

PSG COLLEGE OF ARTS & SCIENCE
(AUTONOMOUS)

MSc DEGREE EXAMINATION MAY 2023
(Second Semester)

Branch – PHYSICS

GROUP THEORY & MOLECULAR SPECTROSCOPY

Time: Three Hours

Maximum: 50 Marks

SECTION-A (5 Marks)

Answer ALL questions

ALL questions carry EQUAL marks

(5 x 1 = 5)

- 1 Any group of order 3 is
(i) cyclic and abelian (ii) cyclic but not abelian
(iii) infinite cyclic (iv) none of these
- 2 Which of the following belongs to C_{3v} point group?
(i) SO₃ (ii) BBr₃
(iii) NH₃ (iv) AlCl₃
- 3 Raman effect is scattering of _____
(i) Atoms (ii) Molecules
(iii) Protons (iv) Photons
- 4 Select the wavelength range corresponding to UV-Visible region.
(i) 200-800 nm
(ii) 400-800 nm
(iii) 25 micro metre-2.5 micro metre
(iv) 400-4000 nm
- 5 In NMR, nuclei in the upfield resonate at
(i) high frequency (ii) low frequency
(iii) constant value (iv) none of these

SECTION - B (15 Marks)

Answer ALL Questions

ALL Questions Carry EQUAL Marks

(5 x 3 = 15)

- 6 a Determine the point group of water molecule.
OR
b Define a group. What are its properties?
- 7 a State Great Orthogonality theorem.
OR
b Explain how reducible representations are derived.
- 8 a Discuss the principle of IR spectroscopy.
OR
b Briefly write about degree of depolarization.
- 9 a What are chromophores and auxochromes?
OR
b Explain Fischer-Kuhn rule for calculating absorption maximum in polyenes.

Cont...

- 10 a Discuss the chemical shifts in ^{13}C NMR.
OR
b Write the impacts of germinal and vicinal coupling.

SECTION -C (30 Marks)

Answer ALL questions

ALL questions carry EQUAL Marks

(5 x 6 = 30)

- 11 a Derive the matrix representation for rotation.
OR
b Give the various symmetry elements.
- 12 a Explain the normal modes of vibrations of POCl_3 .
OR
b What are character table? Deduce the character table for NH_3 .
- 13 a Discuss the applications of IR spectroscopy.
OR
b Explain how the structures of X_2Y and XY_3 molecules are determined.
- 14 a What are the different types of electronic transitions? Explain.
OR
b (i) State and derive Beer – Lambert's Law.
(ii) Give the woodward Fisher rules for calculating λ max of dienes.
- 15 a Explain how inductive effect, ring current and anisotropic effects help in determining the chemical shifts in NMR.
OR
b Outline the different relaxation process.

Z-Z-Z

END