INDIAN INSTITUTE OF SCIENCE EDUCATION AND RESEARCH KOLKATA

SEMESTER 2

CH1201: General Physical Chemistry

Mid-Semester Examination

Maximum mark: 20   Time: 1 hr.   Date: 19.02.2019

Answer any four questions, each question carries equal mark.

1. (a) Plot and explain the difference between Maxwell distribution curve for 1D, 2D and 3D. (b) Plot and explain C_{rms} against temperature for helium and oxygen.

2. (a) Draw and explain Maxwell distribution plot for translational K.E. for three different gases at a fixed temperature. (b) How do the mean free path depend on temperature (keeping volume constant) and pressure (keeping temperature constant)?

3. (a) Suppose molecular diameter of a gas (say nitrogen) = 4 Å. Calculate (i) collision frequency, and (ii) mean free path at 27°C and 100 mm of Hg pressure. (b) Calculate the value of mean square deviation of speed for N_2 at 27°C.

4. (a) What is the ratio of the number of molecules having speed in the range of $3u_{mp}$ and $3u_{mp}+du$ to the number of molecules having speeds in the range of u_{mp} and $u_{mp}+du$? (b) Estimate the fraction of molecules in the first excited rotational energy level at 27°C if the first excited rotational energy level is at 4 cm^{-1} higher energy than the ground rotational energy level.

5. (a) Estimate the magnitude of total energy (translational, rotational and vibrational) for a tri-atomic molecule. (b) Comment on the validity of Boltzmann distribution for translational, rotational, vibrational, and electronic transitions.

All terms have their usual meaning.