Calloway Mandy

MET330

9/4/24

1/3

HW 1.1

HW 1

1.48 Force Required F_R = 18000 lb

Cylndr Diameter = 2.50 in

Cylndr Area = $\pi (1.25\ in)^2 = 1.5625(\pi)\ in^2$

Pressure = Force/Area = $18000\ lb / 1.5625\pi\ in^2 = 3667.429\ psi$

3667 psi

1.58

Pressure Change Required to decrease a Volume of Mercury by 1.00 % in psi & MPa

Change in Volume 8hy = 1% or $\frac{\Delta V}{V}$ 3rd time

Bulk modulus of Mercury is: E = 3.59×10^6 psi

or 24750 mPa

$E = \frac{\Delta P}{\frac{\Delta V}{V}}$ => $3590000\ psi = \frac{\Delta P}{.01}$ $\Delta P = 35900000 \cdot .01$

$\frac{\Delta V}{V} = .01$

$24750\ mPa = \frac{\Delta P}{.01}$ $\Delta P = 24750\ mPa \cdot .01$

The pressure Change would have to be 3.59×10^4 psi or 247.5 mPa to decrease the volume of the Mercury by 1%

1-63 Stiffness is F_R to deflect, measured in lb/in

Actuator inside Diameter = 0.50 in

Actuator length = 42 in

Filled w/ machine oil => machine oil E = 189,000 psi

Bulk mod

ΔL = 1 inch

$\Delta L/L = 1/42$

F = 884 lbs

$E = \Delta P/(\Delta L/L)$

$189,000\ psi = \Delta P/(1/42)$

$4500 = \Delta P$ psi

$P = F/A$

$F = 4500\ psi \cdot (\pi(.25^2))$

feels low? I guess that's a small inch tho.

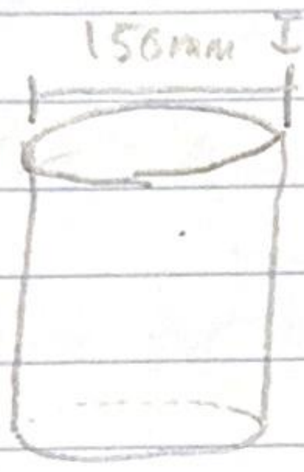
1.76 hamburger → 1 lbm USy Appendix K

mass in slugs → 32.174 lbm / slug → 1/32.174 slug
= .031 slug

mass in kg → 2.205 lbm / kg → 1/2.205 kg
= .454 kg

Weight in N → 4.448 N / lb_f = 1 lbm on earth = 4.448 N

1.92



2.25 N @ 0 mm or empty
35.4 N @ 200 mm full
Specific weight: (Vol)

$\gamma = w/V$

$w = (35.4\,N - 2.25\,N) = 33.2\,N$

$V = \pi r^2 \cdot h = \pi (0.075\,m)^2 \cdot 0.2\,m$

$\gamma = \frac{33.2\,N}{\pi \cdot (.0011 25\,m^3)} = \boxed{9393.7\,N/m^3}$

1.107 Alcool specific gravity $SG_A = .79$

find density in slugs/ft^3 & g/cm^3

$SG_A = \rho_A / 1.94\ slugs/ft^3 = \rho_A / 1000\ kg/m^3$

$\rho_A = (1.94\ slugs/ft^3)(.79) = \underline{1.53\ slugs/ft^3}$

$\rho_A = (1000\ kg/m^3)\left(\frac{1000\ g}{kg}\right)\left(\frac{1\ m^3}{1000000\ cm^3}\right)(.79) = \underline{.79\ g/cm^3}$

(Also: $515.4\ kg/m^3 = 1\ slug/ft^3$; $1000\ (.79\ g/cm^3) = 1.53\ slug/ft^3$) Conversions checked w/ table K

2.17 4 types of Non-newtonian Fluids

Time independent { Pseudoplastics → latex, inks, syrup, molasses
Dilatant fluids → Starch in water (like for kids cookbook)
Bingham fluids → Paint, Chocolate, Mayo, asphalt
Time dependent fluids → Some Jelly, grease, Pizza dough (like)

2-13

Viscosity of water @ 40°C using Appendix D

is: $\eta \approx 6.5 \times 10^{-4} \frac{N \cdot s}{m^2}$

2-27 Sam Setup For Hydrogen @ 40 °F = 4.4°C

Not today

40 °F => (40 - 32) / 1.8

is $\eta = 1 \times 10^{-5} \frac{N \cdot s}{m^2}$ = 4.4°C

2 → 35

Same Setup SAE 30 oil @ 210°F

210°F => (210 - 32) / 1.8 = 99°C

is $\eta = 1 \times 10^{-2} \frac{N \cdot s}{m^2}$

2-61

Steel ball 1.6 mm diameter Sg. 94

Sphere Volume: $V = 4/3 \pi r^3$

$V = 4/3 \pi (.8\,mm)^3 = 2.145\,mm^3$

Steel density: 77 kN/m³ → ball falls 250 mm in 10.4 s find viscosity of oil.

$2.145\,mm^3 = 2.145 \times 10^{-9}\,m^3$

$(77\,kN/m^3) \cdot (2.145 \times 10^{-9}\,m^3)$

Steel weight $= 1.65 \times 10^{-7}\,kN$

Need to study this