Ch 19
Electric Field &
Electric potential

$$E = \frac{F}{q_o}$$

E represents the electric field and is the ratio of the size of the force experienced by a small test charge to the size of the charge itself.

We could have discussed gravity in terms of gravitational field strength: Here the units of grav field strength would be N/kg

$$g = \frac{F_w}{m}$$

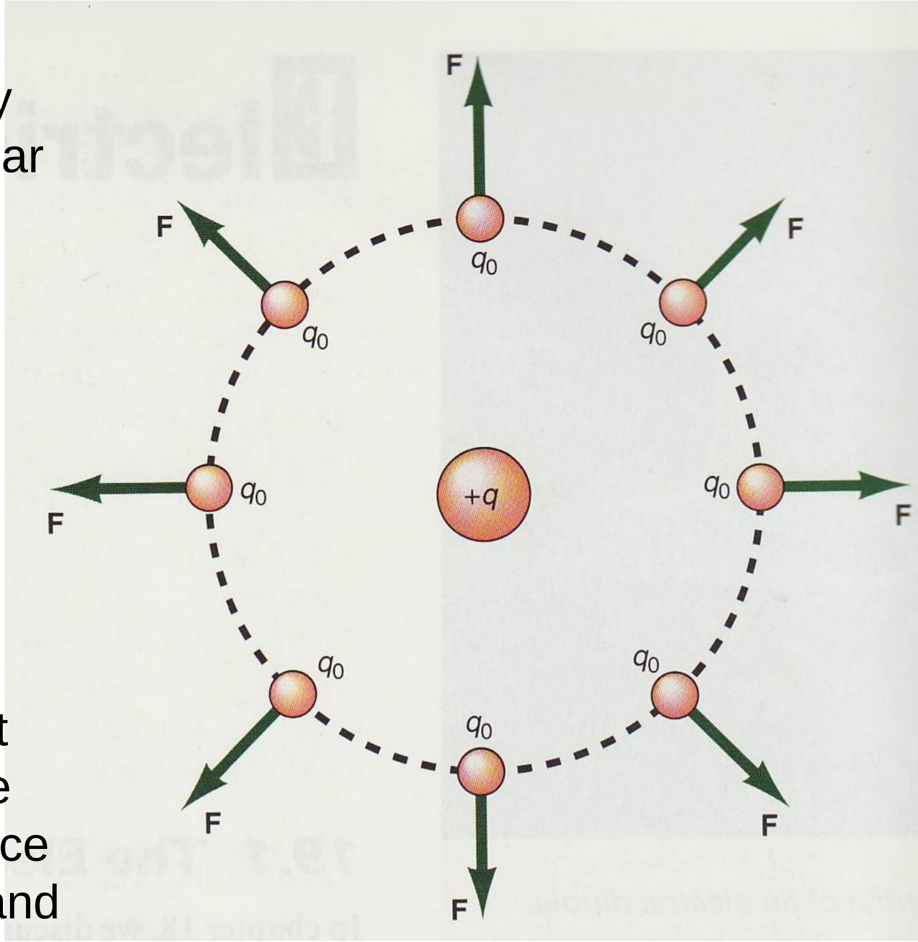
$$F = Eq_o$$

$$E = \frac{F}{q_o}$$

$$E = \frac{\frac{kq_1q_2}{r^2}}{q_o}$$

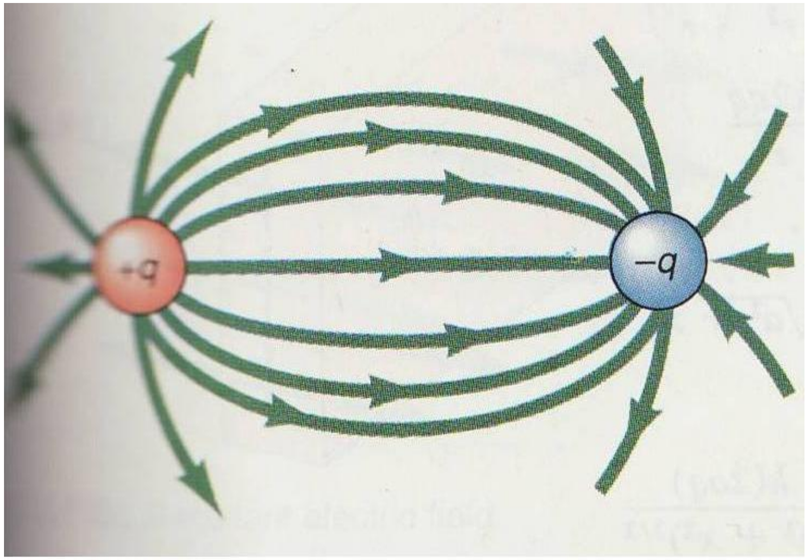
$$E = \frac{kq}{r^2}$$

Earlier we talked about using vectors to represent the force experienced by a positive test charge when it was near some larger force, either + or -.

