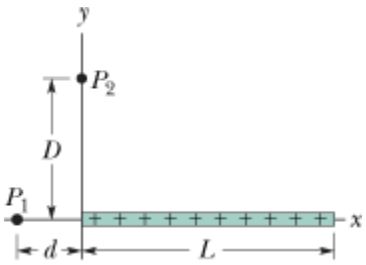
Answer on Question #65281-Physics-Other

The figure below shows a thin rod with a uniform charge density of 2.10 μC/m. Evaluate the electric potential at point P if d = D = L/4.00. Assume that the potential is zero at infinity.

Solution



For an infinitesimal segment of the rod the potential at $P = P_1$ is

$$dV = \frac{kdq}{d+x} = \frac{k\lambda dx}{d+x}$$

The electric potential at point $P = P_1$ is

$$V = \int_0^L dV = \int_0^L \frac{k\lambda dx}{d+x} = k\lambda \ln(d+x)_0^L = k\lambda[\ln(L+d) - \ln(d)]$$

$$= k\lambda \ln\left(1+\frac{L}{d}\right) = (8.99 \cdot 10^9)(2.10 \cdot 10^{-6}) \ln\left(1+\frac{1}{4}\right) = 4.21\ kV.$$

Answer: $4.21\ kV$.