**BIRLA INSTITUTE OF TECHNOLOGY, MESRA, RANCHI**
**(MID SEMESTER EXAMINATION)**

**CLASS: IMSC** **SEMESTER: I**
**BRANCH: CHEMISTRY** **SESSION : MO/2019**

**SUBJECT : CH104 PHYSICAL CHEMISTRY-I: STATES OF MATTER & IONIC EQUILIBRIUM**

**TIME: 2.00 HOURS** **FULL MARKS: 25**

**INSTRUCTIONS:**
1. The total marks of the questions are 25.
2. Candidates may attempt for all 25 marks.
3. Before attempting the question paper, be sure that you have got the correct question paper.
4. The missing data, if any, may be assumed suitably.

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Q1 (a) What is collision frequency, $Z_{1(1)}$ and mean free path ($\lambda$)? [2]
Q1 (b) Derive the expression for $Z_{1(1)}$ and show its relationship with mean free path ($\lambda$). [3]

Q2 (a) What is the law of equipartition of energy? Estimate the molar heat capacity '$C_{V,m}$' of HCl at high temperature. [2]
Q2 (b) Calculate the most probable velocity of $SO_2$ at 25 °C. [3]

Q3 (a) Why does real gas behave differently than ideal gas? [2]
Q3 (b) The density of mercury (atomic wt. 200.59) is 13.6 g/cc. Estimate the '*b*' value. [3]

Q4 (a) What are the critical constants for real gases? [2]
Q4 (b) The critical temperature and pressure of $CO_2$ gas are 304 K and 72.9 atm respectively. What is the radius of $CO_2$ molecule assuming it to behave as van der Waals gas? [3]

Q5 (a) Show the surface tension and surface energy have same dimension. [2]
Q5 (b) The surface tension of water at 20 ℃ is $72.75 \times 10^{-3}$ N/m. How high will a column of water rise in a capillary tube with radius of 0.005 cm? [3]

**:::::: 14/10/2019 M ::::::**