

## Electric Circuits

### **Current:**

$$\text{Current: } I = \frac{\Delta q}{\Delta t}$$

⇒ Current flows because a potential difference across a conductor creates an electric field which exerts a force on free electrons in the circuit.

*Conventional current:* the “hypothetical” flow of positive charge (it is really electrons flowing in opposite direction)

*Electromotive force or emf:* the maximum difference in electrical potential between the terminals of a battery

### **Ohm's Law:**

$$\text{Ohm's law: } R = \frac{\Delta V}{I} = \text{constant}$$

Ohm's law is more commonly stated as:  $V = IR$  or  $I = \frac{V}{R}$

### **Resistance and Resistivity:**

Resistance of a wire is given by:  $R = \frac{\rho L}{A}$

Resistivity depends upon temperature:  $\rho = \rho_0[1 + \alpha(T - T_0)]$

### **Power:**

*Power:*  $P = IV$  applies to any circuit element

$$P = I^2 R = \frac{V^2}{R} \quad \text{applies only to resistors}$$

### **Resistors in series:**

Current is the same through each resistor

Voltage is split among individual resistors

$$R_{eq} = R_1 + R_2 + R_3 + \dots$$

### **Resistors in parallel:**

Voltage is the same across each resistor

Current is split among the individual resistors

$$\frac{1}{R_{eq}} = \frac{1}{R_1} + \frac{1}{R_2} + \frac{1}{R_3} + \dots$$