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T – 1650

Reg. No. : .....

Name : .....

Sixth Semester B.Sc. Degree Examination, April 2024

First Degree Programme under CBCSS

Chemistry

Core Course – X

CH 1641 : PHYSICAL CHEMISTRY – II

(2020 Admission Onwards)

Time : 3 Hours

Max. Marks : 80

SECTION – A

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

1. What is inversion temperature?
2. What is an adiabatic process?
3. Mention the limitations of first law of thermodynamics.
4. Explain the significance of Gibbs free energy.
5. What is absolute entropy?
6. Write the selection rule for rotational spectra.
7. What is meant by precessional frequency?
8. Write the Clausius - Mosotti equation.
9. What is meant by order of a point group?
10. Calculate the number of fundamental modes of vibrations of CO_2.

(10 × 1 = 10 Marks)

P.T.O.

SECTION – B

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

11. Calculate the work done in expanding one mole of an ideal gas from a volume of 1 to 10 dm^3 at 27°C.

12. What do you mean by enthalpy of neutralization?

13. What is meant by chemical potential?

14. Vapour pressure of water at 95°C and 100°C are 634 and 700 mm, respectively. Calculate the molar heat of vapourisation of water between 95°C and 100°C.

15. What is Planck's statement of the third law of thermodynamics?

16. What is an ensemble in statistical mechanics?

17. What is a symmetric top molecule? Give an example.

18. Write the equation for rotational constant, B and explain the terms.

19. What is TMS in NMR spectroscopy? Mention its significance.

20. Explain predissociation with diagram.

21. How will you correlate dipole moment with geometry of molecules? Explain with one example.

22. Explain centre of symmetry with an example.

(8 × 2 = 16 Marks)

SECTION – C

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

23. Write a note on Hess's law and its applications.

24. Derive – Clausius – Clapeyron equation.

25. State and explain Nernst heat theorem.

26. Explain Frank Condon principle with neat diagram.

27. The fundamental vibrational frequency of HCl is 2890 cm^{-1}. Calculate the force constant of this molecule. The atomic masses are H = 1.673×10^{-27} kg and Cl = 58.06×10^{-27} kg.

28. Write short note on spin-spin coupling in NMR spectroscopy.

29. What is parachor? Explain the applications of atomic parachor.

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

31. Discuss the Group theoretical rules.

(6 × 4 = 24 Marks)

SECTION – D

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

32. What is meant by reversible and isothermal processes? Derive an expression for work done in the reversible isothermal expansion and reversible isothermal compression of an ideal gas.

33. (a) Explain the fugacity and its physical significance. How fugacity is determined by graphical method?

    (b) What is meant by efficiency of heat engine? Derive an expression for the same.

34. (a) What is statistical thermodynamics? Discuss its types. (8)

    (b) Discuss the quantum theory of Raman spectroscopy. (7)

35. (a) Discuss the basic principle and applications of ESR spectroscopy. (8)

    (b) What are the symmetry elements present in BF3 molecule? (3)

    (c) Draw the group multiplication table of C_{2v} point group. (4)

(2 × 15 = 30 Marks)