.

(ii) Crypton compounds

(iii) Relaxation process in ESR measurements

(iv) Chemiluminescence

(v) Lanthenide Shift reagents

(vi) Precipitation reactions in liquid ammonia.