

PSG COLLEGE OF ARTS & SCIENCE  
(AUTONOMOUS)

MSc DEGREE EXAMINATION MAY 2024  
(First Semester)

Branch – CHEMISTRY

THERMODYNAMICS, ELECTROCHEMISTRY AND PHASE EQUILIBRIUM

Time: Three Hours

Maximum: 75 Marks

SECTION-A (10 Marks)

Answer ALL questions

ALL questions carry EQUAL marks

(10 x 1 = 10)

- The equation relating E, P, V and T which is true for all substances under all conditions is given by  $(\partial E/\partial V)_T = T(\partial P/\partial T)_H - P$ . This equation is called -----.  
a) Maxwell's equation  
b) Thermodynamic equation of state  
c) Equation of state  
d) Redlich-Kwong equation of state
- The activity coefficient for non ideal solution is \_\_\_\_\_.  
a) less than 1  
b) greater than 1  
c) equal to 1  
d) none of the above
- $\text{CO}_2(\text{g}) + \text{C}(\text{s}) \rightleftharpoons 2\text{CO}(\text{g})$  is an example of \_\_\_\_\_.  
a) homogeneous equilibrium  
b) heterogeneous equilibrium  
c) neither homogeneous nor heterogeneous  
d) both homogeneous and heterogeneous
- The equilibrium constant at 427°C for the reaction:  $\text{N}_2(\text{g}) + 3\text{H}_2(\text{g}) \rightleftharpoons 2\text{NH}_3(\text{g})$  is  $K_p = 9.4 \times 10^{-5}$ . Calculate the value of  $\Delta G^\circ$  for the reaction at 427°C.  
a) -33 kJ  
b) -54 kJ  
c) 54 kJ  
d) 33 kJ
- As temperature increases electrolytic conduction-----.  
a) increases  
b) decreases  
c) remains unaffected  
d) none of the above
- Debye-Huckel limiting law is applicable only for \_\_\_\_\_.  
a) dilute solution of strong electrolytes  
b) strong solution of strong electrolytes  
c) dilute solution of weak electrolytes.  
d) strong solutions of weak electrolytes
- The combination of two layers of opposite charges around the colloidal particle is called Helmholtz electrical double layer. The potential difference between the fixed layer and the diffused layer of opposite charge is called-----.  
a) Electrode potential  
b) Zeta potential  
c) Adsorption potential  
d) Diffused potential
- What gets deposited on the plates of a discharged lead-acid battery?  
a)  $\text{PbO}_2$   
b)  $\text{Pb}_2\text{O}_4$   
c) Pb  
d)  $\text{PbSO}_4$
- For the water system, what is the number of phases at the triple point?  
a) 0  
b) 3  
c) 2  
d) 1
- The formula for condensed phase rule is \_\_\_\_\_.  
a)  $F = C - P + 2$   
b)  $F = C + P - 1$   
c)  $F = C + P - 2$   
d)  $F = C - P + 1$

SECTION - B (35 Marks)

Answer ALL Questions

ALL Questions Carry EQUAL Marks

(5 x 7 = 35)

11. a) Derive Gibbs-Duhem equation. Write the applications of it.

[OR]

- b) Explain the concept of Fugacity.

Cont...

12. a) Discuss the significance of equilibrium constant.  
[OR]  
b) Illustrate the apparent exception to third law.
- 13.a) Outline the experimental verification of Debye-Huckel Onsager equation.  
[OR]  
b) Describe on Conductometric titrations.
14. a) Predict the structure of Stern model of electrical double layer.  
[OR]  
b) Discuss on sedimentation potential.
15. a) Derive Gibbs phase rule.  
[OR]  
b) Draw and explain the phase diagram for two component system.

**SECTION -C (30 Marks)**

Answer ANY THREE questions  
ALL questions carry EQUAL Marks

(3 x 10 = 30)

16. Explain the determination of activity and activity coefficients of non electrolyte.
17. State Le-Chalier's principle. Illustrate its applications.
18. Explain the followings: (5+5)  
i) Debye-Huckel limiting law  
ii) Zeta potential.
19. Describe the theories of overvoltage.
20. Illustrate the formation of one, two and three pairs of partially miscible liquids.

Z-Z-Z

END