

21. (a) The magnitude of the force between the (positive) ions is given by

$$F = \frac{(q)(q)}{4\pi\epsilon_0 r^2} = k \frac{q^2}{r^2}$$

where q is the charge on either of them and r is the distance between them. We solve for the charge:

$$q = r\sqrt{\frac{F}{k}} = (5.0 \times 10^{-10} \text{ m})\sqrt{\frac{3.7 \times 10^{-9} \text{ N}}{8.99 \times 10^9 \text{ N}\cdot\text{m}^2/\text{C}^2}} = 3.2 \times 10^{-19} \text{ C} .$$

- (b) Let N be the number of electrons missing from each ion. Then, $Ne = q$, or

$$N = \frac{q}{e} = \frac{3.2 \times 10^{-19} \text{ C}}{1.6 \times 10^{-19} \text{ C}} = 2 .$$