2.1

$$\rho = \frac{p}{RT} = \frac{\left(\frac{1.2\,\text{atm}}{}\,\middle|\,\frac{101{,}325\ \text{Pa}}{1\ \text{atm}}\right)}{\left(287\ \frac{J}{kg\,K}\right)(300\ K)}$$

$$\rho = 1.412\ \frac{kg}{m^3}$$

$$v = 1/\rho = \frac{1}{1.412\ kg/m^3} = \boxed{0.708\ \frac{m^3}{kg}}$$

2.2 Mean kinetic energy of each atom =

$$\frac{3}{2}kT = \frac{3}{2}\left(1.38\times10^{-23}\ \frac{J}{K}\right)(500K)$$

Boltzmann's Constant

$$= 1.035\times10^{-20}\ J/atom$$

Now $\mathcal{M}_{He} = \frac{4.00\ kg}{kg\text{-}mol}$ or $4.00kg = 6.02\times10^{23}$ atoms

thus, $1\ kg = \frac{6.02\times10^{23}}{4} = 1.505\times10^{23}$ atoms

Total internal energy =

$$\left(1.035\times10^{-20}\ \frac{J}{atom}\right)(1.505\times10^{23}\ atoms)$$

$$= \boxed{1558\ J}$$

$\boxed{2.3}$ $$\rho = \frac{p}{RT} = \frac{\left(2116 \frac{lb}{ft^2}\right)}{\left(1716 \frac{ft\text{-}lb}{slug\,°R}\right)(59+460°R)}$$

$$= 0.002376 \text{ slug/ft}^3$$

$$\mathcal{V} = 20 \text{ ft} \times 15 \text{ ft} \times 8 \text{ ft} = 2400 \text{ ft}^3$$

$$\text{Mass} = \rho\mathcal{V} = \left(0.002376 \frac{slug}{ft^3}\right)(2400 \text{ ft}^3)$$

$$= 5.702 \text{ slug}$$

$$\frac{5.702 \text{ slug}}{} \left| \frac{32.2 \text{ lbm}}{1 \text{ slug}} \right. = \boxed{183.6 \text{ lbm}}$$

$$= \boxed{183.6 \text{ lbf}}$$

$\boxed{2.4}$ % change in weight = % change in mass
= % change in density.

$$\rho_{2.4} = \frac{p}{RT} = \frac{\left(2116 \frac{lb}{ft^2}\right)}{\left(1716 \frac{ft\text{-}lb}{slug\,°R}\right)(-10+460°R)} = 0.002740 \frac{slug}{ft^3}$$

$$\%\text{ change} = \frac{\rho_{2.4} - \rho_{2.3}}{\rho_{2.3}} = \frac{\rho_{2.4}}{\rho_{2.3}} - 1$$

$$= \frac{0.002740}{0.002376} - 1 = 0.153 = \boxed{15.3\%}$$

$\boxed{2.5}$ Density $= \dfrac{\Delta m}{\Delta \forall}$

$$\Delta m = \frac{1500 \text{ lbm}}{} \left| \frac{\text{slug}}{32.2 \text{ lbm}} \right. = 46.58 \text{ slug}$$

$$\rho = \frac{46.58 \text{ slug}}{900 \text{ ft}^3} = 0.05176 \frac{\text{slug}}{\text{ft}^3}$$

$$p = \rho R T = \left(0.05176 \frac{\text{slug}}{\text{ft}^3}\right)\left(1716 \frac{\text{ft lb}}{\text{slug °R}}\right)(70+460 \text{ °R})$$

$$= 47{,}075 \frac{\text{lb}}{\text{ft}^2}$$

$$\frac{47{,}075 \frac{\text{lb}}{\text{ft}^2}}{} \left| \frac{1 \text{ ATM}}{2116.2 \frac{\text{lb}}{\text{ft}^2}} \right. = \boxed{22.24 \text{ atm}}$$

Common, but not standard units!

22-141 50 SHEETS
22-142 100 SHEETS
22-144 200 SHEETS
AMPAD