2019

Time : As in Programme

Full Marks : 50

Answer **all** *questions. The figures in the right-hand margin indicate marks.*

1. (*a*) Show that $[a \,.\, b \,.\, c]^{-1} = c^{-1} \,.\, b^{-1} \,.\, a^{-1}$ where a, b and c are group elements. 5

(*b*) Write down the point groups for the following : 4

Boat and chair form of Cyclohexane; staggered and eclipsed form of ethane.

(*c*) Find out the representation matrices and representation of the bond vectors of $CHCl_3$. 5

(*d*) Reduce the representation. 3

OR

2. (*a*) Discuss briefly the phenomena of absorption, emission and transmission. 6

(*b*) What is the difference between natural line width and natural line broadening ? 5

(*c*) What do you mean by transition moment integral ? What is its significance ? 6

3. (*a*) What do you mean by Zeeman effect ? Discuss its significance. 7

(*b*) What is the term symbols for p^5 and d^1 configurations ? 4

(*c*) What is the difference between R-S coupling and spin-orbit coupling ? 6

OR

4. (*a*) What do you mean by vibronic transition ? How does a forbidden transition is allowed by vibronic coupling ? 6

(*b*) What do you mean by Franck-Condon active modes ? Explain with examples. 5

(*c*) How many electronic peaks are expected for d^1 and d^2 transition metal complexes ? 6

5. (*a*) Write a note on photoelectric effect. 8

(*b*) What chemical information is obtained from ESCA ? 8

OR

6. (*a*) Discuss the classification of molecules according to their moments of inertia. 6

(*b*) Discuss the effect of isotopic substitution and external field on the frequency and intensity of Microwave spectra. 5+5

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