

Answer on Question #66092-Physics-Other

Infinite number of particles each with charge q kept along x axis at the points $x=1,2,3,4,\dots$. Then what is the value of electric potential and electric field at the origin?

Solution

The electric potential at the origin:

$$V = kq \left(\frac{1}{1} + \frac{1}{2} + \frac{1}{3} + \dots \right) = kq \sum_{n=1}^{\infty} \frac{1}{n} = kq(\infty) = \infty.$$

The electric field at the origin:

$$E = kq \left(\frac{1}{1^2} + \frac{1}{2^2} + \frac{1}{3^2} + \dots \right) = kq \sum_{n=1}^{\infty} \frac{1}{n^2} = kq \left(\frac{\pi^2}{6} \right) = \frac{\pi^2}{6} kq.$$

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