30.33. Solve: **(a)** From Equation 30.33, the energy stored in the charged capacitor is

$$U_{\mathrm{C}} = \frac{1}{2}C\left(\Delta V_{\mathrm{C}}\right)^2 = \frac{1}{2}\left(\frac{A\varepsilon_0}{d}\right)\left(\Delta V_{\mathrm{C}}\right)^2$$

$$= \frac{1}{2}\frac{\pi(0.01\ \mathrm{m})^2\left(8.85\times10^{-12}\ \mathrm{C^2\ /\ N\,m^2}\right)}{0.50\times10^{-3}\ \mathrm{m}}(200\ \mathrm{V})^2 = 1.11\times10^{-7}\ \mathrm{J}$$

(b) From Equation 30.35, the energy density in the electric field is

$$u_{\mathrm{E}} = \frac{1}{2}\varepsilon_0 E^2 = \frac{1}{2}\varepsilon_0\left(\frac{\Delta V_{\mathrm{C}}}{d}\right)^2 = \frac{1}{2}\left(8.85\times10^{-12}\ \mathrm{C^2\ /\ N\,m^2}\right)\left(\frac{200\ \mathrm{V}}{0.5\times10^{-3}\ \mathrm{m}}\right)^2 = 0.708\ \mathrm{J\ /\ m^3}$$