

Electric Potential of a Uniformly Charged Wire



- Consider a uniformly charged wire of infinite length.
- Charge per unit length on wire: λ (here assumed positive).

- Electric field at radius r : $E = \frac{2k\lambda}{r}$.

- Electric potential at radius r :

$$V = -2k\lambda \int_{r_0}^r \frac{1}{r} dr = -2k\lambda [\ln r - \ln r_0]$$

$$\Rightarrow V = 2k\lambda \ln \frac{r_0}{r}$$

- Here we have used a finite, nonzero reference radius $r_0 \neq 0, \infty$.
- The illustration from the textbook uses R_{ref} for the reference radius, R for the integration variable, and R_p for the radial position of the field point.

