

M. Sc. CHEMISTRY EXAMINATION, 2023

(3rd Semester, CBCS)

PAPER: XI-I

[INORGANIC CHEMISTRY SPECIAL]

Time : Two Hours

Full Marks : 40

(20 marks for each unit)

Use a separate answer script for each unit.

UNIT - I - 3111

1. What is a crystal system? Describe the crystal systems in terms of unit cell parameters. 1+2
2. State the meaning, and draw stereographic projection of *any three* of the following :
(i) $2mm$ (ii) 32 (iii) $\bar{4}$ (iv) $\bar{6}2m$ 2x3
3. Write short notes on :
(i) axial glide (ii) isogonal symmetry group $2\frac{1}{2} \times 2$
4. Define space group. Describe the space groups under monoclinic system. 1+2
5. A compound with molecular weight of 868 is found to crystallize in monoclinic space group ($P2_1/c$), which has the following parameters :
 $a = 9.718 \text{ \AA}$, $b = 17.469 \text{ \AA}$, $c = 23.109 \text{ \AA}$, $\beta = 91.864^\circ$,
and $Z = 4$. 3

Find out the density of the crystal in gm/cm^3

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UNIT - I - 3112

6. Answer any 10 questions : 2×10

- a. Pictorially present a CD spectroscopy instrument.
- b. Prove that $[\psi]_{\lambda}^T$ (in degree) $\approx 3300\Delta\epsilon$
- c. Give one example of an optically active pure inorganic compound.
- d. What will be the circular dichroism spectral pattern of poly (L-glutamic acid) at pH 4.5 in α -helix form in aqueous solution?
- e. State Pt-olefin bonding pattern in Zeise's salt using IR spectroscopy.
- f. Comment on the nature of $\nu_{S=O}$ stretching frequency in $[\text{Ru}(\text{dmsO})_4\text{Cl}_2]$ and $[\text{Ru}(\text{dmsO})_3\text{Cl}_3]$. Among these two Ru-compounds, which one will show geometrical isomerism?
- g. Comment on the nature of ν_{CO} stretching frequency in halocarbonyls compounds.
- h. Calculate the zero point energy and the energy of the fundamental vibration ν_0 of $^1\text{H}^{35}\text{Cl}$. Given bond force constant : 516.3 Nm^{-1} . $^1\text{H}=1.673 \times 10^{-27} \text{ kg}$, $^{35}\text{Cl}=58.066 \times 10^{-27} \text{ kg}$.
- i. Using classical theory, explain the occurrence of Stokes and anti-stokes Raman scattering.

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- j. Vibrational measurements of the Raman technique have several advantages over infrared. Evaluate the correctness of the statement.
- k. The symmetrical stretching mode of CO_2 is infrared inactive but Raman active. Explain.