$$
C=\frac{Q}{V}=\frac{2.0 \times 10^{-10} \mathrm{C}}{139 \mathrm{~V}}=1.44 \times 10^{-12} \mathrm{~F}
$$

(d) The dielectric displacement may be computed by combining Equations 18.31, 18.32 and 18.6, as

$$
D=\varepsilon_{0} E+P=\varepsilon_{0} E+\varepsilon_{0}\left(\varepsilon_{r}-1\right) E=\varepsilon_{0} \varepsilon_{r} E=\frac{\varepsilon_{0} \varepsilon_{r} V}{l}
$$

And incorporating values for $\varepsilon_{r}$ and $l$ provided in the problem statement, as well as the value of $V$ computed in part
(a)

$$
\begin{gathered}
D=\frac{\left(8.85 \times 10^{-12} \mathrm{~F} / \mathrm{m}\right)(3.5)(39.7 \mathrm{~V})}{4.0 \times 10^{-3} \mathrm{~m}} \\
=3.07 \times 10^{-7} \mathrm{C}^{2}
\end{gathered}
$$

(e) The polarization is determined using Equations 18.32 and 18.6 as

$$
\begin{gathered}
P=\varepsilon_{0}\left(\varepsilon_{r}-1\right) E=\varepsilon_{0}\left(\varepsilon_{r}-1\right) \frac{V}{l} \\
=\frac{\left(8.85 \times 10^{-12} \mathrm{~F} / \mathrm{m}\right)(3.5-1)(39.7 \mathrm{~V})}{4.0 \times 10^{-3} \mathrm{~m}} \\
=2.20 \times 10^{-7} \mathrm{C} / \mathrm{m}^{2}
\end{gathered}
$$

Excerpts from this work may be reproduced by instructors for distribution on a not-for-profit basis for testing or instructional purposes only to students enrolled in courses for which the textbook has been adopted. Any other reproduction or translation of this work beyond that permitted by Sections 107 or 108 of the 1976 United States Copyright Act without the permission of the copyright owner is unlawful.

