11.32. In the Challenger Deep of the Marianas Trench, the depth of seawater is 10.9 km and the pressure is 1.16 x 10^8 Pa (about 1.15 x 10^3 atm). (a) If a cubic meter of water is taken from the surface to this depth, what is the change in its volume? (Normal atmospheric pressure is about 1.0 x 10^5 Pa. Assume that *k* for seawater is the same as the freshwater value given in table 11.2.) (b) What is the density of seawater at this depth? (At the surface, seawater has a density of 1.03 x 10^3 kg/m^3.)

Identify: Apply $B = -\frac{(\Delta p)V_0}{\Delta V}$. $\text{Density} = m/V$.

Set Up: At the surface the pressure is $1.0\times10^5\ \text{Pa}$, so $\Delta p = 1.16\times10^8\ \text{Pa}$. $V_0 = 1.00\ \text{m}^3$. At the surface $1.00\ \text{m}^3$ of water has mass $1.03\times10^3\ \text{kg}$.

Execute:

(a) $B = -\frac{(\Delta p)V_0}{\Delta V}$ gives $\Delta V = -\frac{(\Delta p)V_0}{B} = -\frac{(1.16\times10^8\ \text{Pa})(1.00\ \text{m}^3)}{2.2\times10^9\ \text{Pa}} = -0.0527\ \text{m}^3$

(b) At this depth $1.03\times10^3\ \text{kg}$ of seawater has volume $V_0 + \Delta V = 0.9473\ \text{m}^3$. The density is $\frac{1.03\times10^3\ \text{kg}}{0.9473\ \text{m}^3} = 1.09\times10^3\ \text{kg/m}^3$.

Evaluate: The density is increased because the volume is compressed due to the increased pressure.