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MET 330

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HW #1.1

48.

A coining press is used to produce commemorative coins with the likenesses of all the U.S. presidents. The coining process requires a force of 18,000 lb. The hydraulic cylinder has a diameter of 2.50 in. Compute the required oil pressure

Given: F=18,000 lb
d= 2.50 in

Formulae: $P=F/A$
$A=(\pi/4)d^2$

Solve: Find area of coin face
A 4.908739

Solve for pressure with given force and calculated area

p 3666.93 $lb/in^2$

$P\approx 3.6*10^3$ psi

58.

Compute the pressure change required to cause a decrease in the volume of mercury by 1.00 percent. Express the result in both psi and Mpa

Given: Hg ↓1% v Find: $E_{hg}$ 3590000 psi 24750 Mpa Table 1.3

Formulae: $E=((-\Delta p)/((\Delta V)/V)$

Solve: $E=((-\Delta p)/((\Delta V)/V)$

$E=(-\Delta p)/(\Delta V)$

$E(\Delta V)=-\Delta p$

$(-\Delta p)=E(\Delta V)$

psi: -35900
Mpa: -247.5

Solution:

Δp required to decrease volume by 1%:

| | |
|---|---|
| psi: | $35.9*10^3$ |
| Mpa: | 247.5 |

63.

A measure of the stiffness of a linear actuator system is the amount of force required to cause a certain linear deflection. For an actuator that has an inside diameter of 0.50 in and a length of 42.0 in and that is filled with machine oil, compute the stiffness in lb/in

| | | | | |
|---|---|---|---|---|
| Given: | id=0.50 in | | | |
| | L=42.0 in | | | |
| | machine oil | E: | 189000 psi | Table 1.3 |

Formulae: $E=((-\Delta p)/((\Delta V)/V)$

$A=(\pi/4)d^2$

Solve: $E=((-\Delta p)/((\Delta V)/V)$

$E=(-pV)/\Delta V$

$p=(F/A)$

$V=(A*L)$

$\Delta V=-A(\Delta L)$

$E=(-(F/A)*(A*L))/(-A(\Delta L))$

$E=(FL)/(A(\Delta L))$

$(EA/L)=(F/\Delta L)$

A: 0.19635

F/ΔL: 883.5729

| Stiffness: | 883.6 | lb/in |
|---|---|---|

76.

1.76; $F = M * A$

$32.2\ ft/S^2$

$32.2lb = 1slug *$

$M = \frac{1}{32.2} = .031 = 3.1 * 10^{-2}slug$

$1slug = 14.594kg$

$3.1 * 10^{-2}slug * 14594kg = 0.452kg$

$W = M * g = 0.452kg * 9.8\,m/S^2 = 4.42kgM/S^2 = 4.42N$

92

A cylindrical container is 150 mm in diameter and weighs 2.25 N when empty. When filled to a depth of 200 mm with a certain oil, it weighs 35.4 N. Calculate the specific gravity of the oil

Given:

d=150 mm

$m_1$= 2.25 N $w_1$ 0.229357798 kg A: 0.017671 $m^2$

Δz=200 mm V=AxΔz 0.003534 $m^3$

$m_2$=35.4 N $w_2$ 3.608562691 kg

Formulae:

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

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

$$\rho = \frac{m}{V}$$

Data:

$$\gamma_w @ 4°C = 9.81\ {}^{kN}/_{m^3}$$

$$\rho_w @ 4°C = 1000\ {}^{kg}/_{m^3}$$

Solve:

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

$m_{oil}=m_2-m_1$ 33.15 N

w 3.37920489 kg

$\rho_{oil}$ 956.1194

| sg | 0.9561194 |
|---|---|

107.

[Grab your reader's attention with a great quote from the document or use this space to emphasize a key point. To place this text box anywhere on the page, just drag it.]

Alcohol has a specific gravity of 0.79. Calculate its density both in slugs/ft$^3$ and g/cm$^3$

