extra credit: Ch 12 problem 32

atmospheric pressure $= 1.013 \times 10^5 \, N/m^2$

a) with $\Delta P = 1.13 \times 10^8 \, N/m^2 - 1.013 \times 10^5 \, N/m^2 \approx 1.13 \times 10^8 \, N/m^2$,

change in volume from $B = -\frac{\Delta P}{\Delta V / V_i} = -\frac{\Delta P V_i}{\Delta V}$

$$\Rightarrow \Delta V = -\frac{\Delta P V_i}{B}$$

for water with $V_i = 1.00 \, m^3$, $B = 0.21 \times 10^{10} \, N/m^2$

$$\Delta V = -\frac{(1.13 \times 10^8 \, N/m^2)(1 \, m^3)}{0.21 \times 10^{10} \, N/m^2} = -0.0538 \, m^3$$

that is, decreases in volume by $0.0538 \, m^3$

new volume $= 0.95 \, m^3$

b) density at surface $\rho = m/V = 1.03 \times 10^3 \, kg/m^3$

so $1.00 \, m^3$ of seawater has $m = 1.03 \times 10^3 \, kg$

at 11 km deep, $\rho = \frac{1.03 \times 10^3 \, kg}{0.95 \, m^3} = 1.09 \times 10^3 \, kg$

c) since the volume + density change by only about 5%
even under these extreme conditions, it's usually a good approximation to think of water as incompressible