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B – 1442

Reg. No. : .....

Name : .....

Fifth Semester B.Sc. Degree Examination, November 2016
First Degree Programme under CBCSS
CHEMISTRY
Core Course – VII
CH1543 : Physical Chemistry II
(2013 Admission Onwards)

Time : 3 Hours

Max. Marks : 80

SECTION – A

(Answer in **one** word to a maximum of **2** sentences)

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

1. What is the important application of the third law of thermodynamics ?
2. What is the relation between thermodynamic probability (W) and entropy (S) ?
3. What is meant by Brownian motion ?
4. Give the BET adsorption isotherm and explain the terms.
5. What is the de Broglie wavelength of a particle in motion having a momentum 3.3×10^{-24} Kg m s^{-1} ?
6. What is the physical significance of wave function ?
7. State the selection rule for rotational transitions of a rigid rotator.
8. What is meant by the fingerprint region in an IR spectrum of an organic compound ?
9. State the rule of mutual exclusion.
10. Explain the term parachor.

(10×1=10 Marks)

P.T.O.

SECTION – B

(**Not** to exceed **one** paragraph) :

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

11. Explain the term residual entropy and calculate the residual entropy of N_2O.
12. Distinguish between statistical probability and thermodynamic probability.
13. How are sols purified by ultrafiltration ?
14. Distinguish between elastic and non-elastic gels with suitable examples.
15. How is the Langmuir adsorption isotherm useful in the determination of the surface area of an adsorbent ?
16. What are Hermitian operators ? Explain.
17. Explain Compton effect.
18. State Franck-Condon principle and explain it with regard to electronic transitions in a diatomic molecule.
19. What is the most common reference compound used in NMR spectroscopy ? Why ?
20. What are the different types of electronic transitions in molecules ? Arrange them in the increasing order of energy.
21. Explain the terms fundamental bands and overtone bands with reference to IR spectroscopy.
22. Explain the correlation between the unpaired electrons and magnetic properties.

(8×2=16 Mark

SECTION – C

(**Not** to exceed **120** words) :

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

23. Discuss the Nernst heat theorem.
24. What is an ensemble ? Discuss briefly the different types of ensembles.
25. Briefly explain the electrical properties of colloids.

26. What are quantum numbers ? Discuss the significance of each quantum number.

27. Deduce expressions for the rotational energy of a rigid diatomic molecule.

28. Explain the term hyperfine splitting associated with ESR spectroscopy with a suitable example.

29. Sketch the different vibrational modes of H_2O. Classify them as IR active and IR inactive modes. Justify your answer.

30. The microwave spectrum of gaseous CO consists of a series of equally spaced lines separated by 3.844 cm^{-1}. Calculate the moment of inertia and the C – O bond length.

31. Distinguish between Stoke's and anti Stoke's lines with regard to Raman spectra.

(6×4=24 Marks)

SECTION – D

Weightage **4** (Long essay type) :

Answer **any 2** from the following. **Each** question carries **15** marks.

32. Deduce relation between partition function and the following thermodynamic properties :
    a) Internal energy
    b) Work function
    c) Enthalpy
    d) Free energy function.

33. a) Explain the terms electrical double layer and Zeta potential.
    b) Discuss briefly the applications of colloids in the purification of water and delta formation.

34. Set up and solve the Schrodinger wave equation for a particle in one dimension box and get expression for the wave function and energy.

35. a) Using NMR technique, distinguish between the structures of 1-propanol and 2-propanol.
    b) Calculate the force constant of the carbon-oxygen bond. Given the fundamental vibrational band for CO is at 2140 cm^{-1}.

(2×15=30 Marks)