PHYS101

QUIZ#12 - CHAPTER 14

DATE: 23/12/12

Name: Key   Id#:   Sect#

An iceberg floats on the sea. Its volume above the seawater is 5.0 × 10^2 m^3. Assume the density of ice to be 9.5 × 10^2 kg/m^3 and the density of seawater to be 1.25 × 10^3 kg/m^3. Calculate the total mass of the iceberg.

$$F_b = F_g$$

$$m_f \cancel{g} = m_o \cancel{g}$$

$$\rho_f V_{sub} = \rho_o V_o = \rho_o (V_{app} + V_{sub})$$

$$V_{sub} (\rho_f - \rho_o) = \rho_o V_{app}$$

$$V_{sub} = \frac{\rho_o}{\rho_f - \rho_o} V_{app} = \frac{950}{1250-950} \times 500$$

$$= 1583 \ m^3$$

$$V_o = V_{sub} + V_{app} = 500 + 1583 = 2083 \ m^3$$

$$m_o = V_o \rho_o = 2083 \ \cancel{m^3} \times 950 \ \frac{Kg}{\cancel{m^3}} = 1.98 \times 10^6 \ Kg$$

$$\boxed{m_o = 1.98 \times 10^6 \ Kg}$$

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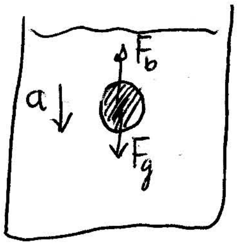
An aluminum ball of volume 6.0 cm^3 is dropped in water. Assume the density of water to be 1200 kg/m^3 and the density of aluminum to be 2700 kg/m^3. Find the acceleration with which the ball sinks in the water. Treat the water as an ideal fluid.

$$\vec{F_b} - \vec{F_g} = -m\vec{a}$$



$$F_b - F_g = -ma$$

$$a = \frac{F_g - F_b}{m} = \frac{mg - m_f g}{m}$$

$$= \frac{(m - m_f)g}{m}$$

$$= \frac{(\rho V - \rho_f V)g}{m}$$

$$= \frac{(\rho - \rho_f)Vg}{m} = \frac{(2700 - 1200)\,6\times10^{-6}\times 9.8}{6\times10^{-6}\times 2700}$$

$$\boxed{a = 5.4\ m/s^2}$$

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A pipe 20 cm in diameter is connected to the top of a water storage tank of volume 1.0×10^5 liters. If the tank is filled at a constant rate in 20 minutes, what is the entry speed of water from the pipe into the tank? 1 liter = 10^{-3} m^3.

$$R_V = \frac{10^5 \times 10^{-3}}{20 \times 60} = 0.083 \ m^3/s$$

$$R_V = A v = \frac{\pi D^2}{4} \times v$$

$$0.083 = \pi \frac{(0.2)^2}{4} v$$

$$\boxed{v = 2.65 \ m/s}$$