# DC Notes

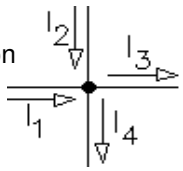
ECE 2210 / 00

A.Stolp
2/8/00, rev 1/28/06

| **Basic electrical quantities** | | **Unit** |
|---|---|---|
| Charge, actually moves | $Q$ | Coulomb (C) |
| Current, like fluid flow | $I = \frac{Q}{s}$ | Amp (A, mA, μA,...) |
| Voltage, like pressure | $V$ | volt (V, mV, kV,...) |
| Resistance | $R = \frac{V}{I}$ | Ohm (Ω, kΩ, MΩ,...) |
| Conductance | $G = \frac{1}{R}$ | Siemens (S, old unit mho) |
| Power energy/time | $P = V \cdot I$ | Watt (W, mW, kW, MW,...) |

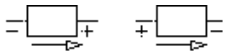
**KCL**, **K**irchhoff's **C**urrent **L**aw

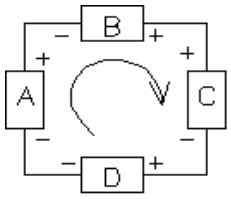
$I_{in} = I_{out}$ of any point, part, or section




**KVL**, **K**irchhoff's **V**oltage **L**aw

$V_{gains} = V_{drops}$ around any loop

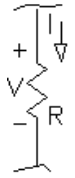





**Node** = all points connected by wire, all at same voltage (potential)

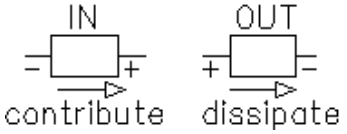
**Ohm's law** (resistors)

$V = I \cdot R$



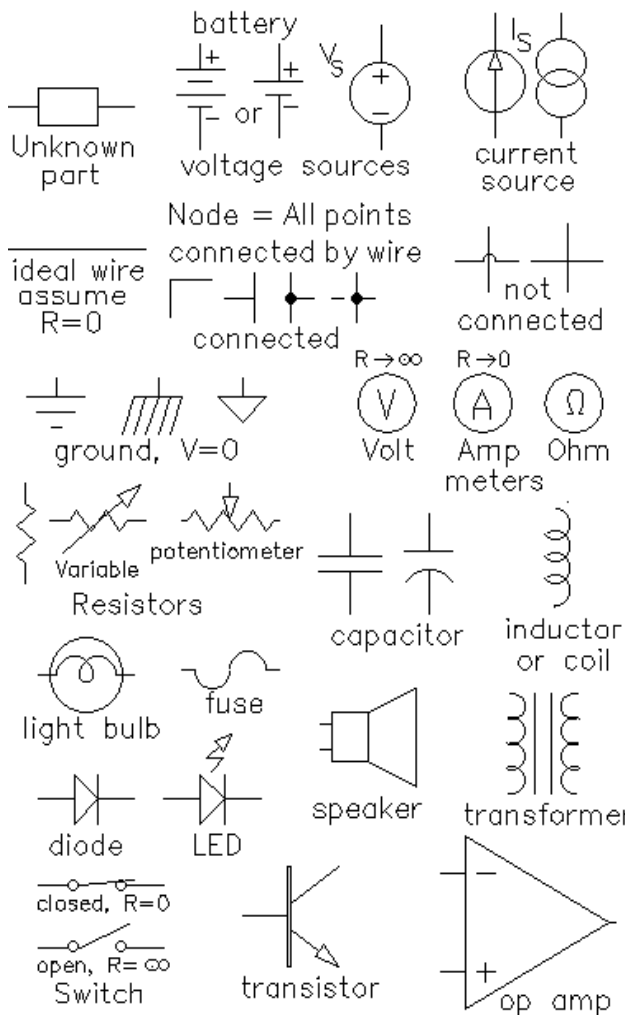

$I = \frac{V}{R}$ $\quad R = \frac{V}{I}$

**Power** $P_{IN} = P_{OUT}$ for resistor circuits




$P = V \cdot I$ for everything

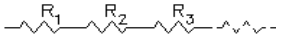
$= I^2 \cdot R = \frac{V^2}{R}$ for resistors




Maximum power transfer: $R_L = R_{Th}$

Load = Thevenin's

**Resistors**



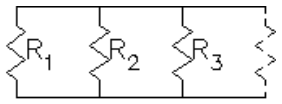

**series:** $R_{eq} = R_1 + R_2 + R_3 + \ldots$

Exactly the **same current** through each resistor

**Voltage divider:**

$$V_{Rn} = V_{total} \cdot \frac{R_n}{R_1 + R_2 + R_3 + \ldots}$$

**parallel:** $R_{eq} = \frac{1}{\frac{1}{R_1} + \frac{1}{R_2} + \frac{1}{R_3} + \ldots}$




Exactly the **same voltage** across each resistor

**current divider:**

$$I_{Rn} = I_{total} \cdot \frac{\frac{1}{R_n}}{\frac{1}{R_1} + \frac{1}{R_2} + \frac{1}{R_3} + \ldots}$$

Multiple unknowns:

1. Combine resistors into equivalents where possible.
2. Use superposition if there are multiple sources and you know all the resistors.
3. Use KCL, KVL, & Ohm's laws to write multiple equations and solve.

**DC Notes** ECE 2210 / 00