SI based quantities

1. Length	L	meters	Relative to observer, No direction
2. Time	t	seconds	Relative to observer
3. Mass	m	kilo-grams	Relative to observer, non-negative
4. Charge	q	coulombs	

Properties of charge

1. Charge is conserved - Net charge can't be created or destroyed.
2. Charge is quantized - The charge on an electron is the smallest unit.
3. Charge is invariant - If it moves by you, it doesn't change.
4. Charge comes in two flavors - Negative (-) and positive (+)
5. Force is between pairs of charge - Newton's 3rd law

Inertia - Property of a body to resist acceleration.

Inertial mass - The measurement of inertia. $F=ma$

Density - Relationship between inertia and volume.

Gravitational mass - $F_g = \frac{G m_1 m_2}{r^2}$ (gravitational mass)

- Gravitational mass equals the intertial mass, but they're different concepts.

Conductor - Charge is free to move. No work is required to make the charge move.

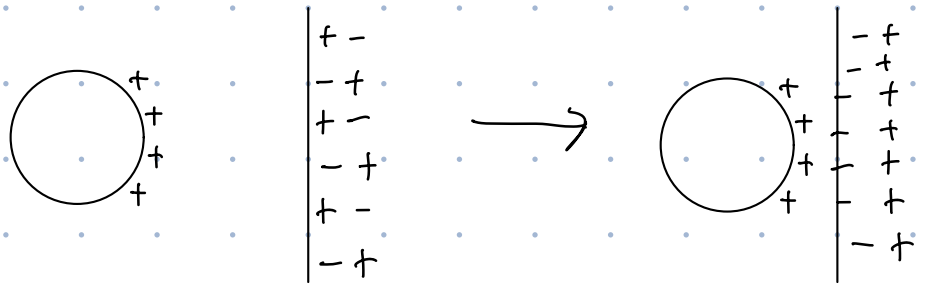
Dielectric - Insulators. Charge isn't free to move, it's bound. Work required to make the charge move.

Semi-conductors - In between conductor and dielectric

Newton's 2nd law - The net external force on a system equals the inertial mass of the system times the acceleration of the system's center of mass. ($F=ma$)

Things about charge

- Negative charge ≠ electrons and positive charge ≠ protons
  - Other particles can have charge
- All normal matter has charge because it's made of atoms, but is rarely charged. It's usually zero net charge.
- Electrons and protons can't colide.
- Induced polarization of charge.



why a charged balloon sticks to a neutrally charged wall.

Coulomb's force law

Magnitude: $\boxed{F_e = \frac{kq_1q_2}{r^2}}$

Direction: Like charges repel and unlike charges attract.

Electric Fields

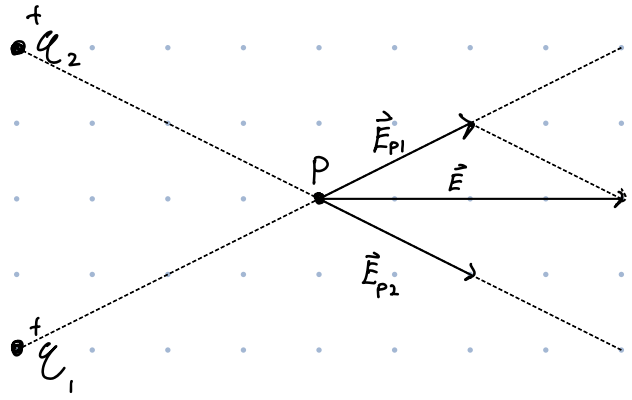
Fields were used to explain how non-contact forces work.

$F = mg$ ← Gravitational field close to earth's surface $= \frac{GM_E}{R_E^2}$

$\vec{F}_E = q\vec{E}$ ← Put the minus sign if negative charge

$$\vec{E}_{src} = \frac{kq_{src}}{r^2}$$

Finding electric field from multiple sources?



Principle of superposition

$$\vec{E} = \vec{E}_{P1} + \vec{E}_{P2} \quad (POS)$$

Direction: Acceleration direction from a positive test charge at the field's point.