

Q. CONT → $v_y = v_{y0} + g t$ $v_y = v_{y0} + a t$
 $t_1 + t_2 = t$ $0 = 14.0 + (-9.8)t$
 $1.43s + 2.39s = 3.82s$ $t_2 = 2.39s$
 $v_y = 14.0 \frac{m}{s}$

Review Pressure and Fluids

1. What is the pressure due to wind on the wall of a building 14 x 3.5 m, if the horizontal force of the wind on the wall is 9800 N?

$$P = \frac{F}{A} = \frac{9800 \text{ N}}{14 \times 3.5 \text{ m}} = 2.0 \times 10^2 \frac{\text{N}}{\text{m}^2}$$

2. A stone of volume 0.7 m³ weighs 150 N in air. What fraction of its weight would it lose if it were submerged at the bottom of a fresh-water lake? F_{RAU} = 6860

$\rho = \frac{m}{V}$ $m = 700 \text{ kg}$ $F_{RAU} = 6860$
 $F_b = 700 \text{ kg} \times 9.8 = 6860 \text{ N}$ $W_{\text{air}} = 15000 - 6860$ $W_{\text{lost}} = 15000 - 8140$ 15000
 $\frac{15000 \text{ N}}{700 \text{ kg}} = \frac{m}{0.7 \text{ m}^3}$ $W_{\text{air}} = 8140$ $W_{\text{lost}} = 6860$ $= 45.7\%$

3. In a solid-waste recycling plant, the small piston of a hydraulic press has radius of 2 cm and the larger piston has radius of 6 cm. If 300 N of force can be applied to the small piston, how much force can be applied to a load of used-metal cans?

$$P_1 = P_2 \quad \frac{F_1}{A_1} = \frac{F_2}{A_2} \quad \frac{300 \text{ N}}{\pi (2 \text{ cm})^2} = \frac{F_2}{\pi (6 \text{ cm})^2} \quad F_2 = 2.70 \times 10^3 \text{ N}$$

4. A geologist, analyzing an irregular piece of ore, finds that the sample is balanced by 88 g when weighed in air and 76 g when weighed in water. What is the volume of the sample?

$W_{\text{air}} = (0.088) (9.8) = 0.862 \text{ N}$ $V = 11.9 \text{ cm}^3$
 $W_{\text{H}_2\text{O}} = (0.076) (9.8) = 0.745 \text{ N}$ $W_{\text{H}_2\text{O}} = W_{\text{air}} - F_b$ $F_b = m g$ $0.117 = m (9.8)$ $m_{\text{H}_2\text{O}} = 0.0119 \text{ kg}$ $d = \frac{m}{V}$ $V = \frac{0.0119 \text{ kg}}{1000 \frac{\text{kg}}{\text{m}^3}} = 1.19 \times 10^{-5} \text{ m}^3$

5. A 60 kg man is just floating in water, with negligible volume in the air. What is his volume?

$W = F_b$ $V = 6.0 \times 10^{-2} \text{ m}^3$
 $(60)(9.8) = F_b$ $F_b = 588 \text{ N}$ $F = m g$ $588 = m (9.8)$ $m = 60 \text{ kg}$ $V = \frac{60 \text{ kg}}{1000 \frac{\text{kg}}{\text{m}^3}}$

6. A crate, whose bottom surface is 50.4 cm by 28.3 cm, exerts a pressure of 2.5 x 10³ Pa on the floor. What is the mass of the crate? (1 Pascal = 1 N/m²)

$P = \frac{F}{A}$ $F = 358 \text{ N}$ $F = m g$ $\frac{358}{9.8} = m$ $3.65 \times 10^1 \text{ kg}$
 $A = 50.4 \times 28.3 = 1426 \text{ cm}^2 = 1.43 \times 10^{-1} \text{ m}^2$ $2.5 \times 10^3 \frac{\text{N}}{\text{m}^2} = \frac{F}{1.43 \times 10^{-1} \text{ m}^2}$

7. A rowboat, mass of 42 kg, is floating on a lake.

a. What is the size of the buoyant force?
 $W = F_b$ $F_b = 4.12 \times 10^2 \text{ N}$
 $42(9.8) = F_b$

b. What is the volume of the submerged part of the boat?

$F_b = m g$ $V = 4.2 \times 10^{-2} \text{ m}^3$
 $412 \text{ N} = m (9.8)$ $m = 42.0 \text{ kg}$ $V = \frac{42 \text{ kg}}{1000 \frac{\text{kg}}{\text{m}^3}}$

8. A piece of metal weighs 75 N in air and 60 N in water. What is the density of the metal?

$F = m g$ $d = \frac{m}{V} = \frac{1.53}{1.53 \times 10^{-3}} = 1.0 \times 10^3 \frac{\text{kg}}{\text{m}^3}$
 $75 = m (9.8)$ $W_{\text{H}_2\text{O}} = W_{\text{air}} - F_b$ $F_b = m g$ $15 = m (9.8)$ $m = 1.53 \text{ kg}$ $V = \frac{1.53}{1000} = 1.53 \times 10^{-3} \text{ m}^3$
 $m = 7.65 \text{ kg}$ $d = 7.65$

9. What will the total time be for a rock (volume = 120 cm³ and 300 g) to fall from a bridge 10 m high and then reach the bottom of a 10 m deep pond?

$y = v_y t + \frac{1}{2} g t^2$ $F_{\text{H}_2\text{O}} = F_{\text{air}} - F_b$ $d = \frac{m}{V}$ $F_b = 0.12 \times 9.8$ $F_{\text{H}_2\text{O}} = m a$
 $10 \text{ m} = 0 + \frac{1}{2} (9.8) t^2$ $= (1.3)(9.8) = 2.94 - 1.18 = 1.76 \text{ N}$ $\frac{1}{2} g = \frac{m}{t^2}$ $1.76 = 1.3 a$ $a = 5.87 \frac{\text{m}}{\text{s}^2}$
 $t_1 = 1.43 \text{ s}$ $m = 120 \text{ g} = 0.12 \text{ kg}$ $1.76 = 1.3 a$ $a = 5.87 \frac{\text{m}}{\text{s}^2}$