Electric Field

What would be the force on a charge if it were located here (or anywhere)?

Electric Field

Gravitational Field Analogy
- Consider a smoothly varying surface near the earth.
- Imagine placing a ball anywhere on the surface.
- Direction of force would be downhill.
- Strength of force would be proportional to steepness.
- The field exists everywhere.

Force per mass that would be experienced by an object at any location.

Electric Field

- Consider space around a charge or a set of charges.
- Imagine placing another charge anywhere in the space.
- Electric field gives the direction and relative strength of the force.
- The field exists everywhere.

Force per charge that would be experienced by an object at any location.

Electric Field

Force per charge

$$\vec{E} = \frac{\vec{F}}{q}$$

$$\vec{F}_{01} = k\frac{q_0 q_1}{r_{01}^2}\hat{r}_{01}$$

$$\vec{E} = k\frac{q_0}{r^2}\hat{r}$$

Electric Field

Force on a particular charge at a particular location (due to another charge or set of charges elsewhere).

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Force per charge that would exist at all locations (due to a charge or set of charges elsewhere).

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- Does it make sense to calculate the force of a charge on itself?
- Does it make sense to calculate the electric field due to a charge at the location of the charge?

Examples: Two protons are a distance d apart, as illustrated. Determine the electric field at P a distance x from the midpoint of the line joining the two protons and equidistant from the two protons.

p^+ •
d - - - - - - - x - - - • P
p^+ •

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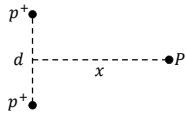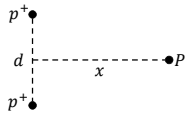
- What would be the force on a third proton placed at P?
- How would the answer change if one of the protons were replaced with an electron?

Examples: A proton enters a region with a uniform electric field. Describe the proton's motion as a function of time.

$\vec{v}_0$

$\vec{E}$

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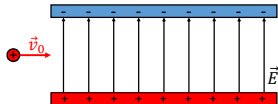
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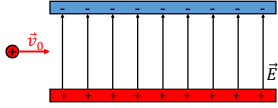
Was it reasonable to ignore gravity?