

48. (a) Using $k = 1/4\pi\epsilon_0$, we estimate the field at $r = 0.02$ m using Eq. 23-3:

$$E = k \frac{q}{r^2} = \left(8.99 \times 10^9 \frac{\text{N} \cdot \text{m}^2}{\text{C}^2} \right) \frac{45 \times 10^{-12} \text{ C}}{(0.02 \text{ m})^2} \approx 1 \times 10^3 \text{ N/C} .$$

- (b) The field described by Eq. 23-3 is nonuniform.
- (c) As the positively charged bee approaches the grain, a concentration of negative charge is induced on the closest side of the grain, leading to a force of attraction which makes the grain jump to the bee. Although in physical contact, it is not in electrical contact with the bee, or else it would acquire a net positive charge causing it to be repelled from the bee. As the bee (with grain) approaches the stigma, a concentration of negative charge is induced on the closest side of the stigma which is presumably highly nonuniform. In some configurations, the field from the stigma (acting on the positive side of the grain) will overcome the field from the bee acting on the negative side, and the grain will jump to the stigma.