Homework Solutions
10/16/2007

Conceptual Questions

2. If the air pressure at ground level is $1 \bullet 10^5$ Pa and the density is 1.3 kg/m^3, then by dividing pressure by density times the acceleration due to gravity we get somewhere around 10^4 m, which is 10 km.

4. Force is pressure times area. If the dams are equally as deep and have equal the surface area pushing on the water, then the force is the average pressure times the surface area. The result would be the same in each case.

6. It would be difficult to use a snorkel in deep water because your muscles would have to exert a large pressure to sufficiently expand your lungs to take in air because of the large external force pushing on your body from water pressure.

Problems

15.

$$1atm = 1.013 \bullet 10^5 Pa$$

$$P = P_0 + \rho g h$$

$$P = (1.1atm)\left(\frac{1.013 \bullet 10^5 Pa}{1atm}\right) + \left(806\frac{kg}{m^3}\right)\left(9.8\frac{m}{s^2}\right)(4.0m)$$

$$P = 1.4 \bullet 10^5 Pa = 1.4atm$$

17.

$$P = \frac{F}{A} = \frac{\rho V}{A} = \frac{\rho A h}{A}$$

$$P = \rho h$$

$$h = \frac{P}{\rho} = \frac{1.7 \bullet 10^7 \, Pa}{5.0 \bullet 10^4 \, \frac{N}{m^3}} = 340m$$

19.

$$\rho_{glucosesolution} = sg \bullet \rho_{water} = 1.02 \bullet 1.0 \bullet 10^3 \, \frac{kg}{m^3} = 1.02 \bullet 10^3 \, \frac{kg}{m^3}$$

$$P_{gauge,vein} \leq P_{gauge,solution}$$

$$P_{gauge} = \rho g h$$

$$h \geq \frac{P_{gauge}}{\rho g} \geq \frac{1.33 \bullet 10^4 \, Pa}{\left(1.02 \bullet 10^3 \, \frac{kg}{m^3}\right)\left(9.80 \frac{m}{s^2}\right)} = 1.33m$$