Electric Field Intensity

Again, we will start with what we know. For a gravitational field, we can find the intensity of the field by rearranging $F_g = mg$ to solve for acceleration due to gravity:

$$g = \frac{F_g}{m}$$ Here, we can find how strong the gravitational field is at a point.

This is very similar to an electric field, denoted ε:

$$\varepsilon = \frac{F_e}{q}$$ where: ε is electric field strength in N/C

F is electric force (like Coulomb's law) in N
q is charge on a particle in C

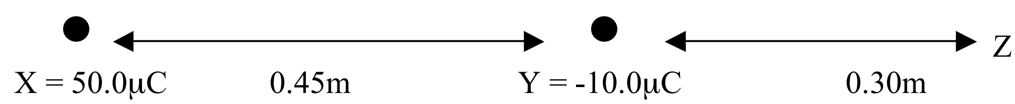
Unit Analysis:

This may cause us to look at gravity differently. Gravity will apply a force to every unit of _______________ in an object while an electric field will apply a force to every unit of _________________ on a particle.

For the field around point particles, we can apply Coulomb's law and insert it for F:

$$\varepsilon = \frac{F_e}{q} =$$

Eg. Calculate the magnitude and direction of the electric field at point Z due to charges X and Y:



Unlike gravity (which is always attractive), we may have attractive or repulsive points in any given electric field.

Linear Charge Density

Sometimes we need to consider a long conductor as a "long string of charges." If so, we can calculate its linear charge density using:

$$\lambda = \frac{q}{L}$$ where: λ is the charge density in C/m

q is the charge in Coulombs (C)
L is the desired length of conductor in metres (m)

Fields: Note 3

We can envision an electric field that permeates all space from a charged conductor just like a gravitational field.

We know that as we travel farther from the Earth's surface, the gravitational field strength becomes weaker. This is also true for any charged conductor. At any distance away, we can find the electric field strength using the following formula (if we know the linear charge density):

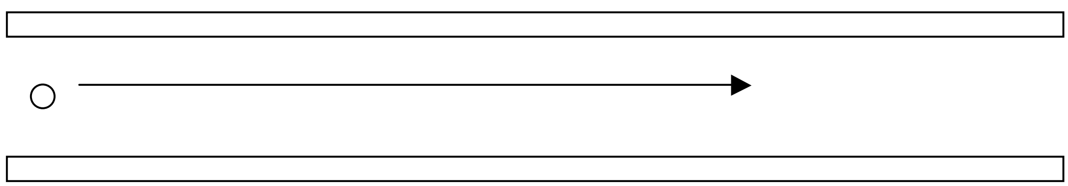
$$\varepsilon = \frac{2k\lambda}{r}$$

where: ε is electric field strength in N/C

k is Coulomb's constant (9.0×10^9 Nm^2/C^2)
r is separation distance in metres (m)

Unit Analysis:

This equation is valid for the field surrounding a single charged stream of particles. But what if we have two charged plates where a charged particle can pass between?



Here, it is not necessary to have both the plates having the exact same charge. If this happened (and the particle were in the exact centre), all forces would be balanced thus having no effect. If we change the charge on one of the plates, we create a ________________ __________________ and a gradual electric field between them.

This electric field is described by the following equation:

$$\varepsilon = \frac{V}{d}$$

where: ε is electric field strength in N/C

V is the potential difference between the plates in V
d is the separation between the plates in metres (m)

Unit Analysis: