EE47008

Notation and symbols, in SI[1] units

| Quantity | Description | Units |
|---|---|---|
| Area (A) | length × length | square meters ($m^2$) |
| Capacitance ($C$) | charge/potential | Coulomb/volt (C/V), Farad (F) |
| Charge density | either, linear charge density $\rho_l$ (charge/length)<br>surface charge density $\rho_s$ (charge/area)<br>volume charge density $\rho_v$ (charge/volume) | C/m<br>$C/m^2$<br>$C/m^3$ |
| Charge($Q$)<br>fundamental (q) | current × time<br>electron charge | Coulomb (C)<br>$1.602 \times 10^{-19}$ C |
| Conductance | 1/resistance | 1/Ohm, $\Omega^{-1}$ |
| Conductivity ($\sigma$) | conductance/length | $\Omega^{-1}m^{-1}$ |
| Current ($I$) | charge/time | A |
| Current density ($\boldsymbol{J}$) | current/area | $A/m^2$ |
| Efficiency ($\eta$) | energy out/energy in | dimensionless, % |
| Electric dipole ($\boldsymbol{p}$) | $\boldsymbol{p} = q\boldsymbol{d}$ | C m |
| Electric field ($\boldsymbol{\xi}$) | force/charge or potential/length | V/m |
| Electric flux density ($\boldsymbol{D}$) | electric flux = $\int_{surface} \boldsymbol{D} \bullet d\boldsymbol{s} = Q$<br>$\boldsymbol{D}$ is electric flux/area | $C/m^2$ |
| Force ($\boldsymbol{F}$) | mass × acceleration | Newton (N) |
| Frequency ($f$) | cycles/second | Hertz, (Hz or $s^{-1}$) |
| Inductance ($L$) | magnetic flux/current | Henry (H) or Wb/A |
| Length ($l$, $d$) | | meter (m) |
| Magnetic field intensity ($\boldsymbol{H}$) | $\int_{loop} \boldsymbol{H} \bullet d\boldsymbol{l} = I$ | A/m |
| Magnetic flux ($\Phi$) | $\Phi = \int_s \boldsymbol{B} \bullet d\boldsymbol{s}$ | Weber (Wb) |
| Magnetic field ($\boldsymbol{B}$) | magnetic flux density ($\Phi$/area) | Tesla (T)<br>Weber/$m^2$ ($Wb/m^2$) |
| Mass ($m$) | | kilogram (kg) |
| Permeability ($\mu_o$) | for vacuum | Henry/meter (H/m) |
| Permittivity ($\varepsilon_o$), dielectric constant | for vacuum or air at atmospheric pressure | F/m |
| Polarization ($\boldsymbol{P}$) | electric dipole/volume | $C/m^2$ |
| Potential | voltage | V |
| Power | energy/time | Watt (W) |

Bold face indicates vector quantities

[1] International System of Units (SI), The NIST Reference on Constants, Units, and Uncertainty, http://physics.nist.gov/cuu/Units/, Aug. 2, 2008.

| Quantity | **Description** | **Units** |
|---|---|---|
| Power density | power/area | $W/m^2$ |
| Relative permittivity ($\varepsilon_r$) | material permittivity/$\boldsymbol{\varepsilon_o}$ | dimensionless |
| Resistance ($R$) | voltage/current | Ω |
| Resistivity ($\rho$) | resistance × length | W cm |
| Seebeck coefficient ($Q$) | electric field/temperature gradient | V/K |
| Strain ($s$) | relative change in length $\Delta l/l$ | dimensionless |
| Stress ($\sigma$) | force/area | $N/m^2$ |
| Temperature ($T$) | | Kelvin (K) |
| Time ($t$) | | s |
| Thermal conductivity ($\kappa$) | Watts/Kelvin/meter | W/(K m) |
| Thermoelectric figure-of-merit ($Z$) | $Q^2/\kappa\sigma$ | $K^{-1}$ |
| Velocity ($v$) | distance/time | m/s |
| Wavelength ($\lambda$) | propagation velocity/ frequency | m |
| Young's modulus ($Y$) | strain/stress | $N/m^2$ |

Some symbols have to be determined by context: $\sigma$ is used for both conductivity and stress, and $Q$ is used for charge and Seebeck coefficient. This table is based on Appendix B of Iskander[2].

[2]M. F. Iskander, Electromagnetic Fields and Waves, Waveland Press, 1992, pp. 720-723.