Important Units and Formulas

Important Units				
Variable	**Meaning**	**Units**	**Description**	**Unit Abbrev.**
t	Time	seconds	Measured in seconds	s
V	Voltage	Volts	Energy per charge (Joules per Coulomb); referred to as "Potential" because the higher the voltage is, the more energy each electron has	V
J	Joule	Joules	A measure of energy equal to a Newton meter per second	J
C	Coulombs	Coulombs	SI Unit of electrical charge, roughly equal to the charge of 6.24×10^{18} electrons*	C
I	Current	Amperes (Amps)	Flow of charge per unit time (Coulombs per second); Every second, 6.24×10^{18} electrons flow past any point in a circuit with 1 ampere of current	A
P	Power	Watts	Energy per unit time (can take any measure of energy, e.g. KE = ½ mv^2, PE = mgh, Thermal E and divide it by time to get average power); we will focus on electrical power (VoltAmps, Joules/second, or Watts)	W
E	Energy	Watt-second	Energy is power multiplied by time (measured in Joules in SI Units). In this case, time is measured in seconds, but in many real-world cases of electrical energy, it is measured by hour and designated a Watt-hour (Wh)	Ws

*Note: In electrical engineering or other discussions of electricity, the Coulomb is generally used to reflect the charge of **electrons.** Electrical charge was originally defined as a flow of *positive* charges (and that convention remains to this day). From a technical standpoint and in some physics applications, 6.24×10^{18} electrons = *negative* 1 C.

Important Formulas				
Formula			**Description**	**Output Units**
P	=	IV	Power is equal to the product of the current flowing through a circuit multiplied by the circuit's voltage *while that current is flowing.*	W
E	=	Pt	Energy is equal to a constant (or average) power over a given length of time	Ws, Wh
Irradiance = P/Area			Irradiance, or the flux density (of light) equals a given total rate of power over a given area	W/m^2
e	=	E_{out}/E_{in}	Efficiency is a measure of the percentage output from a given input. For this unit, the inputs/outputs can be Energy or Power (P_{out}/P_{in})	[none; a %]