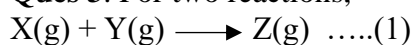


Assignment 11
Indian Institute of Science Education and Research
CHM202: Energetics and dynamics of chemical reactions
Instructor: Dr. Arijit K. De

Ques 1. In a sample of nitrogen (N_2 , with a molar mass of 28.0 g mol^{-1}) at a temperature of 27°C , find the ratio of the number of molecules with a speed very close to 300 ms^{-1} to the number with a speed very close to 100 ms^{-1} .

Ques 2. Using collision theory, calculate the frequency factor 'A' for the following reaction $\text{O}_2 + \text{H} \longrightarrow \text{OH} + \text{O}$ at 273K . Given molecular diameter of H_2 and O_2 are 2.74 \AA and 3.1 \AA respectively.

Ques 3. For two reactions,



According to collision theory, calculate the ratio of squares of pre-exponential factors of reactions at the same temperature.

Species	Mass (gmol^{-1})	Diameter (nm)
X	5	0.3
Y	20	0.5
M	10	0.4
N	10	0.4

Ques 4. Use the collision theory of gas-phase reactions to calculate the theoretical value of the second-order rate constant for the reaction $\text{D}_2(\text{g}) + \text{Br}_2(\text{g}) \longrightarrow 2\text{DBr}(\text{g})$ at 450 K , assuming that it is elementary bimolecular. Take the collision cross-section as 0.30 nm^2 , the reduced mass as 3.930 u , and the activation energy as 200 kJmol^{-1} .

Ques 5. Calculate the following:

a) Temperature at which the root mean square velocity of SO_2 molecules is equal to that of O_2 molecules at 27°C .

b) Most probable speed for O_2 at 1 atm having the density 0.0081 gm/ml .

c) Root mean square speed for ethane at 27°C and 720 mm of Hg .