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

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

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

**Answer:** 4.21 kV.

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