

16U513

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Name: .....

Reg. No. ....

FIFTH SEMESTER B.Sc. DEGREE EXAMINATION, NOVEMBER 2018

(CUCBCSS-UG)

CC15U CHE5 B08 - PHYSICAL CHEMISTRY - II

(Chemistry - Core Course)

(2015-Admission onwards)

Time: Three Hours

Maximum: 80 Marks

### Section A

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

1. The equivalent symmetry operation for  $S_2$  is -----.
2. Selection rule for rotational spectrum is -----.
3. ESR spectroscopy uses ----- region of the electromagnetic radiation.
4. The number of vibrational modes of  $C_{10}H_{10}$  is -----.
5. Condition for molecule to show Raman spectrum is -----.
6. In chromatography the separation of components are based on -----.
7. At the triple point both the ----- and ----- are fixed.
8. The number of components in a solution of common salt is -----.
9. The modified distribution law for the solute undergoing dissociation in one of the solvents is,  $K_D =$  -----
10. The lyophilic colloids which stabilizes a lyophobic sol, are known as -----.

(10 x 1 = 10 Marks)

### Section B

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

11. What is chemical shift?
12. Give two methods for determining the order of a reaction.
13. Define the terms fluorescence and phosphorescence.
14. Write the expression for Gibb's phase rule and explain the terms.
15. Predict the number of components, phases and degrees of freedom in following equilibrium system  $CaCO_3(g) \rightleftharpoons CaO(s) + CO_2(g)$
16. Explain Hardy Schulze rule with suitable example. Type equation here.
17. Write down BET equation and explain the terms.
18. Predict the ESR spectrum of phenyl radical.
19. What is Born-Oppenheimer approximation?
20. What is meant by the fingerprint region of IR spectroscopy?

21. List out all the symmetry elements of  $\text{NH}_3$  molecule.
22. Give equations for the normal modes of vibration for a linear molecule and nonlinear molecule.

(10 x 2 = 20 Marks)

### Section C

Answer any *five* questions. Each question carries 6 marks.

23. Derive the expression for the rate constant of a first order reaction.
24. Distinguish between primary and secondary process in a photochemical reaction.  
How does it control the quantum yield of photochemical reaction?
25. Explain the phase diagram of ferric chloride water system.
26. Explain the principle and application gel permeation chromatography.
27. Sketch the modes of vibrations of  $\text{H}_2\text{O}$  and  $\text{CO}_2$ .
28. Briefly explain the spin-spin coupling in NMR spectroscopy.
29. Write down the group multiplication table for  $\text{C}_{2h}$  point group.
30. Explain the classical theory of Raman spectroscopy.

(5 x 6 = 30 Marks)

### Section D

Answer any *two* questions. Each question carries 10 marks.

31. a) Derive the expression for rate constant of a bimolecular gaseous reaction using collision theory.  
b) The activation energy of a first order reaction is 250 KJ/mole. The half life of the reaction is  $6.5 \times 10^6$  seconds at  $450^\circ\text{C}$ . What will be the half life at  $550^\circ\text{C}$ .
32. Define adsorption isotherm. Also derive the expression for Freundlich and Langmuir adsorption isotherms.
33. a) Explain how rotational spectrum can be used for calculating the bond length of linear diatomic molecules.  
b) The fundamental vibrational frequency of HCl is  $2890 \text{ cm}^{-1}$ . Calculate the force constant of this molecule. (The atomic masses of H and Cl are 1.008 and 35.5 g/mol).
34. a) Discuss the principle and application of high performance liquid chromatography.  
b) Explain the principle and application of photosensitization reaction.

(2 x 10 = 20 Marks)

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