MET 330 | HW 1.1 | John Buttle

Ch 1:

48) $P_{oil} = \frac{F}{A} = \frac{18{,}000\ lb}{\pi/4 (2.50\ in)^2} = 3.66\ lb/in$

58) $h = -V\frac{\Delta P}{\Delta V} \Rightarrow \Delta P = -h \times \frac{\Delta V}{V}$ Bulk Modulus of Mercury 2.8E4 MPa

$\Delta P = -2.8E4 \times -0.01 = 280\ MPa$

1 MPa = 145.038 PSi

$\Delta P = 280 \times 145.038 = 40{,}610.64\ PSi$

63) $E = \frac{-PV}{\Delta V}$ $(\Delta V) = -A(\Delta L)$ $P = \frac{F}{A}$

$\Rightarrow \frac{EA}{L} = \frac{F}{\Delta L}$ $A = \frac{\pi}{4}(0.5)^2 = 0.196\ in^2$

$\Rightarrow \frac{(11{,}690{,}000\ lb/in) \times (0.196\ in^2)}{42\ in} = 682\ lb/in$

76) 1 lb = 0.0311 Slug
1 lb = 0.454 kilogram
1 lb = 4.45 Newtons

92) d = 150mm w = 2.25N W = 35.4 h = 200mm

Weight of oil = 35.4 − 2.25 = 33.15 N = 3.38 kg (÷ 9.81)

Volume of oil = $(\pi/4\ d^2) \cdot h \Rightarrow \frac{\pi}{4}(0.150)^2(0.2) = 3.534E-3\ m$

Density of oil = $\frac{M_{oil}}{Volume} = \frac{3.38}{3.534E-3} = 956.423\ kg/m$

107) $\gamma = (0.79)(62.4) = 49.29\ lb/ft$ — Specific Weight —
$\gamma = (0.79)(9.79) = 7.734\ kN/m$

$\rho = (0.79)(1.94) = 1.532\ Slugs/ft$
$\rho = (0.79)(1000) = 790\ kg/m$ — Density —

Ch 2:

17) Quick Sand, Silly Putty, toothpaste and melted cheese

18) How at 40°C => 6.2E-4 (N·S/M²)
27 lb at 40°F => 1.9E-7 (lb-S/FT²)
351 SAE 30 oil at 210°F => 2.3E-4 (lb-S/FT²)

C1) D = 1.6mm => 1.6E-3 m $\gamma = 77\ kN/m$

Specific Gravity = 0.94 => $0.94 = \frac{\gamma_f}{9.81} = 9.22\ kN/m$

$F_b = \gamma_f V = \gamma_f \frac{\pi D^3}{6} = 9.22$

$F_b = 1.97E-8\ kN$ $\times \pi \times (1.6E-3)^3/6$

Felt unsure on some units

Velocity = D/t = 2.5E-3 / 10.4 = 0.024 m/s

$W = \gamma V = (77\ kN)(2.14E-9) = (1.65E-7\ kN)$

$F_d = W - F_b = (1.65E-7 - 1.97E-8) = 1.45E-7\ kN$

$h = \frac{F_d}{3\pi V D} = \frac{1.45E-7}{3 \times 3.14 \times 0.024 \times 1.6E-3} \Rightarrow \mu = 400.85\ \frac{kN}{m^2}$