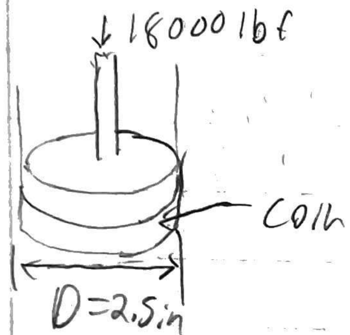
HW 1.4

Chapter 1

48. Find oil pressure needed to produce Coinmerative Coins in Coining Press



Data
- F = 18000 lbf
- D = 2.5 in

$$A = \frac{\pi}{4} \cdot D^2$$

$$A = \frac{\pi}{4} \cdot 2.50 in^2$$

$$A = 4.91 \, in^2$$

$$P = \frac{F}{A} = \frac{18{,}000 \text{ lbf}}{4.91 in^2}$$

$$P = 3666.93 \text{ lbf}/in^2$$

$$\boxed{P = 3666.93 \text{ psi}}$$

HW1.4

58. Compute Pressure Change required to cause a decrease in Volume of mercury by 1.00%. Express in both psi and MPa

1.00% reduction in fluid volume

$$E = \frac{-\Delta P}{\frac{\Delta V}{V}}$$

$E = 3,590,000\,psi$

$E = 24,750\,MPa$

$$\Delta P = -E \cdot \frac{\Delta V}{V}$$

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

$\Delta P = -E \cdot -0.01\%$

$\Delta P = 3,590,000\,psi \cdot 0.01\%$

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

$\Delta P = 24,750\ MPa \cdot 0.01\%$

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

HW 1.4

63. Compute Stiffness in lb/in $E = 189000$ psi

$D = 0.50''$

$P = \frac{F}{A}$ $F = P \cdot A$ $P = E = 189{,}000$ psi $L = 42''$

$A = \frac{\pi}{4} \cdot D^2$

$A = \frac{\pi}{4} \cdot 0.50\,in^2$

$A = 0.196\,in^2$

$F = 189{,}000 \frac{lbf}{in^2} \cdot 0.196\,in^2$

$F = 37110\ lb$

$Stiffness = \frac{37110\,lb}{42\,in}$

$\boxed{Stiffness = 884\ lb/in}$

1.4

76 lbf → slugs → Kg → N

$$\frac{1.00\ lbf}{32.2\ ft/s^2} = \boxed{0.031\ slugs}$$

$$0.031\ \cancel{slugs} \cdot \frac{14.59\ Kg}{\cancel{slug}} = \boxed{0.45\ Kg}$$

$$0.45\ Kg \cdot 9.81\ m/s^2 = \boxed{4.44\ N}$$

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92. D=150mm W=2.25N when empty

Filled to 200mm weighs 35.4N

SG=?

D = 150 mm

W_0 = 2.25

W = 33.4

H = 200mm

$$SG = \frac{\rho_s}{\rho_w @ 4°C} \qquad \rho = m/V \qquad W = m \cdot g$$

$$\frac{W}{g} = m$$

$$\Delta W = 35.4N - 2.25N = 33.15N$$

$$\frac{33.15N}{9.81 m/s^2} = 3.379 Kg$$

$$V = \frac{\pi}{4} \cdot D^2 \cdot H$$

$$= \frac{\pi}{4} \cdot 0.150^2 \cdot .200m$$

$$V = 0.00353 m^3$$

$$\rho = \frac{3.379\ Kg}{(3.53 \times 10^{-3} m^3)} = 956.12 \frac{Kg}{m^3}$$

$$Sg = \frac{956.12\ Kg/m^3}{1000\ Kg/m^3}$$

$$\boxed{Sg = 0.956}$$

1.4 17, 18, 27, 35, 61

Chapter 2

17. Molasses, ethylene glycol, Chocolate, paint

18. Value of Viscosity for water at 40°C

$\boxed{6.5 \times 10^{-4}\ Pa \cdot s}$

27. Value of viscosity for Hydrogen at 40°F

$\frac{40°F - 32°F}{1.8} = 4.44\ °C$ $1 \times 10^{-5}\ Pa \cdot s$

35. Viscosity of SAE 30 at 210°F

$\frac{210°F - 32°F}{1.8} = 98.89°C$ $\boxed{1 \times 10^{-2}\ Pa \cdot s}$

61. falling ball viscometer $D_{Ball} = 1.6mm = 0.0016m$

$Sg = 0.94$, $\gamma_b = 77\ kN/m^3$

Ball falls 250mm in 10.4s. Viscosity = ?

$\eta = (\gamma_b - \gamma_F) \cdot \frac{D^2}{18V}$ $Sg = \frac{\rho_s}{\rho_w @ 4°C}$ $\gamma = \rho g$

$Sg \cdot \rho_w @ 4°C = \rho_s$

$0.94 \cdot 1000\ Kg/m^3 = \rho_s$

$940\ Kg/m^3 = \rho_s$

$\gamma_F = 940\ Kg/m^3 \cdot 9.81\ m/s^2$

$\gamma_F = 9221.4\ N/m^3$

$V = \frac{.250m}{10.4s}$

$V = 0.024\ m/s$

$\eta = (77000\ N/m^3 - 9221.4\ N/m^3) \frac{(1.6 \times 10^{-3} m)^2}{18(0.024 m/s)}$

$\boxed{\eta = 0.402\ Pa \cdot s}$