

Circuit Laws

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January 11, 2023

- Voltmeter — Measures voltage without drawing current
- Ammeter — Measures current without dropping voltage
- Resistance is a function of size, shape, and media properties:

$$R = \frac{V}{I} = \frac{l}{\sigma A} = \rho \frac{l}{A}$$

– σ is the conductivity, ρ is the resistivity, l is the length of the wire, and A is the cross-sectional area

- Siemens (S), the unit for conductance, is the inverse of resistance, where: $S = \frac{1}{\Omega}$

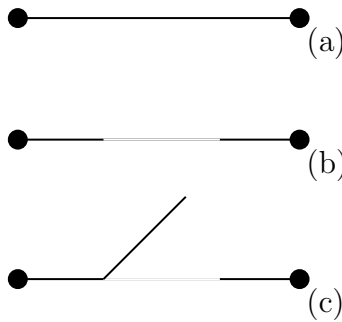


Figure 1: Different Circuit Types

- (a) shows a short circuit
- (b) shows an open circuit
- (c) shows an open switch

- Kirchhoff's Laws

- A circuit is said to be solved when voltage and current across each circuit element has been determined
- Consist of Kirchhoff's current law (KCL) and Kirchhoff's voltage law (KVL)
- Node — A point where two or more circuit elements meet
- Sum of currents entering a node is zero (also holds for closed boundary)

$$\sum_{n=1}^N i_n = 0 \quad (\text{KCL})$$

- For any node, a unique voltage can be assigned