PHY 2048 HW DUE 4/10

12.15 "1.5 N above force from $P_{Atmosphere}$"
So we use gauge pressure (ignores $P_{Atmosphere}$)

$$Area = \pi \frac{d^2}{4} = \pi \frac{(8.2 \times 10^{-3})^2}{4} = 5.27834 \times 10^{-5} \ m^2$$

$$F_{\substack{ON\\EAR\\DRUM}} = 1.5 = P_{\substack{ON\ EAR\\DRUM}} * Area$$

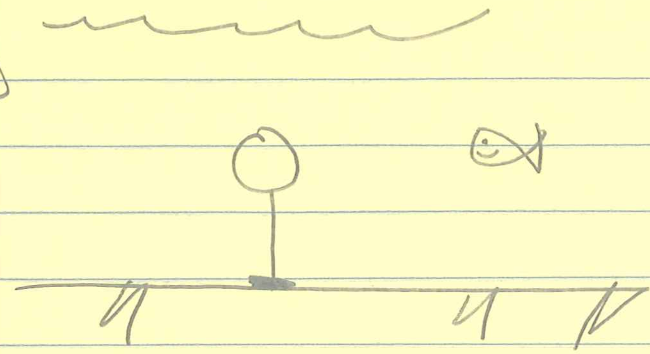
$$* \therefore P_{\substack{ON\\EAR\\DRUM}} = 28.418 \times 10^3 \text{ pascals}$$

"diving in ocean" $\Rightarrow$ assume seawater
Table 12.1 $\Rightarrow \rho_{SW} = 1.03 \times 10^3 \ kg/m^3$

* Set this equal to $(\rho_{SW}\, g\, h)$ and solve for h:

$$h = \frac{P_{\substack{ON\ EAR\\DRUM}}}{\rho_{SW}\, g} = 2.815 \text{ meters}$$

12.32)

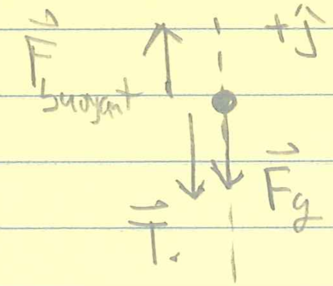


$F_{buoyant} = \rho_{water} V_{water}\, g$

$= 1000(0.650)9.8$

$= 6370\ N$ Answer (a)

For the sphere



$\vec{F}_g = -mg\,\hat{j}$

$\vec{T} = -T\hat{j} = -1120\,\hat{j}$

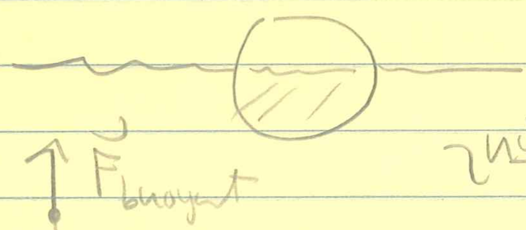
$\vec{F}_{buoyant} = +6370\,\hat{j}$

2^{nd} $\sum F_y = 0$

$-mg - 1120 + 6370 = 0$

$\therefore\ m = 535.7\ kg$ answer (b)

c)



2^{nd} $\sum F_y = 0$

$+\rho_w V_{displaced}\, g = mg$

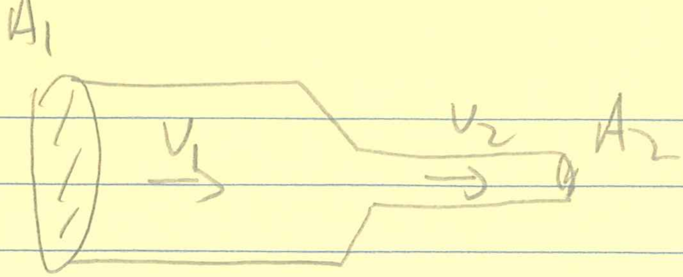
$V_{displaced} = \frac{m}{\rho_w} = \frac{535.7}{1000}$

$= 0.5357\ m^3$

Asked for ratio: $\frac{V_{submerged}}{V_{none}} = \frac{0.5357}{0.650} = 0.824$

82.4% Answer

12.40)



