

HOMEWORK ASSIGNMENT # 4
DUE: THURSDAY, 26 APRIL 2007

Goldstein et al. Chapter 3

Exercises: 8, 31, 32

Additional problem:

In gas-phase chemical reactions, a common approximation for the total cross section is to assume that all impact parameters from $b=0$ until a value of b corresponding to capture lead to reaction. For the attractive part of the Lennard-Jones potential ($V = -\epsilon a^6/r^6$) deduce the total cross section for reaction as a function of collision energy using this approximation. Once you have the total cross section, the so-called rate coefficient

$$k = \langle \sigma_T v \rangle$$

where v is the relative speed and the average is a thermal one, can be calculated. Obtain a formula for k as a function of temperature. The rate coefficient is used because it gives the rate of disappearance of reactants when multiplied by their concentrations. This approximation, however, is an upper limit only because it ignores short-range repulsive forces, known collectively as the “activation energy.”

Goldstein et al. Chapter 4

Exercise 5