Source: [[KBhPHYS201IntroToElectrostaticsLN]]

1 | Electric Fields

You will notice that the *Electric Field* works very similarly to the *Gravitational Field* [[KBhPHYS201GravitationalFields]]

To recall, Coulomb's Law [[KBhPHYS201ColoumbsLaw]] looks like $F_{attraction} = k\frac{Q_1 Q_2}{R^2}$, which is eerily similar to the Force of Gravity, $F_{grav} = G\frac{M_2 M_2}{R^2}$.

And so, by the some token, we could also redefined electric force as:

Definition 1 · **Electric Force** $F_{attraction} = EQ_1$
where E is Q_2's electric field

Unsurprisingly, the units for *Electric Field* is $\frac{N}{C}$, and no, before you get excited, there is nothing it equals.

With masses (and w.r.t. [[KBh]]_PHYS201_GravitationalFields gravitational fields), it's easy. Masses always *attracts* because negative mass doesn't exist (*yet*). But, with an electric field, figuring out directions is harder.

So, we have two choices to dealing with directions:

1) Electric field of any Q has two values, one "attract field" and one "repel field"
2) Drawing a single vector $\vec{E}$, but remember that the direction of the vector depends on what's dropped in it

USE OPTION **2**.

In this manner, when we say, "this atom has a electric field vector in this direction", we mean two things

1. When a positive test change is dropped onto that vector, it will experience force in the same direction as the vector
2. When a negative "" "" "",'"" "" "" the opposite direction as the vector

Illustrating Electric Fields

There are two ways of illustrating electric fields — either drawing an infinite amount of vectors (that's a lot of vectors), or drawing lines originating from the main particle lining up all the vectors (think! original Japanese flags.)

See [[KBhPHYS201IllustratingElectricFields]] illustrating electric fields.

Electric Field Interactions

See [[KBhPHYS201ElectricFieldInteractions]] Electric Field Interactions.

Conductors and Electric field

If the charges on a conductor are stationary…

1) E-field *in* the conducting material must be zero

- Because, uhh…., the conductor is stationary, meaning no electron flow
- So, without electric flow, you know that there is no motivation for electrons to flow, which means no electric field

2) At the surface of the conductor, if any E-field is present, it must be perpendicular to the surface
    - If you have a horizontal component, the conductor would be, well, *conducing* electricity, making it rather not static
    - If the E-Field is perpendicular, because we are in the Physics Vacuum, no charges will flow because it can't flow out of the conductor into something else

An now, something interesting

Take, a neutral conductor.!

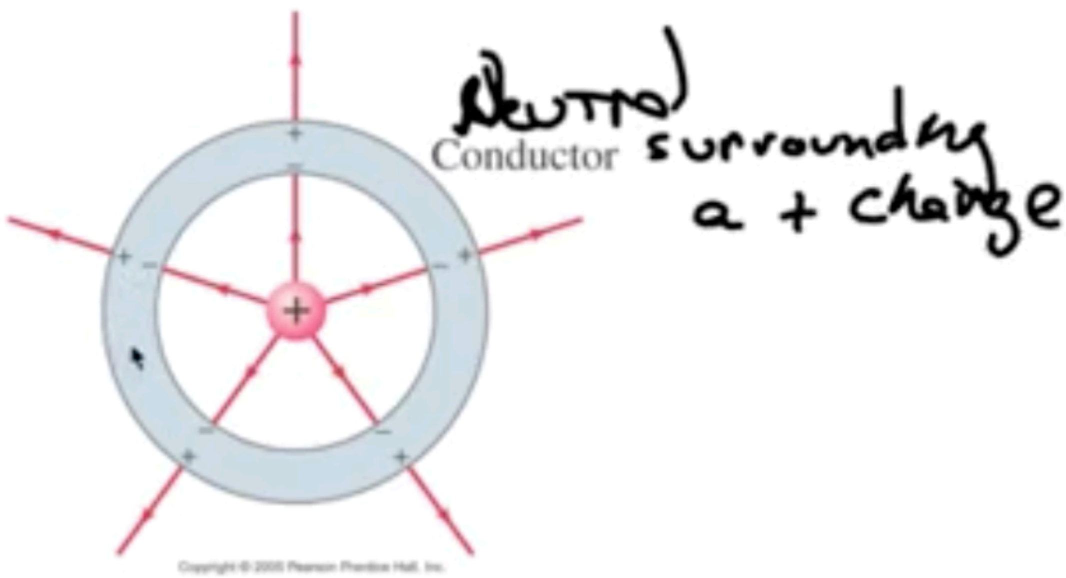

Figure 1: Screen Shot 2020-08-24 at 9.44.46 PM.png

At the point of the cursor, there would be an electric field cause by the central charge going outwards; at which point the following will happen…

1) The red (positive) charge attracts electrons to the inside of the tube
2) These newly electrons set up their own electric fields equal and opposite to the electric field by the central electron (because of the Electric Field Deux. Gravitational Field thing)

So, the conductor has a net electric field of 0. It's static.

Because of the fact that the neutral conductor had both 1) and 2) going on, there is no tangent changes to the conductor (**think!** rule 2 aforementioned), and only field lines that are perpendicular (emitted by the red, positive charge), will be passed out.

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