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N – 7772

Reg. No. : .....

Name : .....

**Fourth Semester B.Sc. Degree Examination, August 2022**

**First Degree Programme Under CBCSS**

**Chemistry**

**Complementary Course for Physics**

**CH 1431.1 — SPECTROSCOPY AND ADVANCED MATERIALS**

**(2020 Admission)**

Time : 3 Hours

Max. Marks : 80

SECTION – A

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

1. How is wavelength of radiation related to wavenumber?
2. What is the selection rule for vibrational spectroscopy?
3. Define chemical shift.
4. Which type of nuclei give NMR spectrum?
5. Give an example for a polydentate ligand.
6. Define atomic fusion.
7. Give any two techniques for characterization of nanoparticles.
8. Give examples for magnetic materials.

P.T.O.

9. What is PLA?

10. Give examples for piezoelectric materials.

## SECTION – B

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

11. What are the different electronic transitions? Arrange them in the order of increasing energy.

12. How vibrational frequency is related to force constant?

13. Explain shielding and deshielding in NMR spectroscopy?

14. Explain the magnetic property of $[Fe(CN)_6]^{3-}$.

15. What is carbon dating?

16. What is SEM? Write its principle.

17. Write the preparation method of polyacetylene.

18. What are the properties of nanoparticles?

19. Define binding energy. How is it related to mass defect?

20. What is half life?

21. What is Raman scattering?

22. Using valence bond theory, find the spin and magnetic nature of $[PtCl_4]$.

23. What is radioactivity? In what units is radioactivity measured?

24. How many NMR signals are obtained from cyclopropane?

25. Difference between double salt and a complex compound.

26. Give the medical applications of ZnO nanoparticle.

## SECTION – C

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

27. State and explain Frank-Condon principle.

28. Discuss the effect of solvent polarity on UV absorption spectra.

29. Discuss Werner's theory of coordination compounds.

30. Discuss about electromagnetic spectrum.

31. What are the disadvantages of valence bond theory?

32. What are the applications of co-ordination compounds in qualitative volumetric analysis?

33. Write a note on Wilson's cloud chamber.

34. Discuss the quantum theory of Raman spectroscopy.

35. Why $H_2$, $Cl_2$ molecules do not show IR spectrum?

36. What is the principle of scanning tunneling microscopy? What are its applications?

37. Give a note on magnetic materials.

38. How are liquid crystals classified?

## SECTION – D

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

39. (a) The moment of inertia of a diatomic molecule of reduced mass $4 \times 10^{26}$ kg is $2.5 \times 10^{-45}$ kg $m^2$. What is the inter nuclear distance?

    (b) Convert a wavelength of 4000 Å° into nanometers.

    (c) The fundamental vibrational frequency of HCl is 2890 $cm^{-1}$. Calculate the force constant of the molecule. The atomic masses are

    $^1H = 1.673 \times 10^{-27}$kg. $Cl = 58 \times 10^{-27}$ kg.

40. (a) Write the rule of mutual exclusion principle.

(b) Difference between Raman spectra and IR spectra.

(c) Write a note on Stoke's and Anti stokes lines in Raman spectra.

41. (a) Write the principle of NMR spectrum.

(b) Discuss about spin-spin coupling. How will you distinguish 2-propanone and 2-butanone using NMR spectroscopy?

(c) Write on the applications of UV spectroscopy.

42. (a) Write a note on artificial radioactivity?

(b) Half life of radio active carbon in wood is 5568 years. What fraction will remain after 11136 years?

43. Write notes on photo conducting and superconducting materials.

44. Discuss the synthesis and applications of conducting polymers.

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