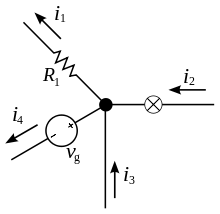
**Kirchhoff's circuit laws** are two approximate [equalities](http://en.wikipedia.org/wiki/Equality_(mathematics)) that deal with the [current](http://en.wikipedia.org/wiki/Electric_current) and potential difference (commonly known as voltage) in [electrical circuits](http://en.wikipedia.org/wiki/Electrical_circuit). They were first described in 1845 by [Gustav Kirchhoff](http://en.wikipedia.org/wiki/Gustav_Kirchhoff).[[1]](http://en.wikipedia.org/wiki/Kirchhoff%27s_circuit_laws#cite_note-1) This generalized the work of [Georg Ohm](http://en.wikipedia.org/wiki/Georg_Ohm) and preceded the work of [Maxwell](http://en.wikipedia.org/wiki/James_Clerk_Maxwell). Widely used in [electrical engineering](http://en.wikipedia.org/wiki/Electrical_engineering), they are also called Kirchhoff's *rules* or simply Kirchhoff's *laws* (see also[Kirchhoff's laws](http://en.wikipedia.org/wiki/Kirchhoff%27s_laws) for other meanings of that term).

Both of Kirchhoff's laws can be understood as corollaries of the [Maxwell equations](http://en.wikipedia.org/wiki/Maxwell_equations) in the low-frequency limit -- conventionally called "DC" circuits. They serve as first [approximations](http://en.wikipedia.org/wiki/Approximation) for AC circuits.[[2]](http://en.wikipedia.org/wiki/Kirchhoff%27s_circuit_laws#cite_note-GSTI-2)

Kirchhoff's current law (KCL)[[edit](http://en.wikipedia.org/w/index.php?title=Kirchhoff%27s_circuit_laws&action=edit&section=1" \o "Edit section: Kirchhoff's current law (KCL))]

[](http://en.wikipedia.org/wiki/File:KCL_-_Kirchhoff%27s_circuit_laws.svg)

[http://bits.wikimedia.org/static-1.22wmf21/skins/common/images/magnify-clip.png](http://en.wikipedia.org/wiki/File:KCL_-_Kirchhoff%27s_circuit_laws.svg)

The current entering any junction is equal to the current leaving that junction. *i*2 +*i*3 = *i*1 + *i*4

This law is also called **Kirchhoff's first law**, **Kirchhoff's point rule**, or **Kirchhoff's junction rule** (or nodal rule).

The principle of conservation of [electric charge](http://en.wikipedia.org/wiki/Electric_charge) implies that:

At any node (junction) in an [electrical circuit](http://en.wikipedia.org/wiki/Electrical_circuit), the sum of [currents](http://en.wikipedia.org/wiki/Current_(electricity)) flowing into that node is equal to the sum of currents flowing out of that node, or:

The algebraic sum of currents in a network of conductors meeting at a point is zero.

Recalling that current is a signed (positive or negative) quantity reflecting direction towards or away from a node, this principle can be stated as:

\sum_{k=1}^n {I}_k = 0

*n* is the total number of branches with currents flowing towards or away from the node.

This formula is valid for [complex](http://en.wikipedia.org/wiki/Complex_number) currents:

\sum_{k=1}^n \tilde{I}_k = 0

The law is based on the conservation of charge whereby the charge (measured in coulombs) is the product of the current (in amperes) and the time (in seconds).