

**[tex70] Collision rate in classical ideal gas**

Given the collision rate  $R_{coll} = \Omega n_1 n_2 \pi d^2 |\mathbf{v}_2 - \mathbf{v}_1|$  in a region of volume  $\Omega$  in the path of two single-velocity beams of particles (diameter  $d$ , mass  $m$ , velocities  $\mathbf{v}_1, \mathbf{v}_2$ , densities  $n_1, n_2$ ), show that the collision rate within a region  $\Omega$  of a classical ideal gas with density  $n$  in thermal equilibrium at temperature  $T$  is

$$R = 2\Omega d^2 n^2 \sqrt{\pi k_B T / m}.$$

**Solution:**