Now, this section was labeled "optional" and you might ask "why are we wasting our time on this?"

Well, if all the molecules, say in water (whose speed distribution can also be represented by a Maxwellian distribution) had all the same speed $v_R$, bad things would happen. It is the extreme right hand tail of the distribution that is important. A small number of the molecules have very high velocities. It is these molecules that have enough energy to break the surface tension of water and leave the water as evaporation. Because these are the highest energy molecules, the result is cooling of the water. Evaporation cools!

This tail of the distribution is also important in the nuclear processes of the sun. Only the protons in the high energy tail of the distribution have sufficient velocity to overcome the Coulomb repulsion (like charges) and fuse to give off energy.

Molar specific heats of an ideal gas

Internal energy $E_{\text{int}} = (nN_A)\overline{K} = nN_A\left(\frac{3}{2}kT\right)$

but $N_Ak = R$

$\therefore E_{\text{int}} = \frac{3}{2}nRT$