Problem 48

Given: F = 18000 lb
D = 2.50 in

Known: $1\ lb/in^2 = 1\ psi$

Calculation:

$$A = \frac{\pi}{4}D^2 = \frac{\pi}{4}(2.5\ in)^2 = 4.909\ in^2$$

$$p = \frac{F}{A} = \frac{18000\ lb}{4.909\ in^2} = 3666.7\ lb/in^2$$

$$3666.7\ \cancel{lb/in^2}\left(\frac{1\ psi}{\cancel{1\ lb/in^2}}\right)$$

$$p = \boxed{3666.7\ psi}$$

Problem 58

Given: Volume of mercury decreases 1 %

☆ Modulus of Mercury from Table 1.3
3,590,000 psi or 24750 MPa

Calculation:

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

psi :

$$\Delta p = -E(\Delta V/V)$$

$$= -(3{,}590{,}000\ psi)(-0.01)$$

$$\Delta p = \boxed{35{,}900\ psi}$$

MPa

$$\Delta p = -E(\Delta V/V)$$

$$= -(24750\ MPa)(-0.01)$$

$$\Delta p = \boxed{247.5\ MPa}$$

problem 17

4 Examples of Non Newtonian fluids

1. Pseudoplastic
2. Dilatant Fluids
3. Bingham Fluids
4. Thixotropic Fluids

problem 18

Viscosity of water at 40°C

- use appendix D estimated $\boxed{\eta = 6.3 \times 10^{-4}\ N \cdot s/m^3}$

1-76 In the United States, hamburger and other meats are sold by the pound. Assuming that this is 1.00-LB Force, compute the mass in slugs, kg, ~~and~~ the mass in kg, and the weight in N.

~~1 LB . 32.2 LB-force = 1 slug~~ $\frac{1 \text{ LB force}}{32.2 \text{ ft/s}^2} = \boxed{.031 \text{ slug}}$

$.031 \text{ slug} \cdot 14.59 \text{ kg/slug} = \boxed{.453 \text{ kg}} \cdot 9.81 \text{ m/s}^2 = \boxed{4.445 \text{ N}}$

2-27 Dynamic Viscosity of Hydrogen @ 40°F $\approx \boxed{2 \times 10^{-7} \text{ lb-s/ft}^2}$

2-35 Dynamic Viscosity of SAE 30 oil @ 210°F $\approx \boxed{2 \times 10^{-4} \text{ lb-s/ft}^2}$

MET 330 HW 1.1

1-63 1-76 2-27 2-35 1/20/22

1-63 A measure of the stiffness of a linear actuator system is the amount of force required to ~~move~~ cause a certain linear deflection. For an actuator that has an inside diameter of 0.5 in and a length of 42.0 in and that is filled with machine oil, compute the stiffness in lb/in.

$E_{oil} = 189000$ PSI $V = (.5 in)^2 \cdot \frac{\pi}{4} \cdot 42 in = 8.247 in^3$

$\cancel{E = \frac{-\Delta P}{(\Delta V)/V} = \frac{-\Delta P \cdot V}{\Delta V} \quad \frac{-\Delta P}{\Delta V} = \frac{E}{V} = \frac{189000 \, LB/in^2}{8.247 \, in^3}}$

$\cancel{\Delta V = \Delta L \cdot A = \Delta L \cdot .196 in^2}$

$\cancel{\left(\frac{-\Delta P}{\Delta L \cdot .196 in^2} = \frac{189000 \, LB/in^2}{8.247 in^3}\right) .196 in^2 \quad \frac{-\Delta P}{\Delta L} =}$

$\Delta V = \Delta L \cdot A = .196 in^2 \cdot \Delta L \qquad \Delta P = F/A = F/.196 in^2 \quad V = A \cdot L$

$E = \frac{-\Delta P}{\Delta L \cdot .196 in^2 / V} = \frac{-\Delta P \cdot V}{\Delta L \cdot .196 in^2} = \frac{-F/\cancel{.196 in^2} \cdot \cancel{V}\ 42 in}{\Delta L \cdot .196 in^2}$

$\left(\frac{-F \cdot 42 in}{\Delta L \cdot .196 in^2} = E\right) \cdot .196 in^2 = \frac{\frac{-F \cdot 42 in}{\Delta L} = \frac{E \cdot .196 in^2}{\cancel{.196 in^2}}}{42 in}$

$\frac{-F}{\Delta L} = \frac{189000 \, LB/\cancel{in^2} \cdot .196 \cancel{in^2}}{42 in} = \boxed{4500 \, LB/in}$

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HW #1 Miranda Cooper MET 330

1.92) $V = \frac{\pi}{4} D^2 H \rightarrow \frac{\pi}{4}(0.15^2)\,0.2 = 3.53 \times 10^{-3}\ m$ 150 mm = 0.15 m

200 mm = 0.2 m

$35.4 - 2.25 = 33.15\ N$

$W = m \times g = 33.15 \rightarrow m_o = \frac{33.15}{9.81} = 3.379\ kg$

$D = \frac{m}{V} \rightarrow \frac{3.379}{3.53 \times 10^{-3}} = 956.1\ kg/m^3$

$\gamma_o = \frac{\rho_o}{\rho} \rightarrow \frac{956.1}{1000} = \boxed{0.9561}$

1.107) $Sg = \frac{\rho_a}{\rho} \rightarrow 0.79 = \frac{\rho_a}{1000\ kg/m^3} = 790\ kg/m^3$

$790\ \frac{kg}{m^3} \times \frac{1000\ g}{1\ kg} \times \frac{1\ m}{100\ cm} \times \frac{1\ m}{100\ cm} \times \frac{1\ m}{100\ cm} = \boxed{0.790\ g/cm^3}$

$790\ \frac{kg}{m^3} \times \frac{1\ m}{3\ ft} \times \frac{1\ m}{3\ ft} \times \frac{1\ m}{3\ ft} \times \frac{2.2\ lb}{1\ kg} \times \frac{1\ slug}{32.2\ lb} = \boxed{1.999\ slug/ft^3}$

2.61) $Sg = \frac{\rho_o}{\rho} \rightarrow 0.94 = \frac{\rho_o}{1000} = 940\ kg/m^3$ 250 mm = 0.25 m

$\rho_s = \frac{77 \times 1000}{9.81} = 7849.1\ kg/m^3$ $V = \frac{distance}{t} \rightarrow \frac{0.25}{10.4} = 0.024\ m/s$

$\mu = \frac{g d^2}{18 V}(\rho_s - \rho_o) \rightarrow \frac{9.81\,(0.0016^2)}{18\,(0.024)}(7849.1 - 940) = \boxed{0.4\ Pa.s}$