



Reg. No. :

Name :

First Semester M.Sc. Degree Examination, February 2019

Branch : Chemistry

CH/CL/CM/CA 213 : PHYSICAL CHEMISTRY – I

(2013 – 2015 Admissions)

Time : 3 Hours

Max. Marks : 75

SECTION – A

Answer **any two** among (a), (b) and (c) from **each** question. **Each** sub question carries **2** marks.

- a) What is zero point energy ? Give an expression for this in case of simple harmonic oscillator.

b) Explain uncertainty principle and its consequences.

c) Comment on the statement that the particle in a one-dimensional box is never at rest.
- a) Define symmetry elements and symmetry operations.

b) Define a subgroup. Give 2 possible subgroup of D_{2h} .

c) How many irreducible representations are possible for C_{3v} and C_{2h} point groups ?
- a) Explain Konowaloff's law.

b) Write down Gibbs-Duhem-Margules equation and explain its significance.

c) Explain the term fugacity. What is the physical significance of fugacity ?
- a) How the energy of activation can be determined experimentally ?

b) Derive Arrhenius equation. What are Arrhenius parameters ?

c) Explain the terms branching chain and explosion limits.





5. a) Explain the mesomorphic behavior of liquid crystals.
b) Discuss how avagadro number is determined from Brownian movement.
c) Explain the term mean free path of a gas molecule. **(2×10=20 Marks)**

SECTION – B

Answer either (a) or (b) of **each** question. **Each** question carries **5** Marks.

6. a) Energy of a particle of mass m in cubic box of length L is $9h^2/8mL^2$. Find the wave function corresponding to this. Also find the degeneracy.
b) Construct the kinetic energy and angular momentum operators.
7. a) State the conditions for two symmetry operations to commute. Write 4 pairs of symmetry operations that always commute.
b) Classify the operations of D_{4h} group into classes and predict the types of irreducible representations in the group.
8. a) Derive any four Maxwell relations. What is the significance of Maxwell relations ?
b) Describe how Nernst heat theorem has been extended to deduce the Third law of thermodynamics. Explain how the absolute entropy of a substance is determined using third law.
9. a) Explain the relaxation method for the study of fast reactions.
b) Briefly explain the Rice Herzfeld mechanism for organic decomposition reactions taking a specific example.
10. a) Explain the effect of temperature and pressure on transport properties of a gas.
b) Discuss the application of XRD in studying the structure of liquids.

(5×5= 25 Marks)





SECTION – C

Answer **any three** questions. **Each** question carries **10** marks.

11. Set up and solve the Schrodinger equation of motion for a SHO. Deduce the expression for energy and wave functions.
12. State Great Orthogonality Theorem and apply this to construct the character table for C_{3v} point group.
13. Define partial molal property. Explain how would you determine the following :
 - a) Partial molal volume
 - b) Partial molal enthalpy of a component in a binary system. **(5+5)**
14. a) Discuss the Semenov-Hinshel wood mechanism of chain reactions and explosion.
 - b) Explain the concept of potential energy surface. **(5+5)**
15. a) Explain and discuss how the viscosity of gas determined.
 - b) Discuss the different applications of liquid crystals. **(5+5)**

(10×3=30 Marks)

