4. For zero mass particles, like neutrinos, the relativistic relationship between energy E and momentum $\mathbf{p}$ is

$$E(p) = c|\mathbf{p}|, \quad \text{per particle} \tag{4}$$

where c is the speed of light. Calculate the pressure and energy of a classical relativistic zero mass gas as a functions of density and temperature and show that $pV = gE$, where g is a numerical constant. What is g? Is it different from the non-relativistic case?