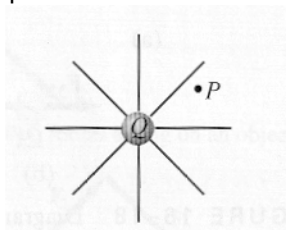


Electric Fields

What is an electric field?

- An electric field is the region of space around a charge where a positive test charge experiences a force.



More About Electric Fields

- Mathematically, we define the electric field as the electric force per unit charge.

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

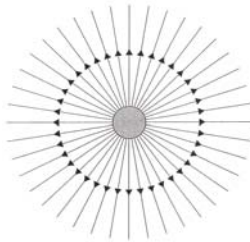
Units: Newtons/Coulomb (N/C)

Electric Field Lines

- A very useful concept in dealing with electric fields is that of electric field lines.
- These are imaginary lines (curved or straight) that point in the direction of the electric force on a positively charged particle at that point.
- A single positive charge creates an electric field that is directed radially out of the charge.

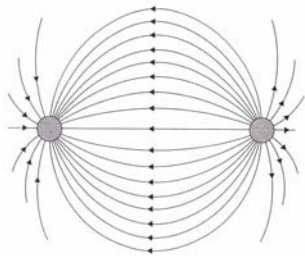
Electric Field Lines Example 1

- For a positive charge, the lines are drawn coming out of the charge.
- For a negative charge, the lines are drawn going into the charge.



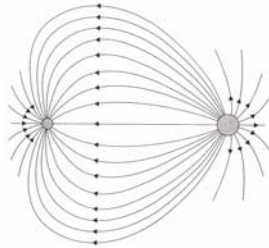
Electric Field Lines Example 2

- Electric field lines for two equal and opposite charges.



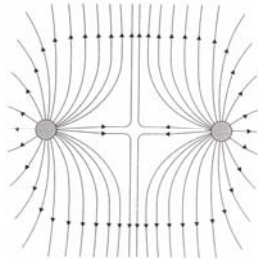
Electric Field Lines Example 3

- The electric field for two unequal and opposite charges.



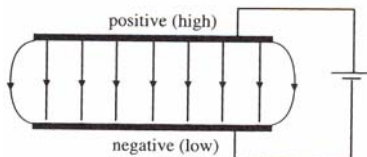
Electric Field Lines Example 4

- The electric field of two equal positive charges.



Uniform Electric Field

- A *uniform* electric field is one that has constant magnitude and direction.
- Such a field is generated between two oppositely charged parallel plates.



Uniform Electric Field Continued

- Near the edges of the plates the field lines are curved, indicating that the field is no longer uniform there.
- This *edge effect* is minimized when the length of the plates is long compared with their separation.

Millikan

- Millikan determined the charge on protons and electrons.
- The charge on protons and electrons is the same.
- Called the “elementary charge”
- $e^- = p^+ = 1.6 \times 10^{-19} \text{ C}$
