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L – 1602

Reg. No. : .....

Name : .....



Sixth Semester B.Sc. Degree Examination, March 2021

First Degree Programme Under CBCSS

Chemistry

Core Course X

CH 1641 – PHYSICAL CHEMISTRY II

(2018 Admission, Regular)

Time : 3 Hours

Max. Marks : 80

SECTION – A

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

1. What is Parachor?
2. State third law of thermodynamics.
3. Explain the term adsorbent and adsorbate.
4. What is Zeta potential?
5. What are quantum numbers?
6. Pick out, from among the following, those which would give microwave spectrum:

$N_2$ , HCl,  $CCl_4$ ,  $CH_3Cl$

P.T.O.

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7. What is the selection rule for anharmonic oscillator?
8. Define dipole moment.
9. Arrange the following electromagnetic waves in increasing order of their energy?  
U.V, IR, microwave, visible.
10. Write the expression for work function  $A$ , in terms of partition function.

(10 × 1 = 10 Marks)

### SECTION – B

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

11. What is meant by residual entropy, Give one example?
12. State Heisenberg uncertainty Principle, and write its mathematical representation.
13. Calculate the wave number in  $\text{meter}^{-1}$  for a radiation of wavelength 200nm.
14. State Hardy-Schulze rule.
15. State rule of mutual exclusion.
16. What is referred to as a fundamental band in vibrational spectrum of a molecule?
17. What is partition function?
18. What is chromophore? Give two examples.
19. Explain the term distortion polarization?

20. What is Lande splitting factor?
21. Write Clausius-Mosotti equation.
22. What is meant by optical exaltation? Explain with one example.
23. Define Molar refraction, Write the equation.
24. What is streaming potential?
25. What is meant by an operator in quantum mechanics?
26. What is black body radiation?

(8 × 2 = 16 Marks)

### SECTION – C

**Each** question carries **4** marks (short essay). Answer **any six** questions.

27. What is thermodynamic probability?
28. What are ensembles? Discuss the different types of ensembles?
29. Distinguish between physisorption and chemisorption?
30. Explain Nernst Heat theorem.
31. Explain the terms micelles and critical micelle concentration.
32. Discuss Compton effect.
33. Derive an expression for moment of inertia of a rigid diatomic molecule.



34. Explain the terms bathochromic and hypsochromic shifts with suitable examples. Shifts in absorption maximum and peak intensity.
35. Dipole moment of ammonia is 1.47D, whereas dipole moment of  $\text{BF}_3$  is zero. Explain.
36. A compound shows a proton NMR peak at 240 Hz downfield from the TMS peak in a spectrometer operating at 60MHz. Calculate the values of the chemical shifts  $\delta$  or  $\tau$  to in ppm relative to TMS?
37. Differentiate between Stoke's and Antistoke's lines.
38. The fundamental frequency of HCl is  $2890\text{cm}^{-1}$ . Calculate the force constant of this molecule. The atomic masses are

$$^1\text{H} = 1.673 \times 10^{-27} \text{ kg} \quad ^{35}\text{Cl} = 58.06 \times 10^{-27} \text{ kg}.$$

(6 × 4 = 24 Marks)

#### SECTION – D

Each question carries **15** marks (essay). Answer **any two** questions.

39. (a) How are dipole moment used to distinguish between cis and trans isomers in dichloroethylene?
- (b) What are quantum numbers? Discuss the significance of each quantum numbers.
- (c) Discuss the BET equation and its utility in determination of surface area of an adsorbent.

(3 × 5 = 15 Marks)

40. (a) Derive the expression for internal energy in terms of partition function.
- (b) Derive Langmuir adsorption isotherm.
- (c) What is spin-spin coupling? Illustrate it by using NMR spectrum of  $\text{CH}_3\text{-CH}_2\text{-Br}$ .

**(3 × 5 = 15 Marks)**

41. (a) How will you determine absolute entropy of gases?
- (b) How are colloidal solutions purified? Discuss two methods.
- (c) Explain Photoelectric effect.

**(3 × 5 = 15 Marks)**

42. (a) Explain the term shielding and desheilding in NMR.
- (b) Solve Schrodinger wave equation for particle in one dimensional box.
- (c) How can measure magnetic susceptibility by Gouy's method.

**(3 × 5 = 15 Marks)**

43. (a) Discuss the postulates of quantum mechanics.
- (b) Discuss the difference between lyophilic and lyophobic colloids.
- (c) State and derive de Broglie relation.

**(3 × 5 = 15 Marks)**



44. (a) The IR and Raman spectroscopies are complementary Explain.
- (b) Discuss what is meant by Tyndall effect and Brownian movement.
- (c) Discuss the hyperfine splitting of methyl radical.

(3 × 5 = 15 Marks)

(2 × 15 = 30 Marks)

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