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Sixth Semester B.Sc. Degree Examination, April 2023

First Degree Programme under CBCSS

Chemistry

Core Course X

CH 1641 : PHYSICAL CHEMISTRY II

(2020 Admission)

Time : 3 Hours Max. Marks : 80

SECTION – A

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

1. State zeroth law of thermodynamics.
2. What is meant by internal energy of a system?
3. Explain the entropy changes in reversible and irreversible processes.
4. What is the significance of fugacity?
5. Explain the criteria for IR activity.
6. What is meant by isochoric process?
7. What is Born-Oppenheimer approximation?
8. What is order of a group with respect to symmetry?

P.T.O.

9. Carbon tetra chloride does not possess dipole moment even though C-Cl bond is polar. Give reason.

10. What is meant by chemical shift?

(10 × 1 = 10 Marks)

SECTION – B

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

11. Calculate w and ΔU for the conversion of one mole of water at 100°C to steam at 1 atm pressure. Heat of vapourisation of water at 100°C is 40670 $Jmol^{-1}$.

12. For an isothermal expansion of ideal gas, prove that $\Delta U = 0$ and $\Delta H = 0$

13. What is zero point energy in IR spectroscopy?

14. Deduce Gibbs-Duhem equation.

15. What are bosons?

16. Define efficiency of a heat engine? Give its mathematical representation.

17. How many lines will be there in the ESR spectrum of methyl radical? Explain.

18. State and explain Frank-Condon principle.

19. How is dipole moment calculated by temperature method?

20. Explain the term parachor.

21. What are the symmetry elements present in benzene molecule?

22. Explain proper and improper axis of symmetry with one example each.

(8 × 2 = 16 Marks)

SECTION – C

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

23. Define C_p and C_v. Deduce the relationship between C_p and C_v.

24. Write Gibbs-Helmholtz equation and explain the various criteria for spontanity.

25. Differentiate Raleigh and Raman scattering.

26. What is an ensemble? Explain the different types of ensembles.

27. What is the basic principle and applications of electronic spectroscopy?

28. What is meant by Optical Exaltation? Calculate the optical exaltation of 2.6-dimethylhepta-2,5-dien-4-one.

29. Define Magnetic susceptibility. Explain how it can be measured?

30. What are point groups? Deduce the point group of ammonia molecule.

31. Construct the group multiplication table of C_{2v} point group.

(6 × 4 = 24 Marks)

SECTION – D

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

32. What is Joule-Thomson effect? How do you account for it? Derive Joule-Thomson coefficient and show that it is zero for an ideal gas.

33. (a) Explain Carnot cycle with a neat diagram.

    (b) Derive - Clausius- Clapeyron equation and mention its applications.

34. Discuss the principle and various applications of NMR spectroscopy.

35. (a) Derive $I = \mu r^2$ in the case of rigid diatomic molecules. **7**

(b) Explain the terms **8**

(i) Fundamental bands

(ii) Overtones

(iii) Combination bands

(iv) Mutual exclusion principle

(2 × 15 = 30 Marks)
