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Reg. No. : ....

Name : ....

Fifth Semester B.Sc. Degree Examination, December 2022

First Degree Programme under CBCSS

Chemistry

Core Course VII

CH 1543 : PHYSICAL CHEMISTRY II

(2013–2016 Admission)

Time : 3 Hours   Max. Marks : 80

SECTION – A

Answer **all** questions. Each question carries **1** mark.

1. A dimensionless quantity which expresses how the energy of a system of molecules is partitioned among the molecules is called —————.

2. The number of modes of vibration of acetylenes is —————.

3. The instrument used to observe colloidal parholes is —————.

4. Names the colloidal system in which dispersed phase is liquid and dispersion medium is solid

5. A mathematical symbol for a rule for transforming a given mathematical function into another function is called —————.

6. Names the molecular spectroscopy used to determine the functional group in organic compounds.

7. The wave length of yellow radiation is 5800 Å. Its frequency is ————.

8. Write down the selection rule of rotational transitions for a rigid diatomic molecule.

9. The dipole moment of BF_3 molecule is ———— D.

10. How does optical exaltation varies with the extent of conjugation?

(10 × 1 = 10 Marks)

SECTION – B

Answer any **eight** questions. Each question carries **2** marks.

11. What is Nernst Heat Theorem?

12. Write down the relation connecting entropy(s) and thermodynamic probability, W.

13. What is Zeta potential?

14. Write down Freundlich adsorption isotherm and explain the terms involved.

15. Write down Plank's equation for radiation and explain the terms involved.

16. What is Born-Oppenheimer approximation?

17. State Mutual exclusion principle.

18. Define (a) Chemical shift (b) Spin-spin coupling constant

19. Sketch csr spectrum of methyl radical.

20. Write down Morse equation and explain the terms involved.

21. What are singlet and triplet states?

22. What are paramagnetic substances? Give any two examples.

(8 × 2 = 16 Marks)

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SECTION – C

Answer any **six** questions. Each question carries **4** marks.

23. What are (a) Micro canonical ensemble (b) Canonical ensembles. How are they related to thermodynamic systems?

24. How are enthalpy and entropy related to partition function?

25. Give any four differences between physisorption and Chemisorption.

26. What are elastic and non-elastic gels? Give one example for each.

27. What are cell behaved wave functions? Explain.

28. What is meant by the concept of degeneracy? Write down the expression for energy of a free parhole in a three dimensional cubic box and explain degeneracy with respect to cubic box.

29. State Hooke's law. What is meant by simple Harmonic Oscillator? Write down the expression for Vibrational energy of a simple harmonic oscillator and explain the terms involved.

30. Sketch and predict the high resolution proton-NMR spectrum of ethyl benzene.

31. Explain the terms (a) Parachor (b) Molar refraction.

(6 × 4 = 24 Marks)

SECTION – D

Answer any **two** questions. Each question carries **15** marks.

32. (a) Write down Lewis Randall statement of third law of thermodynamics. **2**

    (b) What is partition function? What is its dimension? **3**

    (c) Derive relations between partition function and following thermodynamic properties (i) Internal energy (ii) Pressure (iii) Enthalpy (iv) Free energy function. **10**

33. (a) Give any four differences between true solution, colloid and suspension. **4**

(b) Explain optical and kinetic properties of colloids. **8**

(c) Define with examples the terms dialysis and electrodialysis. **3**

34. (a) What are the postulates of quantum mechanics? **8**

(b) Write down the Schrodinger wave equation in three dimensions and derive the expressions for normalised wave function and energy of a free parhole. **7**

35. (a) Calculate and compare the energies of two radiations, one having wave length 800 nm and the other 400 nm. **4**

(b) Derive the expressions for (i) moment of inertia (ii) rotational energy of a diatomic rigid rotator. **7**

(c) The rotational spectrum of gaseous HBr has a series of equispaced lines separated by 16.94 cm^{-1}. Calculate the moment of inertia and bond length for HBr (atomic masses of H = 1.008, Br = 79.909) **4**

(2 × 15 = 30 Marks)

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