REVIEW AND SYNTHESIS: CHAPTERS 9–12

Review Exercises

1. Strategy The magnitude of the buoyant force on an object in water is equal to the weight of the water displaced by the object.

Solution

(a) Lead is much denser than aluminum, so for the same mass, its volume is much less. Therefore, aluminum has the larger buoyant force acting on it; since it is less dense it occupies more volume.

(b) Steel is denser than wood. Even though the wood is floating, it displaces more water than does the steel. Therefore, wood has the larger buoyant force acting on it; since it displaces more water than the steel.

(c) Lead: $\rho_w g V_{Pb} = \rho_w g \dfrac{m_{Pb}}{\rho_{Pb}} = (1.00\times10^3\ \text{kg/m}^3)(9.80\ \text{m/s}^2)\dfrac{1.0\ \text{kg}}{11{,}300\ \text{kg/m}^3} = \boxed{0.87\ \text{N}}$

Aluminum: $\rho_w g V_{Al} = \rho_w g \dfrac{m_{Al}}{\rho_{Al}} = (1.00\times10^3\ \text{kg/m}^3)(9.80\ \text{m/s}^2)\dfrac{1.0\ \text{kg}}{2702\ \text{kg/m}^3} = \boxed{3.6\ \text{N}}$

Steel: $\rho_w g V_{Steel} = \rho_w g \dfrac{m_{Steel}}{\rho_{Steel}} = (1.00\times10^3\ \text{kg/m}^3)(9.80\ \text{m/s}^2)\dfrac{1.0\ \text{kg}}{7860\ \text{kg/m}^3} = \boxed{1.2\ \text{N}}$

Wood: $mg = (1.0\ \text{kg})(9.80\ \text{m/s}^2) = \boxed{9.8\ \text{N}}$ (Since the wood is floating, the buoyant force is equal to its weight.)

13. Strategy The frequency of the sound is increased by a factor equal to the number of holes in the disk. Use Eq. (11-6).

Solution The frequency of the sound is

$f = 25(60.0\ \text{Hz}) = \boxed{1500\ \text{Hz}}$.

Compute the wavelength that corresponds to this frequency.

$\lambda = \dfrac{v}{f} = \dfrac{343\ \text{m/s}}{1.50\times10^3\ \text{Hz}} = \boxed{22.9\ \text{cm}}$