Name Period Date

Chapter 21 Notes: *Electric Fields*

1. gravitational force ~ $1/r^2$ electric force ~ $1/r^2$
2. How can a force be exerted across what seems to be empty space? *"act at a distance"…between <u>objects not in contact with each other</u>*
3. <u>Faraday</u> suggested: *if an electrically charged **object A**, creates a force on another charged **object B**, then…*
   - ***object A*** must somehow change the properties of space
   - ***object B*** somehow senses the change in space and experiences a force due to the properties of the space at its location
   - We call the <u>changed property of space</u> an <u>**electric field**</u>
   - An <u>electric field means</u> that the <u>interaction</u> is <u>not between two distant objects</u>, but <u>between an object</u> and the <u>field</u> at its location
4. But how can the field be detected and measured?
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   -
   -

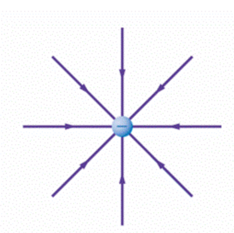
$$F = \frac{GMm}{r^2}$$

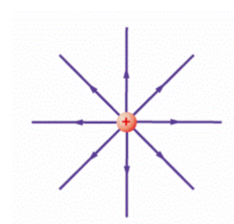
Just as the space around a <u>mass</u> is filled with a <u>gravitational field</u>, ..

the space around every <u>electric charge</u> is filled with an <u>electric field</u>.

$$F = \frac{KQq}{r^2}$$

- The electric field is a "vector field"
  - <u>Magnitude</u> (***electric field strength***) **E = F/q =**
  - <u>Direction</u> by arrow for positive (+) test charge
  - _____________ or _____________ show…_____________ by spacing of lines (**far apart = __________; close = ___________**)





5. Electric Potential

Work done against gravity = gravitational <u>potential energy</u> (GPE)

Work done against electric force = electric <u>potential energy</u> (EPE)

Rather than deal with the <u>total EPE</u> of a <u>group of charges</u>, we want the <u>**energy PER charge**</u>. This value is the <u>*electric potential*</u> or <u>*voltage*</u>

Electric potential (volts) =

Just as *gravitational potential energy* needed a reference level, so does electric potential energy….only differences in electric potential are important.

electric potential difference $$\Delta V = \frac{\Delta PE}{q} = \frac{\text{work done}}{q}$$

P-1. How much work is done to transfer 0.50 C of charge through a potential difference of 9.0 volts?

6. Electric Potential in a Uniform Field (charged parallel plates)

$$\Delta V = \frac{\Delta PE}{q} = \frac{Fd}{q} = Ed$$

P-2. Two charged parallel plates are **1.5 cm** apart. The magnitude of the electric field between the plates is **1800 N/C**. What is the electric potential difference between the plates?

What work is required to move a proton from the negative plate to the positive plate?

7. Storing Charge, the **Capacitor**:

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- unit of ______________________________

$$C = \frac{\quad}{\quad}$$

$$\textit{1 farad (F)} = \frac{\textit{1 coulomb}}{\textit{1 volt}}$$