

# PC-10828/N

M-64/2110

PHYSICAL CHEMISTRY

Paper – 103

(Semester-I)

(Syllabus Dec., 2019)

Time : Three Hours]

[Maximum Marks : 55

**Note :** Attempt *two* questions each from Section A and B  
Section C will be compulsory.

## SECTION – A

I. (a) Obtain, Thermodynamic equation of state

$$\left(\frac{\partial H}{\partial P}\right)_T = V - T\left(\frac{\partial V}{\partial T}\right)_P.$$

(b) Show that for an ideal gas, internal pressure

$$\left(\frac{\partial V}{\partial V}\right)_T = 0. \quad (4,4)$$

II. (a) Discuss the role of Free energy in metabolism.

(b) Explain the term fugacity. How can it be determined  
for real gases at low pressures? (3,5)

- III. (a) Using statistical considerations, obtain expression for Maxwell-Boltzmann distribution law.
- (b) Establish relation between Partition, function and Enthalpy. (5,3)
- IV. (a) State and explain Macro as well as microstates with suitable example.
- (b) Briefly introduce Fermi-Dirac statistics. State the conditions under which Maxwell-Boltzmann, Bose-Einstein and Fermi-Dirac statistics become identical. (3,5)

### SECTION – B

- V. (a) Discuss in detail Born model of ion-solvent interaction. Also discuss its applicability and limitations.
- (b) Write a note on Debye-Huckel limiting law. (5,3½)
- VI. (a) How salt-solvent interaction data are utilized for estimating ion-ion interactions? Explain.
- (b) Derive an equation which explain the effect of ion-association on equivalent conductance in a non-aqueous solution. Also discuss how does the equivalent conductance for aqueous solution differs from non-aqueous solution? (4,4½)
- VII. Discuss in detail adsorption theory of double layer. (4½)
- (a) Also discuss its applications and limitations.
- (b) Write a note on Fuel cells. (4)

VIII. Write a note on the followings :

- (i) Electricity storers and their applications.
- (ii) Electrocatalysis in redox reactions and reactions involving adsorbed species. (3½,5)

### SECTION – C

#### (Compulsory Question)

IX. Answer the followings in brief :

- (a) Discuss the limitations of a First Law of Thermodynamics.
- (b) Explain, why work is not a state function?
- (c) State and explain coupled reactions.
- (d) Establish relation between Entropy and Probability.
- (e) Define Partition function. State the conditions under which it can be factorized?
- (f) Define characteristic vibrational temperature. Discuss its significance.
- (g) What is meant by Electricity storage density? Explain.
- (h) Explain in brief, "Passivation of metals".
- (i) Define excess functions. Also discuss their significance.
- (j) Explain the terms, Ionic conduction and Energy conduction.
- (k) Discuss the need of statistical mechanics. (2×11=22)