Fluid mechanics HW 1 Ben Smithson group 6

1.48

$P = \frac{F}{A}$ $P = \frac{18000\ lb}{A}$

$A = \pi(1.25)^2 = 4.90$

$P = \boxed{3666.92\ lb/in^2}$

1.58 Compute pressure change required for decrease in volume of mercury by 1%

$\Delta V/V = -0.01$

$\Delta P = -E[\Delta V/V] = [-3590000][-0.01] = \boxed{35900\ psi}$

$= -24,750\ [-0.01] = \boxed{247.5\ mpa}$

1.63

Stiffness of linear actuator system

$A = \frac{\pi}{4} d^2 = \frac{\pi}{4}(0.5)^2 = 0.196$

$d = 0.5in$ $L = 42in$

E (machine oil) $= 189000\ lb/in^2$

$S = \frac{F}{\Delta L} = \frac{EA}{L} = \frac{189000\ lb/in^2 \cdot 0.1963\ in^2}{42\ in} = 883$

$\boxed{S = 883.35\ lb/in}$

1.65 = ?

1.76

$1\ slug = 32.174\ lb$

$\frac{11\ lb \cdot 1\ slug}{32.174\ lb} = \boxed{0.03108\ slug}$

$1\ kg = 2.2046\ lb$ $\frac{1}{2.2046} = \boxed{0.4544\ kg}$

$1\ lb = 4.45\ N = \boxed{4.45N}$

1.92

$W_c = 2.25\ N$

$W_c + W_o = 35.4\ N$

$d = 150mm = 0.15m$

$h = 200mm = 0.2m$

$\gamma_o = \frac{W_o}{V}$

$Sg_o = \frac{\gamma_s}{\gamma_w @ 4°C}$

$35.4N - 2.25 = 33.15N$

$r = \frac{0.15}{2} = 0.075m$

$\gamma_w @ 4°C = 9.81 kN/m^3$

$W_o = 33.15N = 0.03315kN$

$V = \pi r^2 h$

$= \pi (0.075m)^2 (0.2)$

$V = 0.003534\ m^3$

$\gamma_o = \frac{W_o}{V} = \frac{0.03315kN}{0.003534m^3} = \boxed{9.38 kN/m^3}$

$\gamma_o = 9.38 kN/m^3$

$Sg = \frac{9.38\ kN/m^3}{9.81\ kN/m^3} = \boxed{0.96}$

1.107

$Sg_a = 0.79$

$Sg = \frac{\rho_s}{\rho_w @ 4°C}$

$\rho_A = ?$ slugs

$\rho_w @ 4°C = 1000\ kg/m^3 = 1.94 slug$

$\rho_a = (0.79)(0g/cm^3) / 0.79g/cm^3$

$\frac{1000kg}{m^3} \left(\frac{1000g}{1kg}\right) \left(\frac{1}{10}\right.$

$= 1g/cm^3$

$\rho_a = (0.79)(1.94\ slug/ft^3) = 1.53\ slug/ft^3$

$\boxed{\rho_a = 0.79g/cm^3 \text{ or } 1.53\ slugs/ft^3}$