

30.4: The Internal Energy of the Reactants Can Affect the Cross Section of a Reaction

A further modification of our collision model involves including the internal energy of the colliding gas particles. Recall that the internal energy for a polyatomic gas particle includes electronic, vibrational, and, possibly, rotational energy. It is possible for polyatomic molecules to be in a high enough vibrational state that their vibrational energy alone is greater than E_0 . Such molecules would not require any additional translational energy to react. Thus, for a constant total energy, the value of σ_r depends on the vibrational and, to a smaller extent, rotational state of the particle. During a collision between reacting particles, energy can be exchanged between the different degrees of freedom of the particle, so we will need to modify our model to take into account these energy exchanges that occur during a collision. We will see in section 30.5 that using a center-of-mass coordinate system to describe the reaction collision will allow us to incorporate internal energy into our model.

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