Given: Alcohol
sg= 0.79

Formulae: $sg = \frac{\gamma_s}{\gamma_w @ 4°C} = \frac{\rho_s}{\rho_w @ 4°C}$

$\gamma = \rho g$

Data: $\gamma_w @ 4°C = 9.81\ ^{kN}/_{m^3}$

g 32.2 ft/s$^2$
9.81 m/s$^2$

$\gamma_w @ 4°C = 62.4\ ^{lb}/_{ft^3}$

$1000\ ^{kg}/_{m^3} = 1\ ^{g}/_{cm^3}$

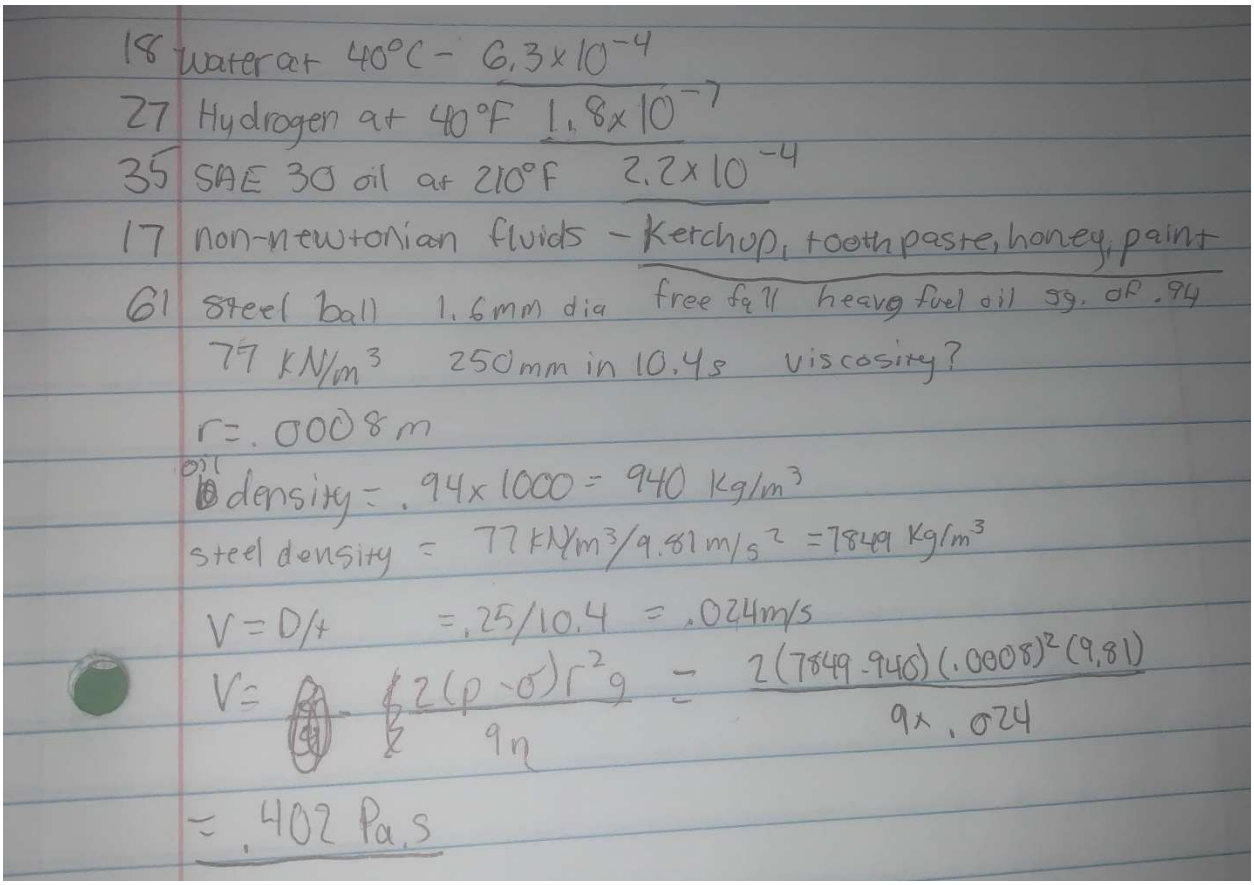
$\rho_w @ 4°C = 1000\ ^{kg}/_{m^3}$

$\rho_w @ 4°C = 1.94\ ^{slugs}/_{ft^3}$

Solve: ρ=sg*g

| | | |
|---|---|---|
| $\rho_{slugs}$ | 1.53 | slugs/ft$^3$ |
| $\rho_{grams}$ | 0.79 | g/cm$^3$ |

18-61.


18 Water at 40°C - 6.3x10^-4
27 Hydrogen at 40°F 1.8x10^-7
35 SAE 30 oil at 210°F 2.2x10^-4
17 non-newtonian fluids - Ketchup, toothpaste, honey, paint
61 steel ball 1.6mm dia free fall heavy fuel oil sg. of .94
77 kN/m^3 250mm in 10.4s viscosity?
r=.0008m
density = .94x1000 = 940 kg/m^3
steel density = 77kN/m^3/9.81m/s^2 = 7849 kg/m^3
V = D/t = .25/10.4 = .024m/s
V = 2(ρ-σ)r^2g / 9η = 2(7849-940)(.0008)^2(9.81) / 9x.024
= .402 Pa.s