

**B-1504**

M. Sc. (First Semester) Examination,  
Dec., 2010

CHEMISTRY

Paper : Fourth

(Group Theory & Spectroscopy-I)

Time Allowed : Three hours

Maximum Marks : 35

Note : Attempt all questions of three sections as directed.

Section-A

(Objective Type Questions) 5×1=5

Note : Attempt all questions. Each question carries 1 mark.

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1. Write the correct answer :

(i) Schönflies symbols for  $\text{BF}_3$  molecule is :

(a)  $C_{2v}$

(b)  $C_{3v}$

(c)  $D_{3h}$

(d)  $D_{2h}$

(ii) Which of the following molecule will show a microwave rotational spectrum?

(a)  $\text{H}_2$

(b)  $\text{HCl}$

(c)  $\text{N}_2$

(d)  $\text{O}_2$

(iii) The skeletal vibrations for organic molecules are in the range :

(a)  $2000 - 3000 \text{ cm}^{-1}$

(b)  $1400 - 700 \text{ cm}^{-1}$

(c)  $1200 - 1500 \text{ cm}^{-1}$

(d)  $800 - 600 \text{ cm}^{-1}$

(iv) The source used for Raman spectroscopy is :

(a) Visible

PTO

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(b) IR [ 3 ]

(c) UV

(d) Laser

(v) The intensity of an electronic absorption is given by :

$$(a) \epsilon = \frac{1}{Cl} \log_{10} \frac{I_0}{I} \text{ l mol}^{-1} \text{ cm}^{-1}$$

$$(b) \epsilon = Cl \cdot A$$

$$(c) \epsilon = \frac{A}{Cl}$$

$$(d) \epsilon = \frac{I_0}{I} \cdot Cl$$

### Section-B

(Short Answer Type Questions) 5 × 10

*Note : Answer the following questions in short.*

2. Define group, subgroup, classes and point symmetry graphs with example.

Or

What is the significance of character table. Explain with example.

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PTO

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3. Write note on stark effect.

Or

Discuss intensities of microwave spectral lines.

4. Explain Morse potential energy diagram and its importance.

Or

Write note on (any one) :

(a) Modes of vibration

(b) Group frequencies

5. What is meant by the term polarisability and its importance in Raman spectroscopy.

Or

Write classical theory of Raman effect.

6. Differentiate between Photoelectron spectroscopy and Angon spectroscopy.

Or

Write note on photoelectric effect.

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## (Long Answer Type Questions)

5×4=20

*Note : Answer the following questions in detail*

7. Write the representation of  $C_{2v}$  and  $D_{2h}$  point group by matrices.

Or

Derive the character table for  $C_{2v}$  point group.

8. What is an isotopic effect? Write the effect of isotopic substitution on the transition frequencies and its applications.

Or

Write theory of microwave spectroscopy and its applications.

9. Write short notes on :

- (a) P. Q. R. branches
- (b) Zero point energy
- (c) Overtones and hot bands

Or

Write the theory of Infrared spectroscopy and its importance in molecular structural determination.

10. Explain Mutual Exclusion principle and its importance with example.

Or

Write notes on (any two) :

- (a) Resonance Raman spectroscopy
- (b) Raman effect
- (c) Stokes and antistokes lines

11. Explain following phenomenon with the help of potential energy curve diagram :

- (a) Franck-Condon principle
- (b) Radiative and nonradiative decay

Or

Write basic principle of photoelectron spectroscopy and its applications.