

(6 pages)

Reg. No. :

Code No. : 10305 E Sub. Code : AMPH 52

B.Sc (CBCS) DEGREE EXAMINATION, APRIL 2023.

Fifth Semester

Physics – Core

SPECTROSCOPY

(For those who joined in July 2020 only)

Time : Three hours Maximum : 75 marks

PART A — (10 × 1 = 10 marks)

Answer ALL questions.

Choose the correct answer :

1. Which among the following is symmetric top molecule
- (a) CH₃F
(b) HCl
(c) OCS
(d) C₂H₂I

2. The molecule which have all three principal moment of inertia different are called
- (a) Assymmetric top molecules
(b) Spherical top molecules
(c) Linear molecule
(d) Symmetric top molecule
3. Mid-IR region mainly consists of
- (a) 4000 – 100 cm⁻¹
(b) 14000 – 4000 cm⁻¹
(c) 4000 – 400 cm⁻¹
(d) 400 – 100 cm⁻¹
4. Overtones are mainly observed in
- (a) Near IR (b) Mid IR
(c) Far IR (d) Not in IR region
5. In Raman spectroscopy the radiation lies in the _____
- (a) Microwave region (b) Visible region
(c) UV region (d) X-ray region

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6. For a compound to be Raman active it should show
- (a) Dipole moment
(b) Polarizability
(c) Induced dipole moment
(d) Unsaturation
7. The possible transitions for water molecule in UV visible region are
- (a) $\sigma - \sigma^*$ (b) $n \rightarrow n^*$, $n \rightarrow n^*$
(c) $\sigma - \sigma^*$, $n \rightarrow n^*$ (d) $n \rightarrow \sigma^*$
8. The unit of absorbance is
- (a) cm (b) L mol⁻¹ cm⁻¹
(c) Lg m⁻¹ cm⁻¹ (d) no unit
9. The nuclei that doesn't give NMR signal is
- (a) ¹⁵N (b) ¹¹B
(c) ¹⁹F (d) ³¹P
10. The chemical shift (δ) in NMR spectrum has
- (a) Dimensional (b) Dimensionless
(c) No unit (d) Unit

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PART B — (5 × 5 = 25 marks)

Answer ALL questions, choosing either (a) or (b).
Each answer should not exceed 250 words.

11. (a) Explain the theory of microwave spectroscopy.
- Or
- (b) Define:
- (i) Rotational constant
(ii) Selection rule for rotational spectra.
12. (a) Outline the theory of IR spectroscopy.
- Or
- (b) Explain analysis by IR techniques.
13. (a) Explain the quantum theory of Raman effect.
- Or
- (b) Describe Raman spectra of symmetric top molecules.
14. (a) Explain transmittance and absorbance of UV spectroscopy.
- Or
- (b) Discuss briefly types of transitions in UV.

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[P.T.O.]

15. (a) Write the application of NMR spectroscopy.

Or

(b) Define chemical shift in NMR. Write the rules for spin spin splitting.

PART C — (5 × 8 = 40 marks)

Answer ALL questions, choosing either (a) or (b)
Each answer should not exceed 600 words.

16. (a) Obtain the transition frequency in terms of B and J for a symmetric top molecule.

Or

(b) Explain the diatomic molecules as a non rigid rotator.

17. (a) Explain diatomic vibrating rotator in IR.

Or

(b) Explain the theory of molecular vibrations.

18. (a) Explain the cause of Raman effect. Give its importance.

Or

(b) Explain structure determination from IR and Raman spectroscopy.

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19. (a) Explain the absorption laws in UV spectroscopy. Write the limitation of Beer Lambert law.

Or

(b) Explain how does a UV spectrophotometer work.

20. (a) Explain origin of NMR signal.

Or

(b) Discuss briefly magnetic resonance imaging.

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