EXAMPLE

A tea mug, the volume of which is $\forall = 3.48 \times 10^{-4}$ m^3, sits empty on Dr. Tom's desk. His office is at 25°C and 101.325 kPa. If air is an ideal gas with $M = 28.97$,

a) find the density of air in Dr. Tom's office.
b) Find the mass of air filling the tea mug. How many air molecules is this?

a) BEST FORM of I.G. EQN IS

$P = \rho R T$

$\rho = \frac{P}{RT}$ $\qquad R = \frac{R_u}{M} = \frac{8.314 \frac{kJ}{kmol \cdot K}}{28.97 \frac{kg}{kmol}} = \frac{kJ}{kg \cdot K}$

$\rho = \frac{101.325 \cancel{kPa}}{\frac{kJ}{kg \cdot \cancel{K}} \cdot [25+273]\cancel{K}} \left\langle \frac{\cancel{kJ}}{\cancel{kPa} \cdot m^3} \right\rangle$

$= 1.185 \frac{kg}{m^3}$

$m_{N_2} = \rho_{N_2} \forall_{tea}$

$= 1.185 \frac{kg}{m^3} \cdot 3.48 \times 10^{-4} m^3 = 4.123 \times 10^{-4} kg$

$m = nM$

$n = \frac{m}{M} = \frac{4.123 \times 10^{-4} kg}{28.97 \frac{kg}{kmol}} = 1.42 \times 10^{-5} kmol$

$\# = n \cdot 6.022 \times 10^{26} \frac{particles}{kmol} = 8.57 \times 10^{21}$ particles