$A_1 = \pi r_1^2$ $\qquad r_1 = 1.25\,in \times \frac{2.54\,cm}{in} = 3.175\,cm$

$A_2 = \pi r_2^2$ $\qquad r_2 = 0.5\,in = 1.27\,cm$

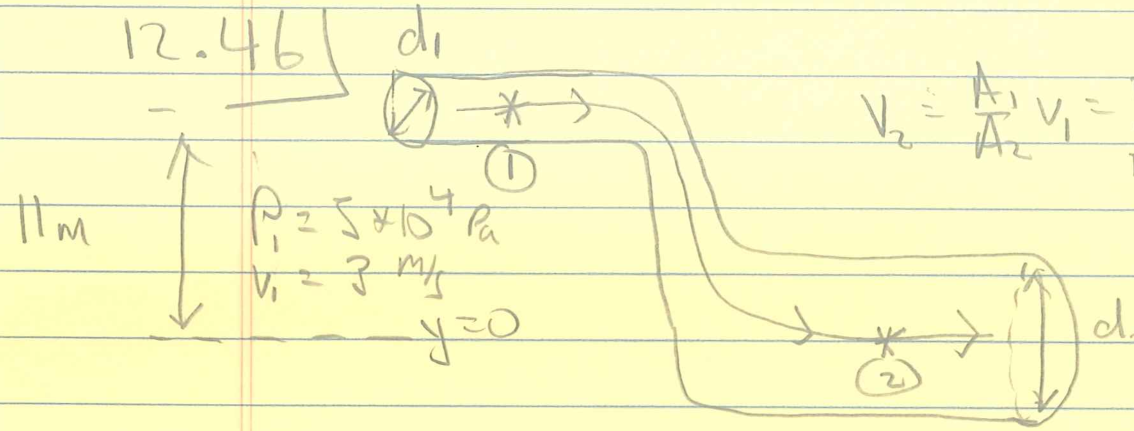
$V_1 = 6\,cm/s$

$$A_1 V_1 = A_2 V_2$$

$$\therefore V_2 = \frac{A_1}{A_2} V_1 = 37.5\,cm/s$$

Answer.

12.46)



$$V_2 = \frac{A_1}{A_2} V_1 = \frac{\pi d_1^2/4}{\pi \frac{4d_1^2}{4}} V_1 = \frac{V_1}{4} = 0.75\,m/s$$

$$P_1 + \tfrac{1}{2}\rho V_1^2 + \rho g(11) = P_2 + \tfrac{1}{2}\rho V_2^2 + \rho g(0)$$

$$\therefore P_2 = 5\times10^4 + \tfrac{1}{2}(1000)(3)^2 + 11(9.8)(1000) - \tfrac{1}{2}(1000)(0.75)^2$$

$$P_2 = 112\times10^3 \text{ pascals}$$

Answer.

12.63) $M_{barge} = (\text{Area of plates}) * (\text{thickness of plates}) * \rho_{steel}$

$$= \left(2*(22*12)+2*(40*12)+22*40\right) *(0.04)*\rho_{steel}$$

$$= 94.72(0.04)(7.8*10^3)$$

From table 12.1 pg 370

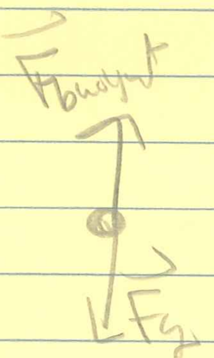
$$= 29552.64 \text{ kg}$$

$$M_{TOTAL} = M_{barge} + M_{coal}$$

The maximum $F_{buoyant}$ would have water right up to the top of the sides:

$$V_{displaced} = V_{barge} = 22*40*12 = 10560 \text{ m}^3$$

*



$$\therefore F_{buoyant\ MAX} = \rho_{water} V_{barge}\, g$$

This must equal the weight.

2^{nd} $\sum F_y = 0$

$$\rho_{water} V_{barge} = M_{barge} + M_{coal}$$

$$10.53*10^6 \text{ kg} = M_{coal}$$ Answer (a)

b.) $\text{Volume} = \dfrac{M_{coal}}{\rho_{coal}} = 7020 \text{ m}^3$ * YES