45. Coining process requires a Force 18000 lb. Hydraulic cylinder has diameter of 2.50 in.

Given: 18,000 lb = F Find: Pressure $P = \frac{F}{A}$

$\phi = 2.50 \text{ in}$

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

$P = \frac{18{,}000 \text{ lb}}{4.91 \text{ in}^2} = \boxed{3{,}665.99 \text{ psi}}$

58 Given: volume of Mercury by 1.00

Find: Pressure change required to decrease [psi & MPa]

Bulk Modulus

$E = \frac{-\Delta P}{(\Delta V)/V} \Rightarrow \Delta P = -E[(\Delta V)/V]$

Table 1.3
[standard value for Mercury at atmospheric pressure 68°F (20°C) is 3,590,000 psi 24,750 MPa]

$(\Delta V)/V = \frac{1.00}{100} \Rightarrow -.01$

$\Delta P = -(3{,}590{,}000 \text{ psi})(-.01) = \boxed{35{,}900 \text{ psi}}$

$\Delta P = -(24{,}750 \text{ MPa})(-.01) = \boxed{247.5 \text{ MPa}}$

63. Given: $\varnothing = .50\,in$

$L = 42.0\,in$

Table 1.3 Machine Oil $E = 189{,}000\,psi / 1305\,MPa$ @ $68°F\,(20°C)$

Find: Stiffness (lb/in)

$$\text{Stiffness} = \frac{F}{\Delta L}$$

Bulk Modulus

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

$$E = \frac{-\left(\frac{F}{A}\right)}{\frac{-A(\Delta L)}{AL}}$$

$$P = \frac{F}{A} \qquad V = A \times L \Rightarrow \Delta V = -A \times \Delta L$$

$$A = \frac{\pi}{4}(.50\,in)^2$$

$$A = .19635\,in^2$$

$$E = \frac{-F}{A} \times \frac{AL}{-A(\Delta L)} \Rightarrow \frac{FL}{A(\Delta L)} \Rightarrow \left[\frac{F}{\Delta L} = \frac{EA}{L}\right]$$

$$\frac{F}{\Delta L} = \frac{189{,}000\,lb/in^2 \cdot (.19635\,in^2)}{42.0\,in} = \frac{37{,}110.15\,lb}{42.0\,in} =$$

$$\boxed{\text{Stiffness} = 883.575\,lb/in}$$

76. Given: 1.00 lb Force Find: mass in Slugs, kg, & N

$$m = \frac{w}{g} \Rightarrow \frac{1\,lb}{32.2\,ft/s^2} = .0311\,lb \cdot s^2/ft \Rightarrow \boxed{.0311\,\text{Slugs}}$$

$$1\,lbf = 4.448\,N \Rightarrow \frac{4.448\,N}{9.81\,m/s^2} = .4534\,N \cdot s^2/m \Rightarrow \boxed{.4534\,kg}$$

$$\boxed{1\,lbf = 4.448\,N}$$

92. Given: $\varnothing = 150mm \Rightarrow .15m$

$w = 2.25N$ empty

depth $= 200mm \Rightarrow .2m$

$w = 35.4N$

Find: specific gravity of oil

Specific weight $\gamma = \frac{w}{V}$

$V = \pi r^2 h$

$Sg = \frac{\gamma_s}{\gamma_w @ 4°C} = \frac{\rho_s}{\rho_w @ 4°C}$

Weight of oil = Total − Empty weight

$W_{oil} = 35.4N - 2.25N$

$W_{oil} = 33.15N \times \frac{1kN}{1000N}$

$W_{oil} = .03315\ kN$

$V = \pi(.075m)^2 \cdot (.2m) = .003534m^3$

Specific weight $= \frac{.03315\ kN}{.003534m^3} \Rightarrow 9.38\ kN/m^3$

$\boxed{Sg = \frac{9.38\ kN/m^3}{9.81\ kN/m^3} = .956}$

107 Given: Alcohol $Sg = .79$

Find: Density slugs/ft³, g/cm³

Density $\Rightarrow \rho = Sg \times \rho_{water} @ 4°C$

$.79 \times 1.94\ slugs/ft^3 = \boxed{1.533\ slugs/ft^3}$

$1\ slugs/ft^3 = .515\ g/cm^3$

$\rho = 1.533 \times \frac{.515\ g/cm^3}{slugs/ft^3} = \boxed{.789\ g/cm^3}$

17. 1. Blood Plasma 3. inks
2. latexes 4. Paint

18. 6.2×10^{-4} Appendix D-1 water @ 40°C

27. 1.7×10^{-7} Appendix D-2 Hydrogen @ 40°F

35. 1.4×10^{-3} Appendix D-2 SAE 30 @ 120°F

61. Given: $\emptyset = 1.6\,mm \rightarrow .0016\,m$ steel ball

heavy oil $sg = 0.94$

$W_{steel} = 77\,kN/m^3$

Depth = 250 mm → .25m

$t = 10.4s$

$.94 = \frac{\gamma_f}{9.81\,kN/m^3}$

$\gamma_f = (.94)(9.81)$

Find: Viscosity of oil

$$\eta = \frac{(\gamma_{steel} - \gamma_{fluid})D^2}{18v} = \frac{(77000 - (.94 \cdot 9810))(.0016)^2}{18\left(\frac{.25m}{10.4s}\right)}$$

$$\eta = \frac{.173513216}{.432692316} = .401008314$$

$$\eta = 4.01 \times 10^{-1}\,N \cdot s/m^2$$

$$\frac{N}{m^3} \times m^2 = \frac{N}{m}$$

$$\frac{N}{m} \times \frac{s}{m} = \frac{N \cdot s}{m^2}$$