

**M. SC. CHEMISTRY EXAMINATION, 2018**

( 3rd Semester )

**ADVANCED GENERAL CHEMISTRY I**

**PAPER - IX**

Time : Two hours

Full Marks : 50

( 25 marks for each unit )

Use a separate answerscript for each unit.

**UNIT - 3091**

1. Answer any five questions .  $5 \times 2 \frac{1}{2} = 12 \frac{1}{2}$
- a) Explain Surface plasmon resonance. What are the conditions to get this band?
  - b) Explain anomalous melting point for nanosized particles with suitable example.
  - c) Increase in magnetization of ferrimagnetic metals is observed with decrease in size from bulk to nanophase. – Explain.
  - d) Explain arm chair carbon nanotube. What are the special properties of carbon nanotube ?
  - e) Explain different types of liquid crystals with their characteristics.
  - f) What are the manifestation of quantum confinement effect for nanoparticles?

[ Turn over

[ 2 ]

2. a) How does Flory -Huggins theory takes into the account of intermolecular interactions in derivation of free energy of mixing?

**Or**

Show that the viscosity average molecular weight of a polymer is given by,  $\bar{M}_v = \left[ \frac{\sum N_i M_i^{1+a}}{\sum N_i M_i} \right]^{1/a}$ , where the various symbols have their usual meaning.

- b) The radial distribution function  $\omega(r)$  of end to end distance 'r' for an isolated flexible polymer chain is given by,  $\omega(r) = 4\pi \left[ \frac{\beta}{\sqrt{\pi}} \right]^3 r^2 \exp(-\beta^2 r^2)$ , where  $\beta = \left[ \frac{3}{2nl^2} \right]^{1/2}$ , in which  $n$  is the number of links of length  $l$  forming the chain. Find the average end to end distance terms of  $n$  and  $l$ .

**Or**

Show that mass average molar mass is given by  $\bar{M}_w = \frac{(1+p)}{(1-p)} M_1$ . The various symbols have their usual meanings.

- c) Light scattering measurement was carried for HSA in 0.1 KI at pH 6.7. The wavelength was set at 546 nm. The following data were obtained :

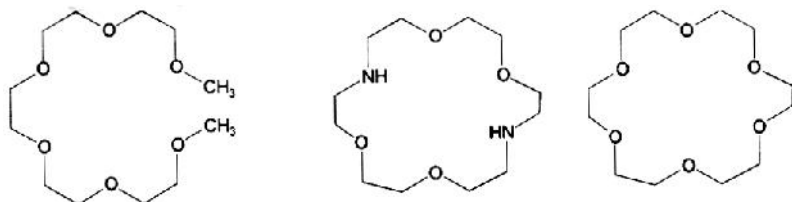
$10^3 C/g \text{ cm}^{-3}$	0.936	1.902	2.801
$10^4 \tau / \text{cm}^{-1}$	2.880	5.750	8.180

[ 5 ]

- c) Determine the structure of the carbonyl cluster,  $[\text{Ir}_4(\text{CO})_{12}]$  with the aid of Wade's rule.
- d) Determine the structure of the metalloborane,  $[2 - \{\text{Co}(\eta^5 - \text{Cp})\}_3 \text{B}_4\text{H}_8]$  and  $[\text{Co}_3(\text{CO})_9\{\text{Ni}(\text{Cp})\}]$ . 1×4
6. a) Calculate the *styx* number and draw the VB structure of the following (*any three*):  
 $\text{B}_2\text{H}_7^-$ ,  $\text{B}_3\text{H}_9$ ,  $\text{B}_3\text{H}_6^+$  and  $\text{B}_5\text{H}_5^{2-}$
- b) Predict the structural type with the aid of Wade's rule :  
 $[\text{I}_3 - \text{C}_2\text{B}_7\text{H}_{12}]^-$ ,  $[\text{B}_{11}\text{H}_{12}\text{N}]$ , and  $\text{B}_3\text{H}_7[\text{Fe}(\text{CO})_3]_2$
- c) Determine the number of metal-metal bonds in the following clusters :  
 $[\text{WCl}_2(\text{PPh}_3)_2]_2$ ,  $[\text{Mo}_2(\mu_2 - \text{OAc})_4]$ ,  $[\text{Rh}_4(\text{CO})_{12}]$  and  
 $[\text{Ru}_4(\text{CO})_{12}]^{2-}$  3+3+2 = 8

[ 4 ]

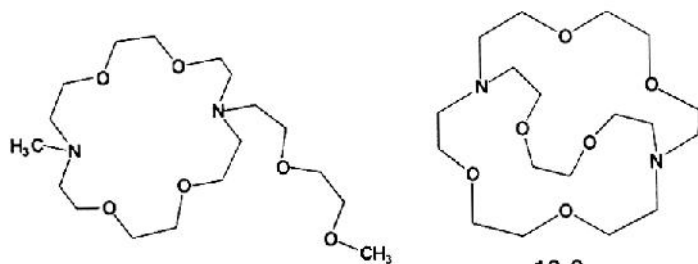
- c) Discuss different types of  $\pi$ - $\pi$  stacking. How can  $\pi$ - $\pi$  stacking be attractive and repulsive?
- d) What are katapinands? Discuss entropic contributions in anion host design.
- e) The logarithms of the  $K^+$  binding constants ( $M^{-1}$ , in MeOH at 25 °C) for the hosts are shown below. Explain this large variation.



2.3

2.04

6.08



4.8

10.0

4. Give one suitable example of closed shell interactions. 1
5. a) Write the IUPAC nomenclature of  $[B_6H_6]^{2-}$ .
- b) Determine the structure and number of capping group in  $[Os_7(CO)_{21}]$  and  $[Os_{10}(CO)_{27}]$ .

[ 3 ]

The value of refractive index of the solvent was 1.3342 and  $\frac{dn}{dc}$  was found to be  $0.168g^{-1}cm^3$ . Determine molar mass and the second virial coefficient.

**Or**

For the following data on the sedimentation equilibrium study at 12.4°C calculate molar mass. Rotation speed of the rotor = 15000 rpm;  $\rho/\rho_2=0.723$ .

r(cm)	6.827	6.917
C(arbitrary unit)	3.52	5.52

The terms have their usual significance.

- d) Write short note on Vapour Pressure Osmometry.

$$4+3+3+2\frac{1}{2}$$
**UNIT - 3092**

3. Answer any three questions 4×3=12
- a) What do you mean by self - assembly? Discuss briefly about different classes of self-assembly.
- b) What do you mean by template effect? How does thermodynamic template effect differ from kinetic effect? Give examples.

[ Turn over