# Weights, distance, and work

<table>
<thead>
<tr>
<th>Unit</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>kilogram</strong></td>
<td>Now the base unit of mass in the <strong>International System of Units</strong>. The mass is equal to a artifact prototype made of a platinum-iridium alloy, stored in a vault preserved by the <strong>International Bureau of Weights and Measures</strong> in Sevres, France.</td>
</tr>
</tbody>
</table>
| **grams/pounds**   | 1 kilogram = 2.20462262 pounds  
1 pound = 0.45359237 kilograms  
1 gram = 0.0352739619 ounces  
1 ounce = 28.3495231 grams                                                                                                                                           |
| **meters/miles**   | 1 meter = 3.2808399 feet  
1 foot = 0.3048 meters  
1 mile = 1.609344 kilometers  
1 kilometer = 0.621371192 miles                                                                                                                                      |
| **liters/gallons** | 1 gallon = 3.78541178 liters  
1 liter = 0.264172052 gallons                                                                                                                                         |
| **Newton**         | The force required to accelerate a mass of one kilogram at the rate of one meter per second per second                                                                                                           
\[
N = \frac{kg \times m}{s^2}
\]
| **Joule (physical)** | The amount of energy or work done when applying one Newton of force through one meter.                                                                                                           
\[
J = N \times m = \frac{kg \times m^2}{s^2}
\]
| **Watt**           | A rate of energy conversion equal to one Joule per second.                                                                                                           
\[
W = \frac{J}{s} = V \times A = A^2 \Omega
\]
| **Joule (electricity)** | The force of an electric current of one ampere through a resistance of one ohm for one second, or the work required to produce one watt of power per second (a watt second)                                                                                                         
\[
J = W \times s
\]

**m**: mass  
**d**: distance  
**f**: force  
**e**: energy or work  
**et**: energy expended per unit of time
### Weights, distance, and work

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<tr>
<th>Kilowatt Hour (kWh)</th>
<th>The energy used by generating 1,000 watts for one hour, equal to 3,600,000 joules.</th>
<th>( kWh = 3.6 \times 10^5 J )</th>
</tr>
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<tr>
<td>Ampere (A)</td>
<td>Also a base unit, the amount of electric current that passes any point, theoretically equal to approximately 6.24151 ( \times 10^{18} ) electrons per second. The International System of Units now defines the ampere to be &quot;that constant current which if maintained in two straight parallel conductors of infinite length, of negligible circular cross-section, and placed 1 meter apart in vacuum, would produce between these conductors a force equal to ( 2 \times 10^{-7} ) newton per meter of length.&quot; [NIST Special Publication (SP330)].</td>
<td></td>
</tr>
<tr>
<td>Coulomb (C)</td>
<td>The amount of electrical charge generated in one second by a constant current of one ampere.</td>
<td>( C = A \times s )</td>
</tr>
<tr>
<td>Volt (V)</td>
<td>A measure of electromotive force equal to watts divided by amps, also Joules divided by coulombs, also the square root of watts times ohms (resistance). Also referred to as electric potential difference in applications like batteries.</td>
<td>( V = \frac{W}{A} = \frac{J}{A \times s} = \frac{J}{C} = \sqrt{W \times \Omega} )</td>
</tr>
<tr>
<td>Ohm (Ω)</td>
<td>A measure of resistance, equal to the resistance implied between two points of a conductor when a potential difference of one volt produces a current of one amp.</td>
<td>( \Omega = \frac{V}{A} )</td>
</tr>
<tr>
<td>Heat (H)</td>
<td>From Joule's Law: Heat is equal to current squared times resistance times seconds</td>
<td>( H = A^2 \times \Omega \times s )</td>
</tr>
<tr>
<td>British Thermal Unit (BTU and mmBTU)</td>
<td>A British Thermal Unit is the amount of energy required to increase the temperature of 1 pound of water by 1 degree Fahrenheit. 3,412 BTUs equals 1 kWh. Natural gas is measured by mmBTU (1 million) or cubic feet. A cubic foot of natural gas has 1,027 BTUs.</td>
<td>( mmBTU = 293.0832 \ kWh )</td>
</tr>
</tbody>
</table>

m: mass  d: distance  f: force  e: energy or work  et: energy expended per unit of time