Ch 1- HW

1-76

given: in the U.S., hamburger & other meats are sold by the lb. (1-lb force)

find: mass in slugs, mass in kg, weight in newtons

solution:

slug: $\frac{1\ lb_f}{32.174} = 0.031081\ slug$

kg: $1 lb_f \times 0.453592\ kg = 0.453592\ kg_f$

newton: $1 lb_f \times 4.448 N = 4.448\ N$

Chapter 1 : 48, 58, 63, 76, 92, 107

1.48) Given $F = 18{,}000\ lb$

$d = 2.50\ in$

Find oil Pressure:

$$A = \pi r^2$$
$$= \pi (1.25)^2$$
$$= 4.907$$

$$p = \frac{F}{A} = \frac{18000}{4.907}$$

$$p = 3666.7 \frac{lb}{in^2}$$

1.58)

1.58 Compute the pressure change required to cause a 1% decrease in the volume of mercury.

$E_m = 3.59E6\ PSI, 24,750\ MPa$

$\frac{\Delta V}{V} = -0.01$

$\Delta P = ?$

$$E_m = \frac{-\Delta P}{\Delta V / V}$$

$\Delta P = (-0.01 \cdot 3.59E6) \cdot -1$

$\Delta P = 35,900\ psi \ldots 247.52\ MPa$

An actuator with an internal diameter of 0.50 in. and length of 42.0 in, filled with machine oil, exists. Compute the stiffness in $^{lb}/_{in}$.

$r = 0.25\,in,\ L = 42.0\,in,\ E_o = 189{,}000\ psi$

$V_1 = 42 \cdot 0.25^2 \cdot \pi = 8.25\,in^3$

$V_2 = 41 \cdot 0.25^2 \cdot \pi = 8.05\,in^3$

$\Delta V = 8.05 - 8.25 = -0.2\,in^3$

$V = 8.25\,in^3$

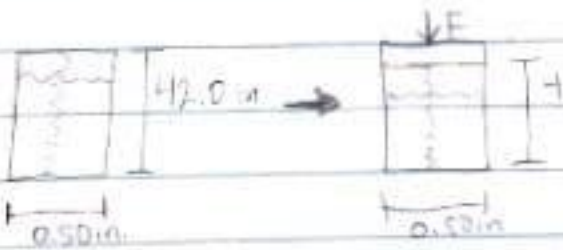
$$E_o = \frac{-\Delta P}{\frac{(V_2 - V_1)}{V}}$$

$\downarrow$

$\Delta p = 4581.818\ \frac{lb}{in^2}$

$4581.818\ \frac{lb}{in^2} \cdot 0.196\,in^2 = 899$

$899\ /_{(41-42)} = 899\ lb/_{in}$



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1-92) A cylindrical container is 150 mm in diameter and weighs 2.25 N when empty. When filled to a depth of 200 mm with a certain oil, it weighs 35.4 N. Calculate the specific gravity of the oil.

$\gamma_o = \frac{W}{V} = \frac{35.4\ N}{0.00353\ m^3}$

$= 10028\ N/m^3$

$S_g = \frac{\gamma_o}{\gamma_w @ 4°C} = \frac{10028\ N/m^3}{9810\ N/m^3}$

$\boxed{S_g = 1.02}$

$r = 0.075 m$

$h = 0.2 m$

$V = \pi r^2 h = 0.00353 m^3$

$W_o = 35.4 N$

$W_c = 2.25 N$

$\gamma_w @ 4°C = 9810\ N/m^3$

1-107) Alcohol has a specific gravity of 0.79. Calculate its density both in slugs/ft^3 and g/cm^3.

slugs/ft^3:

$$SG = \frac{\rho_{C_2H_6O}}{\rho_{H_2O}@4°C} \rightarrow 0.79 = \frac{\rho_{C_2H_6O}}{1.94 \text{ slugs/ft}^3}$$

$$\rho_{C_2H_6O} = 0.79 \times 1.94$$

$$= \boxed{1.53 \text{ slugs/ft}^3}$$

g/cm^3:

$$SG = \frac{\rho_{C_2H_6O}}{\rho_{H_2O}@4°C} \rightarrow 0.79 = \frac{\rho_{C_2H_6O}}{1 \text{ g/cm}^3}$$

$$\rho_{C_2H_6O} = 0.79 \times 1 \text{ g/cm}^3$$

$$= \boxed{0.79 \text{ g/cm}^3}$$