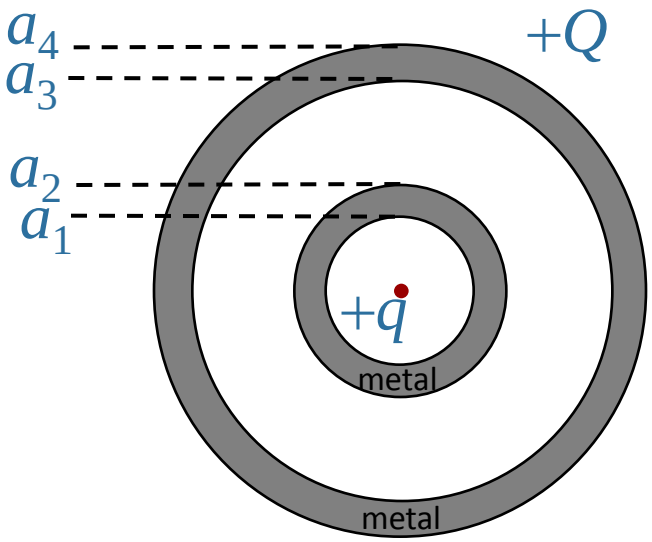
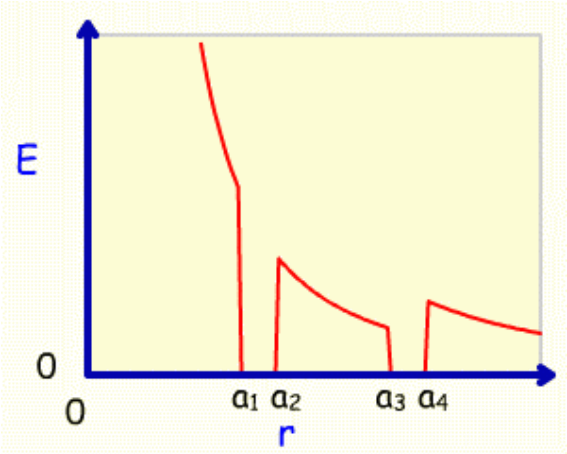
Calculation: Quantitative Analysis

cross-section





$r > a_4$: $V = \frac{1}{4\pi\varepsilon_0}\frac{Q+q}{r}$

$a_3 < r < a_4$: $V = \frac{1}{4\pi\varepsilon_0}\frac{Q+q}{a_4}$

$a_2 < r < a_3$: $V(r) = \Delta V(\infty \to a_4) + 0 + \Delta V(a_3 \to r)$

$$V(r) = \frac{Q+q}{4\pi\varepsilon_0 a_4} + 0 + \frac{q}{4\pi\varepsilon_0}\left(\frac{1}{r} - \frac{1}{a_3}\right)$$

$$\rightarrow \quad V(r) = \frac{1}{4\pi\varepsilon_0}\left(\frac{Q+q}{a_4} + \frac{q}{r} - \frac{q}{a_3}\right)$$

$a_1 < r < a_2$: $V(r) = \frac{1}{4\pi\varepsilon_0}\left(\frac{Q+q}{a_4} + \frac{q}{a_2} - \frac{q}{a_3}\right)$

$0 < r < a_1$: $V(r) = \frac{1}{4\pi\varepsilon_0}\left(\frac{Q+q}{a_4} + \frac{q}{a_2} - \frac{q}{a_3} + \frac{q}{r} - \frac{q}{a_1}\right)$