Dimensions & Units

- Dimension: the type of a physical quantity, e.g., Length, Time, Temperature

- We use the SI system:
  - 6 fundamental dimensions
    - kind of arbitrarily defined
  - Time & current are among them
  - So, Charge = Current × Time is derived.
  - You could define charge & time as fundamental
    then current = charge/time can be derived.

- In physics & engineering, always check
  dimension & units; although this sanity check
  doesn't guarantee correctness.

\[ E = \frac{qC}{4\pi\varepsilon_0 R^2} \]

\[ q - C; \quad \varepsilon_0 - \frac{F}{m} = \frac{C}{Vm}; \quad R - m \]

\[ \frac{C}{Vm} \cdot m^2 = \frac{V}{m} \]

On the other hand, another charge \( q' \) in this field:

\[ F = q'E \quad \Rightarrow \quad E = \frac{F}{q'} \quad \frac{N}{C} \]

Show that \( \frac{N}{C} = \frac{V}{m} \) - Joule

hint: \( W = F \cdot d \quad J = Nm \)

If the force is electric \( \mathbf{F} \), then \( W_{\text{electric}} = q \cdot V \quad J = CV \)