

17. (a) The electric potential V at the surface of the drop, the charge q on the drop, and the radius R of the drop are related by $V = q/4\pi\epsilon_0 R$. Thus

$$R = \frac{q}{4\pi\epsilon_0 V} = \frac{(8.99 \times 10^9 \text{ N} \cdot \text{m}^2/\text{C}^2)(30 \times 10^{-12} \text{ C})}{500 \text{ V}} = 5.4 \times 10^{-4} \text{ m} .$$

- (b) After the drops combine the total volume is twice the volume of an original drop, so the radius R' of the combined drop is given by $(R')^3 = 2R^3$ and $R' = 2^{1/3}R$. The charge is twice the charge of original drop: $q' = 2q$. Thus,

$$V' = \frac{1}{4\pi\epsilon_0} \frac{q'}{R'} = \frac{1}{4\pi\epsilon_0} \frac{2q}{2^{1/3}R} = 2^{2/3}V = 2^{2/3}(500 \text{ V}) \approx 790 \text{ V} .$$