J07T.2 - Diatomic Gas in an Electric Field (M06T.2)

Problem

Consider a dilute gas of diatomic molecules with number density n. Each molecule has a constant electric dipole moment μ. The temperature T is high enough so all degrees of freedom may be treated classically, and the correlations between molecules may be neglected.

a) Calculate, to leading non-vanishing order in the density n, the electric polarization density $\vec{P}$ in an arbitrary external electric field $\vec{E}$.

b) What is the dielectric constant ϵ of this gas?