Herleitung elektrischer Größen

Elektrische Ladung [Q]

$1C = 1As \quad \Rightarrow \quad [I] = \frac{[Q]}{[t]};\ [Q] = [I] \cdot [t] \quad \Rightarrow \quad \underline{\underline{1C = 1A \cdot 1s}}$

Elektrischer Widerstand [R]

$1\Omega = \frac{1V}{1A} \quad \Rightarrow \quad [R] = \frac{[U]}{[I]} \quad \Rightarrow \quad \underline{\underline{1\Omega = \frac{1V}{1A}}}$

Elektrische Spannung [U]

$1V = 1\frac{J}{C} = \frac{1Nm}{1C} \quad \Rightarrow \quad [U] = \frac{[W]}{[Q]} \quad \Rightarrow \quad \underline{\underline{1V = \frac{1J}{1C}}};\quad 1J = 1Nm \quad \Rightarrow \quad \underline{\underline{\frac{1Nm}{1C}}}$

Arbeit [W]

$1J = 1Nm \quad \Rightarrow \quad [W] = [F] \cdot [s] \quad \Rightarrow \quad \underline{\underline{1J = 1N \cdot 1m}}$

$1J = 1CV = 1AsV \Rightarrow \quad [W] = \frac{1}{2} \cdot [Q] \cdot [U] \quad \Rightarrow \quad \underline{\underline{0,5J = \frac{1}{2} \cdot 1C \cdot 1V}};\ 1C = 1As \ \Rightarrow \ \underline{\underline{0,5J = \frac{1}{2} \cdot 1As \cdot 1V}}$

$1J = 1\frac{C^2}{F} = 1\frac{A^2 s^2}{F} \Rightarrow \quad [W] = \frac{1}{2}\frac{[Q^2]}{[C]} \quad \Rightarrow \quad \underline{\underline{0,5J = \frac{1}{2} \cdot 1\frac{C^2}{F}}};\ 1C = 1As \ \Rightarrow \ \underline{\underline{0,5J = \frac{1}{2} \cdot 1\frac{A^2 s^2}{F}}}$

Elektrische Feldstärke [E]

$1\frac{N}{C} = 1\frac{V}{m} \quad \Rightarrow \quad 1N = \frac{1V \cdot 1C}{1m} \quad \Rightarrow \quad \underline{\underline{1\frac{N}{C} = \frac{1V \cdot 1\cancel{C}}{1m \cdot 1\cancel{C}}}}$

Kraft [F]

$1N = 1\frac{kg \cdot m}{s^2} \quad \Rightarrow \quad [F] = [m] \cdot [g] \ \Rightarrow \quad \underline{\underline{1N = 1kg \cdot 1\frac{m}{s^2}}}$

$1N = 1\frac{V \cdot C}{m} \quad \Rightarrow \quad [F] = \frac{[Q^2]}{2 \cdot \varepsilon_0 \cdot [A]} \Rightarrow \quad 1N = \frac{C^2}{2 \cdot \frac{C}{Vm} \cdot m^2} = \frac{C^{\cancel{2}} \cdot V \cancel{m}}{2 \cdot \cancel{C} \cdot m^{\cancel{2}}} = \underline{\underline{\frac{V \cdot C}{m}}}$

Flächendichte [D]

$1\frac{C}{m^2} \quad \Rightarrow \quad [D] = \varepsilon_0 \cdot [E] \quad \Rightarrow \quad 1\frac{C}{m^2} = \frac{\cancel{C}}{Vm} \cdot 1\frac{N}{\cancel{C}} = 1\frac{N}{Vm};\quad 1N = \frac{V \cdot C}{m} \quad \Rightarrow \quad \underline{\underline{1\frac{C}{m^2} = 1\frac{\cancel{V} \cdot C}{\cancel{V}\, m \cdot m}}}$

$1\frac{C}{m^2} \quad \Rightarrow \quad [D] = \frac{[Q]}{[A]} \quad \Rightarrow \quad \underline{\underline{1\frac{C}{m^2} = 1\frac{C}{m^2}}}$

Kapazität [C]

$1F = 1\frac{C}{V} = 1\frac{As}{V} \quad \Rightarrow \quad [C] = \frac{[Q]}{[U]} \quad \Rightarrow \quad \underline{\underline{1F = \frac{1C}{1V}}};\quad 1C = 1As \quad \Rightarrow \underline{\underline{1F = \frac{1As}{V}}}$