18.54 (a) In order to solve for the dielectric constant in this problem, we must employ Equation 18.32, in which the polarization and the electric field are given. Solving for ε_r from this expression gives

$$\varepsilon_r = \frac{P}{\varepsilon_0 E} + 1$$

$$= \frac{4.0 \text{ x } 10^{-6}\,\text{C/m}^2}{(8.85 \text{ x } 10^{-12}\,\text{F/m})(1 \text{ x } 10^{5}\,\text{V/m})} + 1$$

$$= 5.52$$

(b) The dielectric displacement may be determined using Equation 18.31, as

$$D = \varepsilon_0 E + P$$

$$= (8.85 \text{ x } 10^{-12}\,\text{F/m})(1 \text{ x } 10^{5}\,\text{V/m}) + 4.0 \text{ x } 10^{-6}\,\text{C/m}^2$$

$$= 4.89 \text{ x } 10^{-6}\,\text{C/m}^2$$