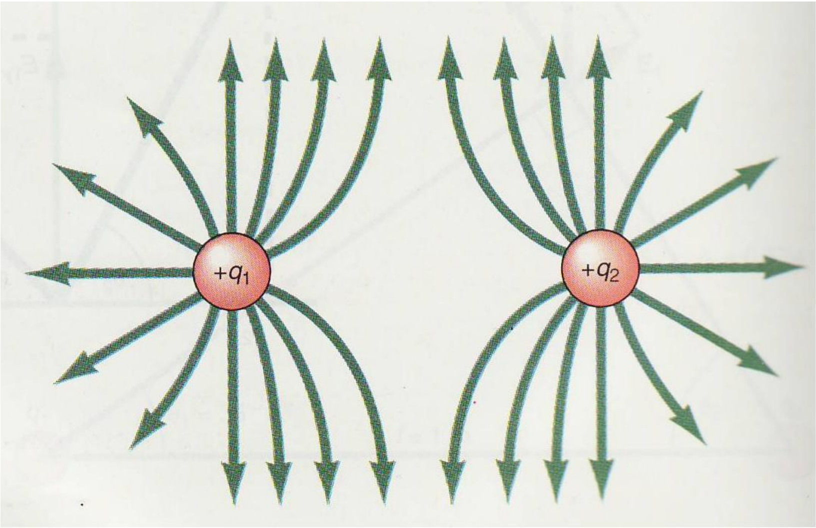


We could assign a vector to each point in space around the charge q, but if we try to actually draw all the vectors, space would be entirely filled with green ink and we could see nothing.

So, using field “lines” we represent the direction of the force experienced at any particular location by a + test charge



Electric field lines always emerge from positive charges and enter negative charges.



It’s important to remember that the electric field is a human convention used to get around the idea of “action at a distance” Modern physics argues that all interactions are the result of particle exchanges.

Field lines are related to vectors, but are not vectors.

Vectors are always straight, and their length represents their _____________

Field “lines” are often curved, and their direction at any particular point represent the direction of the force on a + test charge at that point.

The strength of the E field is represented by the ________________ of the field lines.

The field of a parallel plate capacitor is an interesting special case.

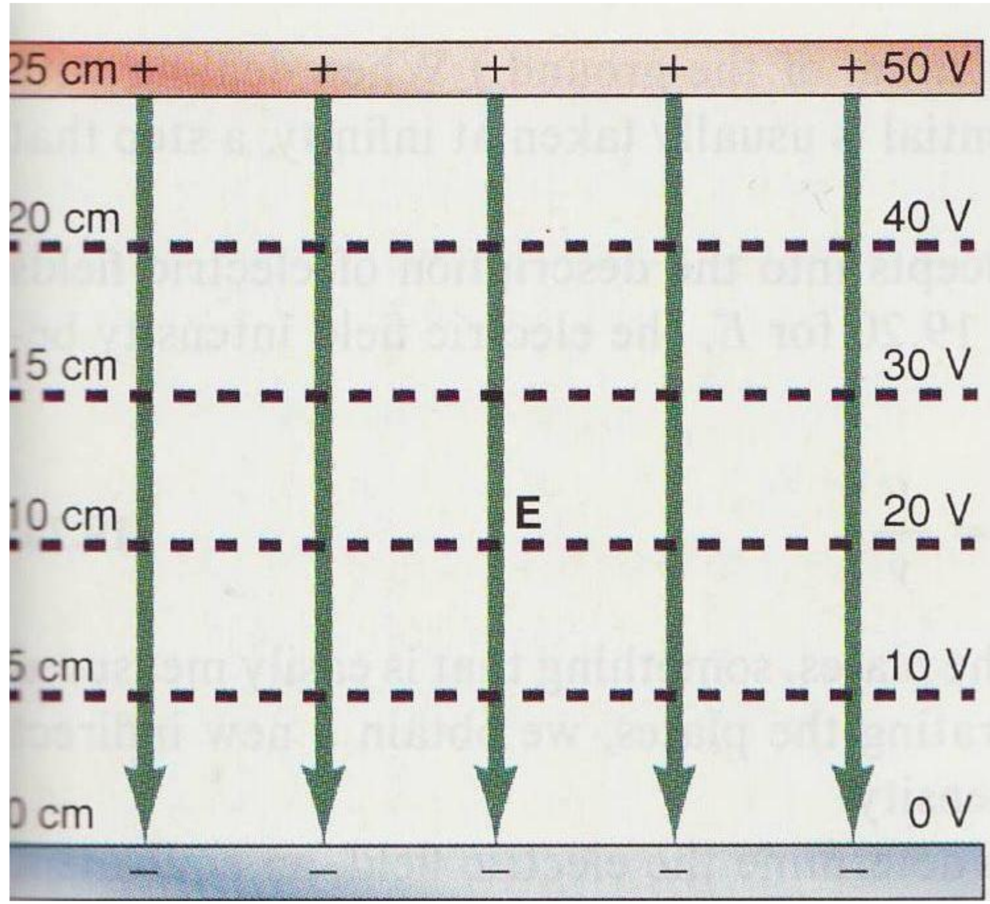
The field essentially exists only between the two plates, and is uniform.

There is a slight “edge effect”

What does it mean for a field to be uniform?

What is a capacitor?

This slide is starting to show both the E field and the electric potential (dashed lines)



Electric potential

- V = electric potential, often called potential
- V is potential energy per charge.

Here is a non-calc way to “derive” the eq:

$$V = \frac{potential\ \ energy}{charge}$$

$$= \frac{work}{charge}$$

$$= \frac{F \cdot r}{q}$$

$$= \frac{Eq \cdot r}{q}$$

$$= Er$$

$$= \frac{\frac{kq_1 q_2}{r^2} \cdot r}{q}$$

$$V = \frac{kq}{r}$$