# Electrostatics

**Equations:**

Coulombs Law:

$$F = k\frac{q_1 q_2}{r^2} \quad = \frac{1}{4\pi\epsilon_0}\frac{q_1 q_2}{r^2}$$

Definition of E-field:

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

Definitions of Electric Potential:

$$\Delta V = -E\Delta x\cos\theta, \qquad \Delta PE = q\Delta V$$

Gauss's Law:

$$EA\cos\theta = \frac{Q}{\epsilon_0}$$

Fields for point charges:

$$E = k\frac{Q}{r^2} \qquad V = k\frac{Q}{r}$$

**Numbers:**

$$e = 1.602 \cdot 10^{-19}\ C$$

$$k = 8.99 \cdot 10^9\ \left(\frac{Nm^2}{C^2}\right)$$

$$k = \frac{1}{4\pi\epsilon_0}, \quad \epsilon_0 = 8.85 \cdot 10^{-12}\ \left(\frac{C^2}{Nm^2}\right)$$

**Assorted Facts:**

1. Charge is conserved, net charge does not change.
2. No electric field exists inside conductors.
3. Electric fields at surfaces of conductors are $\perp$ to surface.
4. All points on or inside a conductor are at the same voltage.

Units:

| Quantity | Units | Conversion |
|---|---|---|
| Electric Field | $(N/C),\ (V/m)$ | $1(N/c) = 1(V/m)$ |
| Charge | $(C),\ (e)$ | $1e = 1.6 \cdot 10^{-19}C$ |
| Voltage | $(V),\ (J/C)$ | $1(V) = 1(J/C)$ |