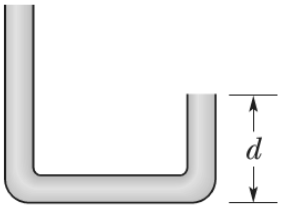
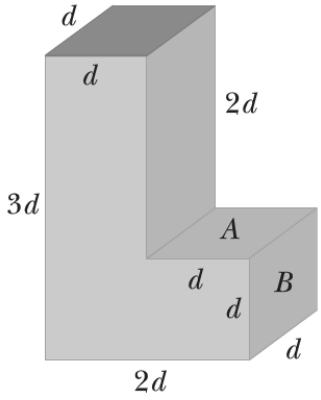
- For material covering Ch. 14 (skipping 14-3)
- Due Friday, Dec. 5 at 5 pm

1. A partially evacuated airtight container has a tight-fitting lid of surface area 78.9 cm^2 and negligible mass. If the force required to remove the lid is 610 N and the atmospheric pressure is 1.00×10^5 Pa, what is the air pressure in the container before it is opened? [Answer: 22.7 kPa].

2. The plastic tube has a cross-sectional area of 5.53 cm^2. The tube is filled with water until the short arm (of length d = 0.525 m) is full. Then the short arm is sealed and more water is gradually poured into the long arm. If the seal will pop off when the force on it exceeds 5.10 N, what total height of water in the long arm will put the seal on the verge of popping? [Answer: 1.47 m].

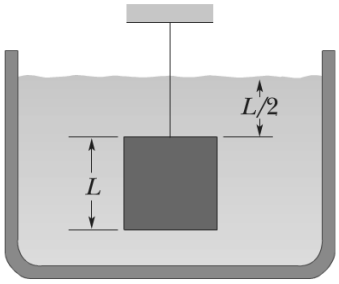


3. The L-shaped tank shown is filled with water and is open at the top. What is the force due to the water **(a)** on face A and **(b)** on face B? Express your answer in terms of d, g, the density of water ρ, and atmospheric pressure p_0. [Answer: **(a)** $(p_0 + 2\rho g d)d^2$; **(b)** $p_0 + 5/2\rho g d)d^2$].



4. At a depth of 10.9 km, the Challenger Deep in the Marianas Trench of the Pacific Ocean is the deepest site in any ocean. Yet, in 1960, Donald Walsh and Jacques Piccard reached the Challenger Deep in the submersible *Trieste*. And in 2012, director James Cameron became the first person to make a solo descent in the submersible *Deepsea Challenger*. Assuming that seawater has a uniform density of 1024 kg/m^3, approximate the hydrostatic pressure (in atmospheres) that these submersibles had to withstand. [Answer: 1080 atm].

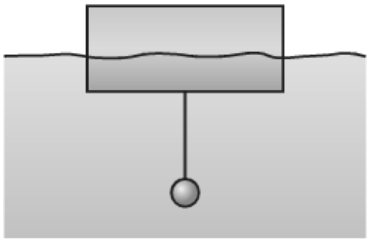
5. A cube of edge length L = 0.765 m and mass 1030 kg is suspended by a rope in an open tank of liquid of density 1040 kg/m^3. Find **(a)** the magnitude of the total downward force on the top of the cube from the liquid and the atmosphere, assuming atmospheric pressure is 1.00 atm, **(b)** the magnitude of the total upward force on the bottom of the cube, and **(c)** the tension in the rope. **(d)** Calculate the magnitude of the buoyant force on the cube using Archimede's principle. [Answer: **(a)** 61.4 kN; **(b)** 66.0 kN; **(c)** 5.49 kN; **(d)** 4.56 kN].



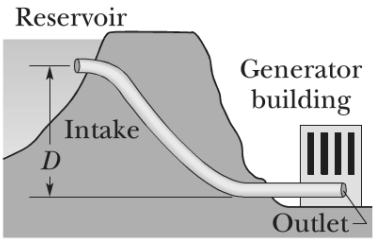
6. What fraction of the volume of an iceberg (density 917 kg/m^3) would be visible if the iceberg floats in **(a)** the ocean (salt water, density 1024 kg/m^3) and **(b)** in a river (fresh water, density 998 kg/m^3)? (When salt water freezes to form ice, the salt is excluded. So, an iceberg could provide fresh water to a community.) [Answer: **(a)** 0.104; **(b)** 0.0812].

7. What is the acceleration of a rising hot-air balloon if the ratio of the air density outside the balloon to that inside is 1.20? Neglect the mass of the balloon fabric and the basket.. [Answer: 1.96 m/s^2].

8. An iron ball suspended by thread of negligible mass from an upright cylinder that floats partially submerged in water. The cylinder has a height of 6.90 cm, a face area of 10.0 cm^2 on the top and bottom, and a density of 0.328 g/cm^3, and 2.20 cm of its height is above the water surface. The water has a density of 1000 kg/m^3, and the iron has a density of 7900 kg/m^3. What is the radius r of the iron ball? [Answer: 9.45 mm].



9. A water intake at a pump storage reservoir has a cross-sectional area of 0.869 m^2. The water flows in at a speed of 0.315 m/s. At the generator building, at distance D = 103 m below the intake point, the cross-sectional area is smaller than at the intake and the water flows out at 9.25 m/s. What is the difference in pressure between inlet and outlet? [Answer: 0.967 MPa].



10. The fresh water behind a reservoir dam has depth D = 15.7 m. A horizontal pipe 5.88 cm in diameter passes through the dam at depth d = 5.11 m. A plug secures the pipe opening. **(a)** Find the magnitude of the frictional force between plug and pipe wall. **(b)** The plug is removed. What water volume exits the pipe in 1.72 h? [Answer: **(a)** 136 N; **(b)** 168 m^3].