

Homework Solutions  
10/17/2007

Conceptual Questions

10. An ice cube will float higher in a more dense fluid because it doesn't have to displace as much of the fluid to equal its weight. Thus, an object will float higher in water.
12. Nothing happens to the level of the water in the glass because the frozen water displaces liquid water equal to its own weight. The same is true for the liquid water after the ice cube melts.

Problems

30. a.

$$P_{top} = P_0 + \rho gh = 1.0130 \cdot 10^5 Pa + \left(1000 \frac{kg}{m^3}\right) \left(9.80 \frac{m}{s^2}\right) (0.0500m)$$

$$P_{top} = 1.0179 \cdot 10^5 Pa$$

$$P_{bot} = P_0 + \rho gh = 1.0130 \cdot 10^5 Pa + \left(1000 \frac{kg}{m^3}\right) \left(9.80 \frac{m}{s^2}\right) (0.1700m)$$

$$P_{bot} = 1.0297 \cdot 10^5 Pa$$

$$F_{top} = P_{top} \cdot A = (1.0179 \cdot 10^5 Pa)(0.01m^2) = 1018N$$

$$F_{bot} = P_{bot} \cdot A = (1.0297 \cdot 10^5 Pa)(0.01m^2) = 1030N$$

b.

$$V = (0.12m)(0.10m)(0.10m) = 1.2 \cdot 10^{-3} m^3$$

$$T + F_B = mg$$

$$T = mg - F_B$$

$$T = mg - \rho Vg = (10.0kg) \left(9.80 \frac{m}{s^2}\right) - \left(1000 \frac{kg}{m^3}\right) (1.2 \cdot 10^{-3} m^3) \left(9.80 \frac{m}{s^2}\right)$$

$$T = 98.0N - 11.8N = 86.2N$$

c.

$$F_B = \left(1000 \frac{kg}{m^3}\right)(1.2 \cdot 10^{-3} m^3) \left(9.80 \frac{m}{s^2}\right) = 11.8N$$

$$F_{bot} - F_{top} = 1030 - 1018 = 12N$$

31.

$$\Sigma F = 0N$$

$$F_B - mg + 1100N = 0$$

$$\rho Vg - (1.20 \cdot 10^4 kg + m)g + 1100N = 0$$

$$m = \left(1030 \frac{kg}{m^3}\right) \left(\frac{4}{3} \pi (1.50m)^3\right) + \frac{1100N}{9.80 \frac{m}{s^2}} - 1.20 \cdot 10^4 kg = 2670kg$$

34.

$$\Sigma F = F_B - F_s - mg = 0$$

$$\rho Vg - kx - mg = 0$$

$$V = \frac{m}{\rho} = \frac{(5.00kg)}{\left(650 \frac{kg}{m^3}\right)} = 7.69 \cdot 10^{-3} m^3$$

$$x = \frac{\rho Vg - mg}{k} = \frac{\left(1000 \frac{kg}{m^3}\right) (7.69 \cdot 10^{-3} m^3) \left(9.80 \frac{m}{s^2}\right) - (5.00kg) \left(9.80 \frac{m}{s^2}\right)}{160 \frac{N}{m}}$$

$$x = 0.165m = 16.5cm$$