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Physics 9B Fall 2013

Assignment 7

12 - 3, 14, 21, 23, 27, 37, 41, 43, 63, 71

$\boxed{12-3}$ $\rho = M/V = .0158 / 5\cdot 15\cdot 30\cdot 10^{-9}$

{ convert mm to m in 3 directions x, y, z

$= 7022 \ kg/m^3$

$\rho_{gold} = 19300 \ kg/m^3$ so NOT GOLD

Density is close to that of iron $\sim 7800 \ kg/m^3$

$\boxed{12-14}$

a) $P = \underbrace{P_0}_{\text{atmospheric}} + \underbrace{\rho g h}_{\text{gauge}}$ $P_{gauge} = (1000)(9.8)(250)$

$= 2450000 \ Pa$

$= 2.43 \ ATM$

b) $F = PA = 2.45 \cdot 10^6 \ \pi \left(\frac{.3}{2}\right)^2 = 1.73 \cdot 10^5 \ Nt$

net force : P_0 of atmosphere cancels

$\boxed{12-21}$ a) Net Force on wood disk $= 0 = -P_{atm} A - mg + P_{\substack{top\\oil}} A$

$\underbrace{(P_{\substack{top\\oil}} - P_{atm})}_{P_{gauge, top, oil}} = mg/A = 45 / \pi \left(\frac{.3}{2}\right)^2 = 636 \ Pa$

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12-21 cont'd b) Change in pressure same throughout all positions in oil $= 83/\pi(.3/2)^2 = 1174\ N/m^2$

$\boxed{12-23}$ $F_1/A_1 = F_2/A_2$

$F_2 = F_1\,A_2/A_1 \quad (9.8)\,1520 = 125\ A_2/A_1$

$A_2/A_1 = 12.16\,(9.8)$

$\left(r_2/r_1\right) = \sqrt{12.16(9.8)} = 10.92$

$\boxed{12-27}$ $mg = 17.5\ N$

$mg - F_{buoy} = 11.2\ N \qquad F_{buoy} = 6.3\ N = \rho_{H_2O} V g$

$V = 6.3/9.8(1000) = 6.4\cdot 10^{-4}\ m^3$

$\rho = 17.5/9.8(6.4\cdot 10^{-4}) = 2790\ kg/m^3$

$\boxed{12-37}$ a) $\dfrac{dV}{dt} = vA$

$1.2 = v(\pi)(.15)^2 \qquad v = 17.0\ m/s$

b) $1.2 = 3.8\,\pi(r)^2 \qquad r = 0.317\ m$

3.//

$\boxed{12-41}$ $P_1 + \rho g h_1 + \frac{1}{2}\rho v_1^2 = P_2 + \rho g h_2 + \frac{1}{2}\rho v_2^2$

$3(1.01\cdot10^5) + 1030(9.8)(11) + \phi$

$= (1.01\cdot10^5) + \phi + \frac{1}{2}(1030)v_2^2$

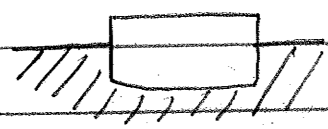
$v_2 = 28.7$ m/s

$\boxed{12-43}$ $P_1 + \rho g h_1 + \frac{1}{2}\rho v_1^2 = P_2 + \rho g h_2 + \frac{1}{2}\rho v_2^2$

$P_1 + \phi + \phi = P_{atm} + 1000(9.8)15 + \phi$

$P_1 - P_{atm} = P_{gauge} = 147\,000$ N $= 1.46$ ATM

$\boxed{12-63}$ a)

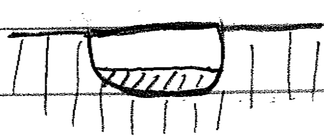


a) $\underbrace{900(9.8)}_{\text{weight of can}} = \underbrace{\underbrace{1000(V)}_{m_{H_2O}}\cancel{g}(9.8)}_{F_{buoy}}$

$V = 0.9$ m^3

fraction $= 0.9/3 = 0.3$

b)



$m\cancel{g} + fV(1000)\cancel{g} = \underbrace{V(1000)}_{F_{buoy}}\cancel{g}$

can weight H$_2$O weight

$900 = (1-f)V\,1000$

$1-f = .3$ $f = .7$

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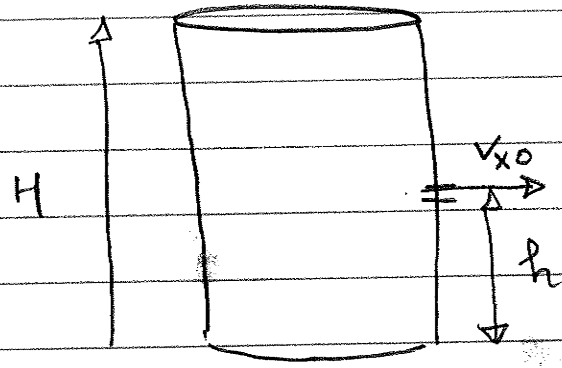
$\boxed{12-71}$



$\cancel{P_{atm}} + \cancel{\rho} g H + \phi$

$= \cancel{P_{atm}} + \cancel{\rho} g h + \tfrac{1}{2} \cancel{\rho} v_{x0}^2$

$v_{x0}^2 = 2g(H-h)$

$y = y_0 + v_{y0} t - \tfrac{1}{2} g t^2$

time to fall to ground $\quad \phi = h + 0 - \tfrac{1}{2} g t^2$

$t^2 = 2\, h/g$

$R =$ distance traveled $= v_{x0} t \quad$ (since $a_x = 0$)

$= \sqrt{2g(H-h)\, 2h/g} = 2\sqrt{h(H-h)}$

$dR/dh = 2 \tfrac{1}{2} (h(H-h))^{-1/2} (H-2h) = 0$

$\Rightarrow \boxed{h = H/2}$

$R = 2 \frac{H}{2} = \boxed{H = R}$