Dimensional Analysis

ALL units are expressed in terms of three basic quantities, mass **M**, length **L**, and time **T**, expressed in Kilogram, Meter, and Second, respectively.

Dimensional Analysis: good physics equations (**and** good students) balance their MLT's.

- Velocity (v): $\mathbf{LT^{-1}}$ (meters per second)
- Acceleration (a): $\mathbf{LT^{-2}}$ (meters per second squared)
- Frequency (f): $\mathbf{T^{-1}}$ – **HERZ** (per second)
- Momentum (mv): $\mathbf{MLT^{-1}}$ (Kg-meters per second)
- Force ($\mathcal{F}$): $\mathbf{MLT^{-2}}$– **NEWTON** (Kg-meter per second squared; remember "f = ma")
- Energy ($\mathcal{E}$): $\mathbf{ML^2T^{-2}}$– **JOULE** (Kg-meter squared per second squared; remember "$\mathcal{E} = mc^2$")
- Power ($\mathcal{P}$): $\mathbf{ML^2T^{-3}}$– **WATT** (Kg-meter squared per second cubed; energy per unit time)
- Electric Charge ($\mathcal{Q}$): $\mathbf{M^{\frac{1}{2}}L^{\frac{3}{2}}T^{-1}}$– **COULOMB** (derived by balancing Coulomb's law)
- Electric Field (E): $\mathbf{M^{\frac{1}{2}}L^{-\frac{1}{2}}T^{-1}}$ (force per unit charge)
- Magnetic Field (B): $\mathbf{M^{\frac{1}{2}}L^{-\frac{3}{2}}}$ – **TESLA** ("force=charge times velocity times B")
- Voltage (V): $\mathbf{M^{\frac{1}{2}}L^{\frac{1}{2}}T^{-1}}$– **VOLT** (Coulomb per meter)
- Current ($\mathcal{I}$): $\mathbf{M^{\frac{1}{2}}L^{\frac{3}{2}}T^{-2}}$ – **AMPERE** (Coulomb per second)
- Resistance ($\mathcal{R}$): $\mathbf{L^{-1}T}$ – **OHM** (seconds per meter; remember "V = current times resistance")
- Capacitance ($\mathcal{C}$): $\mathbf{L}$ – **FARAD** (inverse meter; remember the shopping network: "charge = voltage times capacitance") $\mathcal{R}C$ has units of time
- Inductance ($\mathcal{L}$): $\mathbf{L^{-1}T^2}$– **HENRY** ($\mathcal{LC}$ has units of $\mathbf{T^2}$)