Science Knowledge
04/23/2021

Buoyance Problem Set Solutions

1) $\frac{\rho_{object}}{\rho_{water}}$

Don't wanna solve (Easy Problem)

2)

(a) $\rho_{ball} = \frac{m_{ball}}{V_{ball}} = \frac{624\times10^{-3}\,kg}{\frac{4}{3}(3.14)(12.15\times10^{-2})^3\,m^3} = 83.06\,\frac{kg}{m^3}$

float to the surface since $\rho_{ball} < \rho_{H_2O}$

(b) In water ↓

$m_{ball}\cdot g = \rho_{H_2O}\cdot V_d \cdot g$

$\rho_{ball}\cdot V_{ball} = \rho_{H_2O}\cdot V_d \Rightarrow \frac{V_d}{V_{ball}} = \frac{\rho_{bal}}{\rho_{H_2O}} = \frac{83.06\,\frac{kg}{m^3}}{997\,\frac{kg}{m^3}} = 8.3\%$

$1 - 8.3\% = 91.7\%$

(c) F_b $F_n = F_b$ (buoyancy)

ball

W

$F_b = \rho_{H_2O} g V_{ball} = (997)(9.81)(8.3\%)(\frac{4}{3})(3.14)(12.15\times10^{-2})^3$

$W = 624\times10^{-3}\times9.81 = 6.12N$ $F_b = 6.099N$

$F_n = W - F_b = 0.022N$

3)

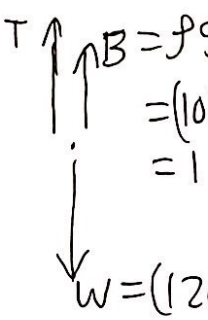
(a) $G = mg = \rho V g = (0.91\,\frac{g}{cm^3})(10\,cm)^3(9.81\,\frac{m}{s^2})\cdot\frac{1kg}{10^3 g} = 0.089N$

(b) $\rho_{H_2O} V_d = m_{ice} \Rightarrow V_d = \frac{m_{ice}}{\rho_{H_2O}} = \frac{\rho_{ice}\cdot V_{ice}}{\rho_{H_2O}} = \frac{(0.91\,\frac{g}{cm^3})(10\,cm)^3\times10^{-3})}{997\,\frac{kg}{m^3}}$

$= 9.127\times10^{-6}\,m^3$

(c) $\rho_{H_2O}\cdot V_d = \rho_{ice}\cdot V_{ice} \Rightarrow \frac{V_d}{V_{ice}} = \frac{\rho_{ice}}{\rho_{H_2O}} = \frac{0.91}{0.977} = 93\%$

4)



$B = \rho g V$
$= (1025)(9.81)(0.1)$
$= 1005.525$

$W = (120)(9.81) = 1127.2\,N$

$\Sigma F_{net} = T + B - W = 0$

$T = W - B = 1127.2 - 1005.525$
$= \boxed{121.675\,N}$

5)

(a) $\rho_{block} = \dfrac{m_{block}}{V_{block}} = \dfrac{1155\,g}{(12)(11)(3.5)\,cm^3} = 2.5\,\frac{g}{cm^3}$

$\rho_{H_2O} = 997\,\frac{kg}{m^3} \cdot \frac{10^3\,g}{1\,kg} \cdot \frac{1\,m^3}{10^6\,cm^3} = 0.997\,\frac{g}{cm^3}$

$\rho_{block} > \rho_{H_2O} \Rightarrow$ **sink**

(b) $F_b = \rho_{H_2O} g V = \left(997\,\frac{kg}{m^3}\right)\left(9.81\,\frac{m}{s^2}\right)(12)(11)(3.5)(10^{-6})\,m^3$

$= 4.519\,N$

$F_n = W - F_b = (1155 \times 10^{-3}\,kg)(9.81) - 4.519 = \boxed{6.812\,N}$