2014-15  
M. Sc. (I SEMESTER) EXAMINATION  
(Polymer Science & Technology)  
PHYSICAL CHEMISTRY  
(AC – 511)  
(Credits – 04)

Maximum Marks: 70  
Duration: Two Hours

Answer all the questions.  
Assume suitable data if missing.

1. Attempt any THREE of the following: [06×3]
   
   (a) Name the different methods used for the determination of rate law. Describe the differential method.
   
   (b) What is Arrhenius equation? The activation energy of catalysed and non-catalysed reactions at 37°C are 25.10 and 83.68 kJ/mol respectively. Calculate the ratio of the rate constant of the catalysed and non-catalysed reactions. Assume that Arrhenius pre-exponential is same for both the cases. (Given R = 8.314 JK⁻¹mol⁻¹)
   
   (c) Discuss the transition state theory. Derive its mathematical form.
   
   (d) Write note on ‘Oscillatory Chemical Reactions’.

2. (a) Define the following terms: [02×3]
   
   i) Ensemble
   
   ii) Configuration
   
   iii) Partition function

2(b) Describe the vibrational and electronic partition functions of an ideal gas. [06]

OR

2(b') Calculate the translational partition function for benzene (molar mass 78 g/mole) in a volume of 1 m³ at 25°C. [06]

2(c) Calculate the number of ways of distributing four molecules in four energy levels so as there are 2 molecules in the energy level E₂, 1 molecule in energy level E₁, 1 molecule in the energy level E₂ and 0 in the E₃ energy level. [05]

3. (a) Define the following terms: [02×3]
   
   i) Chemical potential
   
   ii) Activity coefficient
   
   iii) Raoult’s law

Proof:

Contd....2.
3(b) Derive Gibb's Duhem-Margules equation to relate the composition of the mixtures in the liquid phase with the partial vapour pressure in the gas phase.

3(c) Derive an expression for determination of fugacity of a gas.

OR

3(c') A system of N particles has among others, two energy levels with \( g_1 = 2 \), \( g_2 = 3 \), \( E_1 = 640 \text{J} \), \( E_2 = 748 \text{J} \). Calculate the ratio of the number of particles in the two energy states where \( K \) is unity at 1000K.

4(a) Discuss the effect of nature of solvent on the rate of a chemical reaction.

(b) Write notes on any TWO of the following:
   (i) Relaxation time method for the study of fast reactions
   (ii) Cohesive energy density
   (iii) Primary salt effect
Q.No. | Question                                                                 | M.M. |
--- | ------------------------------------------------------------------------ |------|
1(a) | Define aromaticity. Describe non-aromaticity, antiaromaticity and homoaromaticity with the help of a suitable example from homocyclic and heterocyclic compounds. | [06] |
1(b) | Explain the mechanism of any one the following reactions.               | [06] |

(i) 

\[
\text{OH} + \text{CH}_3 - \text{CH} - \text{CH} - \text{CH}_3 \xrightleftharpoons{\text{AlCl}_3} ?
\]

(ii) 

\[
\text{Cl} \xrightarrow{\text{NaNH}_2, \text{Liq. NH}_3} ?
\]

1(c) | Give the major products of any two of the following reactions with suitable justification for the same | [06] |

(i) 

\[
\text{Cl} + \xrightarrow{\text{HNO}_3, \text{H}_2\text{SO}_4} ?
\]

(ii) 

\[
\text{OH} + \xrightarrow{\text{HNO}_3, \text{H}_2\text{SO}_4} ?
\]

(iii) 

\[
\text{CH}_3 + \xrightarrow{\text{Br}_2, \text{FeBr}_3} ?
\]

2(a) | Define reaction mechanism. Discuss any two methods for the determination of mechanism of reactions. | [06] |
2(b) | Define the Hammet equation to correlate the substituent and reaction constant. | [05] |
2(c) Write explanatory notes on any three of the followings:
   i) Hammond’s postulate
   ii) Isotopic labelling
   iii) Steric effects in substitution reaction
   iv) Reactivity of carbocation

3(a) Write the mechanism for the reaction of an aldehyde/ketone with alpha halocster.
3(b) Give the formation of primary, secondary and tertiary alcohols by the reaction of carbonyl compounds and Grignard reagent.

