

Date : 27/10/2007
Time : 9:00 - 12:00

Dept. No.

Max. : 100 Marks

PART – A

Answer all the questions.

(10 x 2 = 20)

1. State the first law of Thermodynamics. Give its mathematical statement and explain the terms involved.
2. Two van der Waals gases have the same value of 'b' but different 'a' values. Which of these occupy lesser volume under identical conditions.
3. Distinguish between state function and path function.
4. Two moles of an ideal gas expands isothermally and reversibly at 300 K to twice its original volume, calculate the workdone . (R = 8.314 J K⁻¹ mol⁻¹.)
5. Define heat of formation and heat of neutralization.
6. Define Carnot's theorem and Thermodynamic efficiency.
7. At 500⁰ C the reaction between N₂ and H₂ to form NH₃ has K_c = 6.0 x 10⁻². Calculate K_p for the reaction (R= 0.0821 lit. atm. K⁻¹ mol⁻¹).
8. Explain the terms i). Eutectic point and ii). Triple point.
9. Define Nernst Distribution law and state the condition under which the law is strictly valid.
10. 0.1 M aq. solution of KNO₃ shows an osmotic pressure of 4.5 atm at 300K , while the calculated one is 2.5 atm. What is the van't Hoff factor 'i' for the solution.

PART – B

Answer any Eight questions

(8 x 5 = 40)

11. Define C_p and C_v. Derive the relationship between them for an ideal gas.
12. Prove that TV^{γ-1} = constant for an adiabatic reversible expansion of an ideal gas.
13. Give the postulates of Kinetic theory of gases.
14. Derive Kirchoff's equation.
15. a). Define law of mass action.
b).The standard free energy for the reaction
$$\text{N}_2(\text{g}) + \text{O}_2(\text{g}) \rightleftharpoons 2\text{NO}(\text{g})$$
is 173.1kJ. Calculate K_p for the reaction at 25°C.
16. Draw the phase diagram of a typical three component system and describe it.
17. Discuss van't Hoff theory of dilute solutions. What is van't Hoff factor.

18. A solution of 8.585g of sodium nitrate freezes at -3.04°C . Calculate the molecular mass of sodium nitrate and account for the abnormal value. K_f for water is $1.86\text{ K}_g\text{K}_{mol}^{-1}$.
19. Define Raoult's law and Henry's law . How are they related?
20. Define osmotic pressure. Describe a method of determining it.
21. Write notes on azeotropic distillation.
22. Derive van't Hoff equation.

PART – C

Answer any four questions.

(4 x 10 = 40)

23. Describe Carnot's Cycle and derive expressions for the network done and efficiency.
24. a) Derive Gibb's –Helmholtz equation and give its importance.
b) Two moles of an ideal gas are allowed to expand reversibly and isothermally at 300 K from a pressure of 1 atm. to a pressure of 0.1 atm. What is the change in Gibb's free energy?
25. a) Derive thermodynamically phase rule.
b) Draw the phase diagram of lead – silver system and explain.
26. a) Derive a relationship between molecular weight and molal depression constant.
b) Describe Beckmann method of determination of molecular weight of the solute.
27. a) Explain Le-Chatelier –Braun principle, applying it to the formation of ammonia.
b) Derive a relationship between K_p and ΔG .
28. a) Derive Clayperon – Claussius equation.
b) At what temperature will water boil under a pressure of 787 mm? The latent heat of vapourisation is 536 cal. g^{-1} .

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