

BIRLA INSTITUTE OF TECHNOLOGY, MESRA, RANCHI  
(END SEMESTER EXAMINATION)

CLASS: IMSc  
BRANCH: CHEMISTRY

SEMESTER : I  
SESSION : MO/2022

SUBJECT: CH113 PHYSICAL CHEMISTRY-I

TIME: 3 HOURS

FULL MARKS: 50

**INSTRUCTIONS:**

1. The question paper contains 5 questions each of 10 marks and total 50 marks.
2. Attempt all questions.
3. The missing data, if any, may be assumed suitably.
4. Tables/Data handbook/Graph paper etc., if applicable, will be provided to the candidates.

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- Q.1(a) What do you understand by symmetry elements? Illustrate different types of symmetry elements and list their corresponding symmetry operations. [5]
- Q.1(b) What are different types of groups?. Give the group multiplication table of the symmetry operations of H<sub>2</sub>O molecule. [5]
- Q.2(a) Derive the Bragg law for crystal structure determination. [5]
- Q.2(b) What are different methods for crystal structure determinations? Describe the rotating crystal method for determination of crystal structure. [5]
- Q.3(a) What is equipartition of energy? Using this principle estimate the energy of H<sub>2</sub>(3,1,1) and H<sub>2</sub>O (3,3,3) at Room Temp, assuming that all the degrees of freedom are excited and contribute towards the energy of the molecule. [5]
- Q.3(b) What are the different degrees of freedom? Calculate the various degrees of freedom of the following molecules: CH≡CH, HCl, C<sub>6</sub>H<sub>6</sub>. [5]
- Q.4(a) Explain the law of corresponding states. Derive it. [5]
- Q.4(b) Discuss the Vander waals equation when [5]
- (i) Pressure is not too high
- (ii) When the Temperature is high
- Q.5(a) Discuss qualitatively the structure of water and radial distribution function. [5]
- Q.5(b) What is the effect of temperature on Vapour pressure, Surface tension and Viscosity? Discuss it. [5]

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