



(Pages : 3)

7282

Reg. No. : .....

Name : .....

**Fifth Semester B.Sc. Degree Examination, October 2015**  
**First Degree Programme under CBCSS**  
**CHEMISTRY**  
**Core Course – VII**  
**CH1543 – Physical Chemistry – II**  
**(2013 Admissions)**

Time : 3 Hours

Max. Marks : 80

**SECTION – A**

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

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

1. State the third law of thermodynamics.
2. What is the probability of getting an even number, when a die is tossed once ?
3. What is meant by ultra filtration ?
4. Give the Gibbs adsorption equation and explain the terms.
5. What is meant by well behaved wave function ?
6. Calculate the uncertainty in the momentum of a particle whose uncertainty in position is of the order of  $1\text{Å}$ .
7. What is the essential condition for a molecule to absorb microwave radiation ?
8. Calculate the number of peaks in the proton NMR spectrum of 1, 3-dibromopropane.
9. State Franck-Condon principle.
10. Give the Clausius-Mosotti equation and explain the terms. **(1×10=10 Marks)**

P.T.O.



## SECTION – B

(Not to exceed **one** paragraph)

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

11. What is residual entropy ? Calculate the residual entropy of CO.
12. What are Bosons and Fermions ? Explain with examples.
13. Explain why lyophilic sols generally show weak Tyndall effect.
14. Differentiate between physical adsorption and chemical adsorption.
15. Calculate the wavelength of the radiation emitted, when the electron in the hydrogen atom excited to the 5<sup>th</sup> energy level returns to the 2<sup>nd</sup> energy level.  
(Rydberg constant =  $1.097 \times 10^7 \text{m}^{-1}$ ).
16. What are Laplacian and Hamiltonian operators ? Explain.
17. What is photoelectric effect ? What type of metals are used in photoelectric cells ?
18. What is meant by the fingerprint region and what is its significance in the IR spectral studies of organic compounds ?
19. How is force constant related to bond order, bond length and bond energy ? Explain.
20. Explain the terms shielding and deshielding with regard to NMR spectroscopy.
21. Sketch the ESR spectrum of methyl radical and explain it.
22. What information regarding the structure of the molecules can be obtained from the knowledge of their dipole moment ? Explain with examples. **(2×8=16 Marks)**

## SECTION – C

(Not to exceed **120** words)

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

23. Discuss the Nernst heat theorem.
24. Deduce the relation between enthalpy and partition function.



25. Briefly explain the optical and kinetic properties of colloids.
26. State Hardy-Schulze rule. Explain with an example.
27. The volume of nitrogen required at STP to cover the surface of the sample of iron catalyst with a monolayer as determined from the Langmuir plot was found to be  $8.15 \text{ cm}^3\text{g}^{-1}$  of the adsorbent. The area occupied by one nitrogen molecule is  $16.2 \times 10^{-20} \text{ m}^2$ . Calculate the surface area per gram of the iron catalyst.
28. Discuss the postulates of quantum mechanics.
29. Sketch the different vibrational modes of carbon dioxide. Classify them as IR active and IR inactive modes. Justify your answer.
30. Explain the terms stokes and anti-stokes lines with regard to Raman spectra.
31. How can the two isomers of  $\text{C}_2\text{H}_6\text{O}$  be differentiated using NMR spectroscopy?  
(4x6=24 Marks)

### SECTION – D

(Long essay type)

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

32. How is third law of thermodynamics suitable for determining the absolute entropies of crystalline substances at the required temperatures ?
  33. Discuss briefly the postulates of Langmuir adsorption theory and derive the Langmuir adsorption isotherm.
  34. Set up and solve the Schrodinger wave equation for a particle in a three dimension box and get expression for the wave function and energy.
  35. a) Deduce expressions for a) Moment of inertia and b) Rotational energy of a rigid diatomic molecule.  
b) How are the bond stretching frequencies calculated in IR spectroscopy ?  
(15x2=30 Marks)
-