MET 330 Team 5 HW1

Question 1.48

Given:

$F = 18\,000\ lb$

$A = \frac{\pi (2.50\ in)^2}{4} = 4.91\ in^2$

Required:

Oil pressure

$P = \frac{F}{A} = \frac{18000\ lb}{4.91\ in^2}$

$= 3666\ psi$

Question 1.58

Given:

$\Delta V / V = 1\% = -0.01$

$E_{mercury} = 3590000\ psi = 24750\ MPa$

Required:

Pressure change in psi & MPa

(a) Calculating pressure change in psi.

$E = \frac{-\Delta P}{(\Delta V)/V}$ $\therefore \Delta P = -E \cdot (\Delta V)/V$

$\Delta P = -3590000 \times -0.01$

$= 35900\ psi$

(b) Calculating pressure change in MPa.

$\Delta P = -24750 \times -0.01$

$= 247.5\ MPa$

MET 330 Team 5 HW I

Question 1.76
Given:
Weight of Hamburger = 1.00 lb force
Required:
Mass in slugs & Kg and weight in N
$W = mg$

(a) Calculating mass in slugs

$$m = \frac{W}{g} = \frac{1.00\ lb}{32.2\ ft/s^2} = \frac{1.00\ lb \cdot s^2}{32.2\ ft}$$

$$= 0.03\ lb \cdot s^2/ft$$

$$= \underline{0.03\ slugs}$$

(b) Calculating mass in Kg

1 slug = 14.5939029 Kg

$$0.03\ \cancel{slugs} \times \frac{14.5939029\ Kg}{1\ \cancel{slug}}$$

$$= \underline{0.45\ Kg}$$

(c) Calculating weight in N

$W = mg$

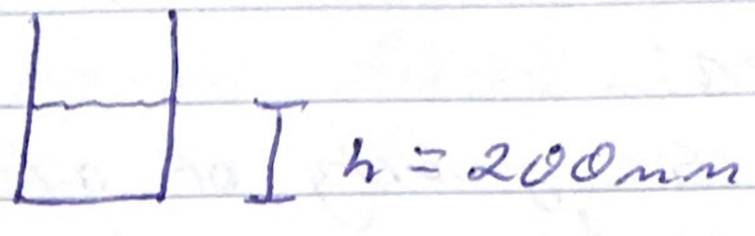
$= 0.45\ Kg \times 9.81\ m/s^2$

$= 4.41\ Kg \cdot m/s^2$

$= \underline{4.41\ N}$

MIT 330 Team 5 HW 1

Question 1.92



Given:
$\emptyset = 150mm = 0.150m$
Weight Empty = $W_1 = 2.25N$
weight with Oil = $W_2 = 35.4N$
$h = 200mm = 0.200m$
Required:
Specific gravity of the Oil

Calculating weight of the oil
$W_o = W_2 - W_1 = 35.4N - 2.25N = 33.15N$

Calculating Volume of the Oil
$V = A \times h = \frac{\pi\, 0.150m^2}{4} \times 0.200m$

$= 0.00353\ m^3$

Calculating Specific weight of the Oil
$\gamma_o = \frac{W}{V} = \frac{33.15N}{0.00353\ m^3}$

$= 9390.935\ N/m^3 = 9.391\ KN/m^3$

$=$

Calculating Specific gravity of the Oil
$S_{go} = \frac{\gamma_o}{9.81\ KN/m^3} = \frac{9.391\ KN/m^3}{9.81\ KN/m^3}$

$= 0.957$

MET 330 Team 5 HW 1

Question 1.107
Given:
Specific gravity of alcohol = 0.79
Required:
density in both slugs/ft^3 and g/cm^3

$S_g = \frac{\rho_A}{\rho_w @ 4°C}$ $\therefore \rho_A = S_g \cdot \rho_w @ 4°C$

(a) Calculating density in slugs/ft^3

$\rho_A = 0.79 \times 1.94$ slugs/ft^3

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

(b) Calculating density in g/cm^3

$\rho_A = 0.79 \times 1000$ kg/m^3

$= 790$ kg/m^3

Converting to g/cm^3

$\frac{790 \text{ kg}}{\text{m}^3} \times \frac{1 \text{ m}^3}{100^3 \text{ cm}^3} \times \frac{1000 \text{ g}}{1 \text{ kg}}$

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

MET 330 Team 5 HW I

Question 2.17

1 Molasses
2 inks
3 Chocolate
4 paint

Question 2.18

The dynamic viscosity of water @ 40°C

$\eta = 6.5 \times 10^{-4}\ N\text{-}s/m^2$

$= 0.65\ mN\text{-}s/m^2$

Question 2.27

The dynamic viscosity of Hydrogen @ 40°F

$\eta = 1.9 \times 10^{-7}\ lb\text{-}s/ft^2$

Question 2.35

The dynamic viscosity of SAE 30 oil @ 210°F

$\eta = 2.2 \times 10^{-4}\ lb\text{-}s/ft^2$

MET 330 Team 5 HW 1

Question 2.61

Given:

Diameter of steel ball = 1.6mm = 0.0016m

$Sg_o = 0.94$

$\gamma_s = 77\ KN/m^3$

$h = 250\ mm = 0.250\ m$

$t = 10.4s$

Required:

Viscosity of the Oil $\eta = \frac{(\gamma_s - \gamma_o)D^2}{18V}$

Calculating velocity of the ball

$V = \frac{d}{t} = \frac{h}{t} = \frac{0.250\ m}{10.4s} = 0.0240\ m/s$

Calculating specific weight of the fluid

$Sg_o = \frac{\gamma_o}{9.81\ KN/m^3}$ $\therefore\ Sg_o \times 9.81\ KN/m^3 = \gamma_o$

$\gamma_o = 0.94 \times 9.81\ KN/m^3$

$= 9.221\ KN/m^3$

Calculating Viscosity

$\eta = \frac{(77\ KN/m^3 - 9.221\ KN/m^3)\ 0.0016\ m^2}{18 \times 0.0240\ m/s}$

$= 0.402\ \frac{KN}{m^2} \times m^2 \times \frac{s}{m}$

$= 0.402\ KN \cdot s/m^2$