3(c) Write short notes on any three of the followings:
   i) Darzen glycidic condensation
   ii) Formation of enols and enolates ions
   iii) Alkylation and acylation of enamines
   iv) Acyloin condensation

4(a) Write the mechanism of any three of the followings:
   i) Peterson reaction
   ii) Heck reaction
   iii) Suzuki reaction
   iv) Glaser coupling reaction

4(b) Write any four of the followings reactions:
   i) Hydroboration of alkene
   ii) Epoxidation of alkene
   iii) Oxymercuration of alkylene
   iv) Hydrogenation of alkylene
   v) Hydration of alkylene
2014-15
M.Sc. I SEMESTER EXAMINATION
(Polymer Science & Technology)
INORGANIC CHEMISTRY
(AC-513)

Maximum Marks: 70  
Credits: 04  
Duration: Two Hours

Answer all the questions.
Assume suitable data if missing.
Notations used have their usual meaning.

Q.No.  
Question  

1(a)  
What are carboranes? How are they synthesized? Mention different forms of carboranes according to Wade’s rule.

1(b)  
Write short notes on any two of the followings:

(a) Noble gas compounds
(b) Interhalogen pseudo halides
(c) Sulphur nitrogen compounds

1(c)  
Discuss the synthesis of the followings:

(a) Borazines
(b) Phosphazenes
(c) Oxyacids of phosphorus (Any two)

2(a)  
State the rules of nomenclature for coordination compounds. Using the rules, name the following coordination compounds:

(a) [Co(en)₂Cl₂]NO₃
(b) [Ag(NH₃)₂][Ag(CN)₂]

2(b)  
Give the molecular formula of the following coordination compounds:

(a) Bisethylenediaminedinitrilotiron(IV)sulphate
(b) Ammoniumdiaquabis(oxalato)nickelate(II)

2(c)  
Write a detailed account on formation constant and the factors influencing stability of coordination compounds.

2(d)  
Write short notes on any two of the followings:


Contd.... 2.
(a) Isomerism in coordination compounds
(b) Chelate and macrocyclic effect
(c) Valence bond theory

3(a) Give the names of the following organometallic complexes:

(i) [Diagram of molecule]

(ii) [Diagram of molecule]

(iii) [Diagram of molecule]

(iv) [Diagram of molecule]

3(b) Explain in detail the structure and preparation of organolithium and organo-aluminium compounds.

OR

3(b)' What are metal carbonyls? Give a detailed account of their preparations.

3(c) Describe the classification of organometallic compounds of transition metals.

OR

3(c)' Write short notes on the followings:
   (a) π- metal olefins
   (b) π acid metal complexes

4(a) Give the classification of metal ions according to their importance in biological systems.

4(b) Draw the schematic diagram of sodium-potassium pump and discuss its mechanism.

4(c) Discuss the functions and structure of cytochromes.

4(d) Write short notes on any two of the followings:
   (a) Carboxypeptidase
   (b) Hemerythrin
   (c) Hemocyanin
2014-15
M.Sc. (I SEMESTER) EXAMINATION
(POLYMER SCIENCE AND TECHNOLOGY)
(AUTUMN SEMESTER)
ANALYTICAL CHEMISTRY
(AC-514)
Credits: 04
Maximum Marks: 70
Duration: Two Hours

Answer all the questions.

Q.No. Question

1. Attempt any two of the following.
   (a) What is digestion of a precipitate and why it is necessary?
   (b) Orthophosphate (PO₄³⁻) was determined by weighing as ammonium phosphomolybdate (NH₄)₂PO₄.12MoO₃. Calculate the percentage of phosphorous in the sample and the percentage of P₂O₅ if 1.523 g precipitate was obtained from 0.321 g sample.
   (c) (i) Is the pH at the end point for the titration of weak acid verses strong base neutral, alkaline or acidic? Why?
       (ii) Distinguish between: end point and equivalence point; primary and secondary standards

OR

1'. (a) What is precipitation titration? Explain the titration of chloride ions with standard AgNO₃ with the help of titration curve.
   (b) Describe the ways in which end points of redox titrations may be detected by potentiometric technique.

2. (a) Define chromatography. How chromatographic techniques are classified on the basis of stationary and mobile phases?
   (b) Describe the characteristics of ion-exchange resins. Discuss the application of ion-exchange resins for the preparation of demineralized water.

3. (a) With the help of schematic diagram describe the principle of scanning electron microscopy (SEM).
   (b) What is coulometry? State the types of coulometric methods and instrumentation involved in potentiometric coulometry.

4. (a) Define error. Describe various types of errors.
   (b) Explain the comparison of two means of data by T-test.
   (c) Describe Neutron activation analysis.

OR

4'. (a) Discuss different methods of radio-dating. Explain isotope dilution method in detail.
   (b) Define saponification value and bromine number.
   (c) Discuss the methods for estimation of blood cholesterol.