Problem 5.2

Problem Purpose

This problem will help you determine whether you have mastered the learning objectives for this unit.

Problem Statement

Collision theory can't be applied directly to a unimolecular reaction like that given in equation (1) below. One approach to developing a theory for unimolecular reactions is to assume that the reactant molecule must first undergo a collision that results in it gaining internal energy. Collision theory can be used to estimate the rate of this preliminary step. Assuming a system contains pure ethane (collision diameter equal to 0.53 nm) at atmospheric pressure and 300 °C, estimate the corresponding pre-exponential factor.

$$C_2H_6 \rightarrow 2\ CH_3 \qquad (1)$$