

M. Sc. CHEMISTRY EXAMINATION, 2017

(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 - 30911. Answer **any three** questions : 4×3

- Explain the factors that affect the growth of nanostructures. Give some examples of common stabilizers. What are the roles of stabilizer during synthesis of nanoparticles ?
- What are the differences between thermotropic and lyotropic liquid crystals ? Smectic state is more solid like than nematic : Explain.
- Define nanocomposite material. How many types of nanocomposite materials are found ? Why are polymer nanocomposites unique ?
- What are the differences in measurement of particle size by TEM and SEM ? How is the surface of a nanoparticle characterized by AFM technique ?

[Turn over

- How are macrocyclic ligands synthesized in the absence of any templates ? Discuss properly.
 - What are the main challenges in designing of hosts for anions ? How can a host for cation be changed to a host for anion ? Give suitable example.
4. a) What do you mean by "Naked Cluster" ? 1×5
- b) Determine the structure and number of capping group in $[\text{Os}_8(\text{CO})_{22}]^{2-}$ and $[\text{Os}_3(\text{CO})_{12}]$
- c) Establish a relation between a closo and the corresponding *nido* structures.
- d) Determine the structural type of the clusters
- $$\text{H} \quad \text{H}_2\text{Ru}_6(\text{CO})_{18}$$
- e) Determine the number of metal-metal bonds in
- $$\text{M} \quad \text{e}$$
5. a) Calculate the *styx* number and draw the VB structure of the followings (**any two**) :
- $$\text{B}_3\text{H}_7, \text{B}_4\text{H}_{10}, \text{B}_3\text{H}_8^-, \text{and } \text{B}_6\text{H}_6^{2-} \quad 3$$
- b) Predict the structural type with the aid of Wade's rule (**any two**) :
- $[\text{3-Me-2CB}_5\text{H}_8]$,
 - $[\text{B}_{11}\text{SH}_{10}\text{Ph}]$, $\text{B}_6\text{H}_{10}(\text{PMe}_3)_2$ and
 - $[\text{C}_2\text{B}_4\text{H}_6(\text{GaMe})]$ 2
- c) Discuss briefly the syntheses of metal carbonyl clusters. 3

[2]

- e) Explain the synthesis process of AgCl nanoparticles using microemulsion technique.
2. a) The radial distribution function $\omega(r)$ of end to end distance 'r' for an isolated flexible polymer chain is given

$$\text{by } \omega(r) = 4\pi \left[\frac{\beta}{\sqrt{\pi}} \right]^3 r^2 \exp(-\beta^2 r^2), \text{ where } \beta = \left[\frac{3}{2nl^2} \right]^{1/2}$$

in which n is the number of links of length l forming the chain. Find the most probable and root mean square and mean value of r in terms of n and l .

5

Or

How does Flory-Huggins theory take into account of difference in size between solvent and polymer molecules in the derivation of entropy of mixing? What are the limitations of Flory-Huggins theory?

- b) Show that the number average molar mass is given by

$$M_n = \frac{M_1}{(1-p)}, \text{ where symbols have their usual meanings.}$$

3

- c) Relative viscosities of solution of a sample of a compound in toluene were determined with an Ostwald viscometer at 25°C.

$c/10^{-2} \text{g cm}^{-3}$	0.249	0.499
η/η_0	1.355	1.782

[3]

Find viscosity average molar mass. Given Mark Houwink parameters : $k = 3.7 \times 10^{-2}$ and $a = 0.62$. Other terms have their usual significances.

Or

Write a short note on Donnan membrane equilibrium.

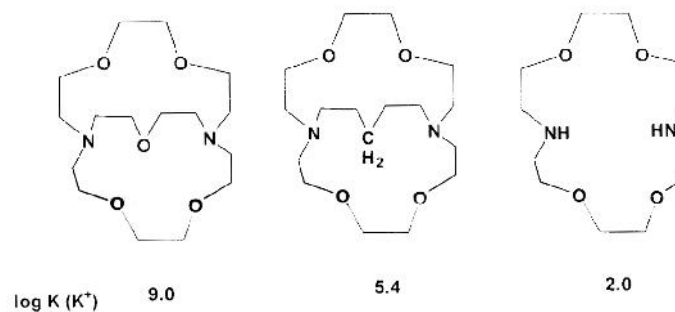
- d) Describe the method of 'vapour pressure osmometry' for the determination of molecular weight of a polymer.

2

UNIT - 3092

3. Answer **any three** questions : 4×3

- a) Define hydrogen bond. Write down the criteria for hydrogen bond.
- b) Make brief explanatory note on pre-organisation and complementarity.
- c) The logarithms of the K^+ binding constants ($M^{-1} \cdot \text{MeOH}$ 25 °C) for three hosts are shown below. Explain this large variation.



2.0

log K (K⁺)

9.0

5.4

[Turn over