PHYS226 – HW1.

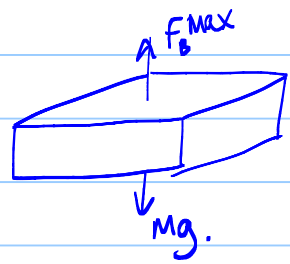
1. $\Delta P = \rho g h = \left(1030 \frac{\cancel{kg}}{m^3}\right)\left(9.8 \frac{N}{\cancel{kg}}\right)(10972.8\,\cancel{m})\left(\frac{1\,atm}{101325\,\cancel{\frac{N}{m^2}}}\right)$

$= 1093\ atm$ **(d)**

1(d).

2.(e)

3.



$F_B^{max} = m_w g = \rho_w V_{ice} g$

$mg = (\rho_{ice} V_{ice} + m_{car}) g$

$(\rho_{ice} V_{ice} + m_{car})\cancel{g} = \rho_w V_{ice} \cancel{g}$

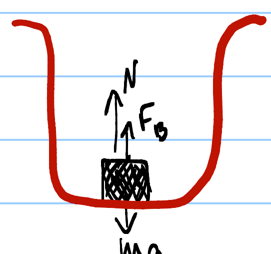
$m_{car} = V_{ice}(\rho_w - \rho_{ice})$

$V_{ice} = \frac{m_{car}}{\rho_w - \rho_{ice}} = Ad$

$A = \frac{m}{d(\rho_w - \rho_{ice})} = \frac{1000\,kg}{(0.5m)\left(1000\frac{kg}{m^3} - 916.7\frac{kg}{m^3}\right)}$

$= 24\,m^2$ **(b)**

4.



$M = 86\ Ch$

$M' = 73\ Ch$

$\rho_w = 1000 \frac{kg}{m^3}$

$m'g + F_B = mg.$ $\quad F_B = \rho_w V g = m_w g.$

$m'g + m_w g = mg$

$m' + m_w = m$ ⊛

want $\rho = \frac{m}{V} \Rightarrow$ find V

$\rho_w = \frac{m_w}{V} \Rightarrow V = \frac{m_w}{\rho_w}$ from ⊛ $m_w = m - m'$

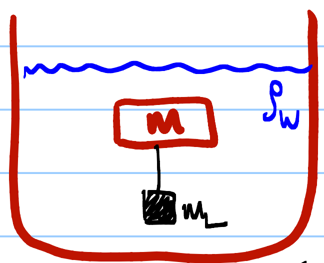
$\Rightarrow V = \frac{m - m'}{\rho_w}$

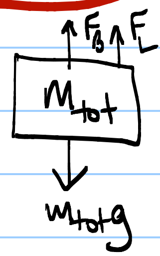
$$\Rightarrow \rho = \frac{m}{V} = \frac{m}{\left(\frac{m-m'}{\rho_w}\right)} = \frac{m}{m-m'}\rho_w$$

$$= \frac{86\,Ch}{(86\,Ch - 73\,Ch)}\left(1000\,\frac{kg}{m^3}\right) = \underline{6615\,\frac{kg}{m^3}} \quad \textbf{(b)}$$

5. $\rightsquigarrow$ $500\,cm^3$ **(c)**

P2.





$$\frac{\rho}{\rho_w} = 0.5 \qquad \rho = 500\,\frac{kg}{m^3} \qquad m = 3.00\,kg$$

$$m_L = ?$$

$$(m_L + m)g = m_w g = \rho_w V g + \rho_w V_L g$$

$$\& \ \rho = \frac{m}{V} \Rightarrow V = \frac{m}{\rho} \quad \& \ V_L = \frac{m_L}{\rho_L}$$

$$\Rightarrow m_L \cancel{g} + m\cancel{g} = \rho_w \frac{m}{\rho}\cancel{g} + \rho_w \frac{m_L}{\rho_L}\cancel{g}$$

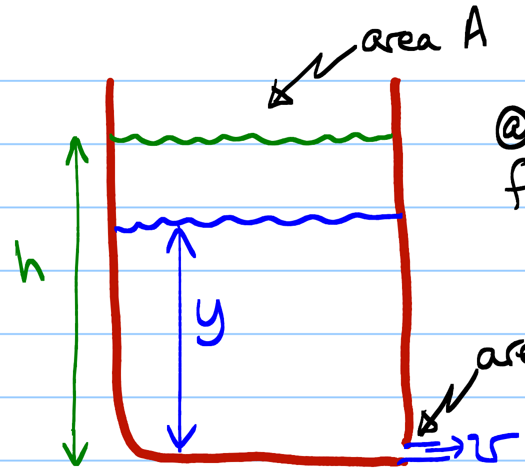
$$m_L + m = \frac{\rho_w}{\rho} m + \frac{\rho_w}{\rho_L} m_L$$

$$m_L\left(1 - \frac{\rho_w}{\rho_L}\right) = m\left(\frac{\rho_w}{\rho} - 1\right)$$

$$m_L = m\,\frac{\left(\frac{\rho_w - \rho}{\rho}\right)}{\left(\frac{\rho_L - \rho_w}{\rho_L}\right)} = m\,\frac{\rho_L}{\rho}\,\frac{\rho_w - \rho}{\rho_L - \rho_w}$$

$$m_L = m\,\frac{11.34\,\frac{g}{cm^3}}{0.5\,\frac{g}{cm^3}}\left(\frac{1 - 0.5}{11.34 - 1}\right) = \underline{3.29\,kg}$$

P.3.



@ $t=0$ $y=h$

find $t=?$ when $y=0$

$a \ll A$.

from Torricelli

$v = \sqrt{2gy}$

$$\frac{\delta V}{\delta t} = -va$$

as ΔV is negative

$$\delta V = \delta(Ay) = A\delta y$$

$$\frac{A\delta y}{\delta t} = -va = -\sqrt{2gy}\,a$$

$$\frac{\delta y}{\delta t} = -\frac{1}{A}\sqrt{2gy}$$

$$\int_{y=h}^{y=0} \frac{dy}{\sqrt{y}} = -\int_{t=0}^{t=t} \frac{a}{A}\sqrt{2g}\,dt$$

$y^{-\frac{1}{2}}$ $\quad 2y^{\frac{1}{2}}$

$$2\sqrt{y}\Big]_{y=h}^{y=0} = -\frac{a}{A}\sqrt{2g}\,t\Big]_{t=0}^{t=t}$$

$$-2\sqrt{h} = -\frac{a}{A}\sqrt{2g}\,t$$

$$t = 2\sqrt{h}\,\frac{A}{a}\frac{1}{\sqrt{2g}}$$

$$t = \frac{A}{a}\sqrt{\frac{2h}{g}}$$