FLUID FLOW

Conceptual Questions

17. Prairie dogs live in underground burrows with at least two entrances. They ventilate their burrows by building a mound around one entrance, which is open to a stream of air. A second entrance at ground level is open to almost stagnant air. Use Bernoulli's principle to explain how this construction creates air flow through the burrow.

18. Municipal water supplies are often provided by reservoirs built on high ground. Why does water from such a reservoir flow more rapidly out of a faucet on the ground floor of a building than out of an identical faucet on a higher floor?

19. If air from a hair dryer is blown over the top of a table-tennis ball, the ball can be suspended in air. Explain how this suspension is possible.

MIXED REVIEW

20. An engineer weighs a sample of mercury ($\rho = 13.6 \times 10^3$ kg/m^3) and finds that the weight of the sample is 4.5 N. What is the sample's volume?

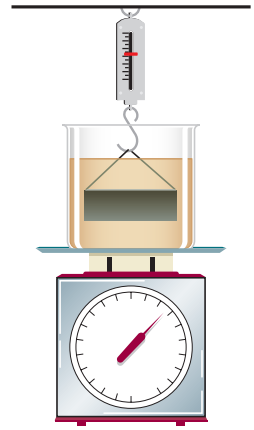
21. About how much force is exerted by the atmosphere on 1.00 km^2 of land at sea level?

22. A 70.0 kg man sits in a 5.0 kg chair so that his weight is evenly distributed on the legs of the chair. Assume that each leg makes contact with the floor over a circular area with a radius of 1.0 cm. What is the pressure exerted on the floor by each leg?

23. A frog in a hemispherical bowl, as shown below, just floats in a fluid with a density of 1.35×10^3 kg/m^3. If the bowl has a radius of 6.00 cm and negligible mass, what is the mass of the frog?

24. When a load of 1.0×10^6 N is placed on a battleship, the ship sinks only 2.5 cm in the water. Estimate the cross-sectional area of the ship at water level. (Hint: See **Table 1** for the density of sea water.)

25. A 1.0 kg beaker containing 2.0 kg of oil with a density of 916 kg/m^3 rests on a scale. A 2.0 kg block of iron is suspended from a spring scale and completely submerged in the oil, as shown at right. Find the equilibrium readings of both scales. (Hint: See **Table 1** for the density of iron.)



26. A raft is constructed of wood having a density of 600.0 kg/m^3. The surface area of the bottom of the raft is 5.7 m^2, and the volume of the raft is 0.60 m^3. When the raft is placed in fresh water having a density of 1.0×10^3 kg/m^3, how deep is the bottom of the raft below water level?

27. A physics book has a height of 26 cm, a width of 21 cm, and a thickness of 3.5 cm.

- **a.** What is the density of the physics book if it weighs 19 N?
- **b.** Find the pressure that the physics book exerts on a desktop when the book lies face up.
- **c.** Find the pressure that the physics book exerts on the surface of a desktop when the book is balanced on its spine.

28. A natural-gas pipeline with a diameter of 0.250 m delivers 1.55 m^3 of gas per second. What is the flow speed of the gas?

29. A 2.0 cm thick bar of soap is floating in water, with 1.5 cm of the bar underwater. Bath oil with a density of 900.0 kg/m^3 is added and floats on top of the water. How high on the side of the bar will the oil reach when the soap is floating in only the oil?

30. Which dam must be stronger, one that holds back 1.0×10^5 m^3 of water 10 m deep or one that holds back 1.0×10^3 m^3 of water 20 m deep?