Electric Field

Region surrounding an electrically charged particle. The Electric Field, E, shows the force exerted on another electrically charged object by the charged particle that the field is surrounding.

Electric Field (“E”)

- Electric fields are generated by charges.
- Given a stationary charge Q (“source charge”) that creates an electric field
- Use a small, separate “test” charge, q, to probe E.
- E is the force F experienced by a small, positive test charge, q, at position r
- $E = F/q$

Direction of Electric Field

- Direction of the electric field is the same as the direction of the force it would exert on a positively charged particle.
- The electric field is directed away from positive charges and toward negative charges.

Example

- A small, test charge q = 2.0 x 10^(-6) Coulomb experiences a force of 2.4 x 10^(-3) N east when placed in an electric field. Determine the magnitude and the direction of the electric field.
- E = F/q = 2.4 x 10^(-3)/2.0 x 10^(-6)
- = 1.2 x 10^3 N/C east

- What is the magnitude of the electrostatic force experienced by one elementary charge at a point in an electric field where the magnitude of the electric field strength is 3.0 x 10^3 N/C?
- E = F/q
- 3.0 x 10^3 = F/1.6 x 10^(-19)
- 3.0 x 10^3 x 1.6 x 10^(-19) = 4.8 x 10^(-16) = F

Field between two oppositely charged parallel plates

- If the distance between two oppositely charged parallel plates is small, the electric field between the plates is uniform.

Potential Difference

- If the direction of an electric field is such that it opposes (acts against) the motion of a charged particle, work must be done to move the particle in that direction.
- Potential difference is the work done per unit charge as a charged particle is moved between the points.
- $V = W/q$ (volts)

Example

- How much energy is needed to move one electron through a potential difference of 100 volts?
- $V = W/q$
- $100 = W/(1.6 \times 10^{(-19)})$
- $W = 1.6 \times 10^{(-17)}$ J

Example

- In an electric field, 6.0 J of work are done to move 2.0 C of charge from point A to point B. Calculate the potential difference between points A and B.
- $V = W/q = 6.0/2.0 = 3$ volts