

Simple Circuit Analysis

Ohm's Law

ET 150



Ohm's Law

Learning Objectives

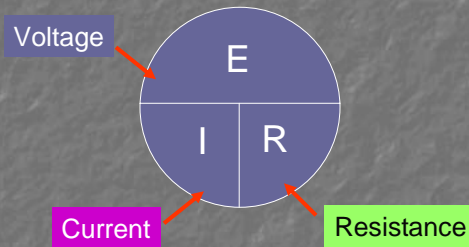
- **In this lesson you will see:**
- the mathematical relationship between voltage, current and resistance call Ohm's Law.
- the Ohm's Law circle and use it to find the three forms of the formula
- examples using Ohm's Law to find voltage, current and resistance
- the linear mathematical relationship between voltage and current
- the relationship between current and resistance is non-linear
- low resistance causes current to increase quickly



Ohm's Law

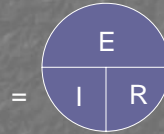
Ohm's Law – a mathematical formula that relates voltage, current and resistance

Three forms of Relationship
Ohm's Law Circle



1.) $E = IR$

2.) $R = \frac{E}{I}$

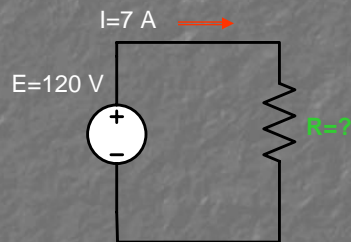


3.) $I = \frac{E}{R}$



Ohm's Law Example Calculations

- An electric heater draws 7 A from a 120 V dc source. What is the resistance of the heater coil?



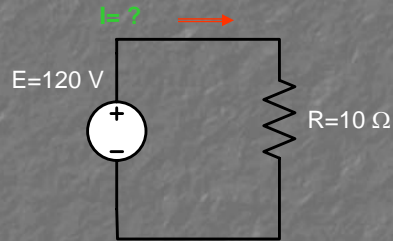
$$R = \frac{E}{I}$$

$$R = \frac{120 \text{ V}}{7 \text{ A}} = 17.14 \Omega \text{ (Ohms)}$$



Ohm's Law Example Calculations

- A water heater has a resistance of $10\ \Omega$. What current will it draw from a $120\ \text{V}$ dc source?

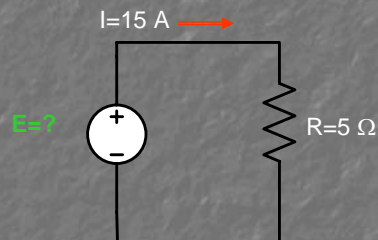


$$I = \frac{E}{R}$$
$$I = \frac{120\ \text{V}}{10\ \Omega} = 12\ \text{A}$$



Ohm's Law Example Calculations

- An iron draws $15\ \text{A}$ and has a $5\ \text{ohm}$ heating element resistance. What is the supply voltage to the iron?

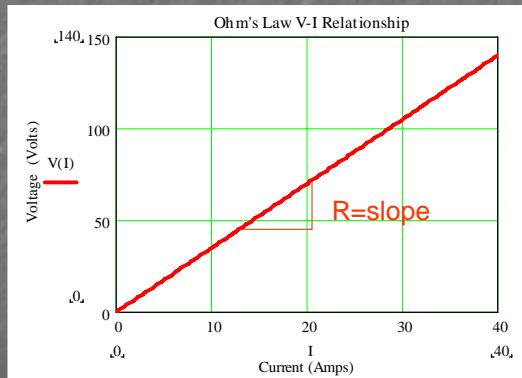


$$E = IR$$
$$E = (15\ \text{A})(5\ \Omega) = 75\ \text{V}$$



Ohm's Law Voltage-Current Relationship

Voltage is proportional to current (Linear relationship)



$$E = RI$$

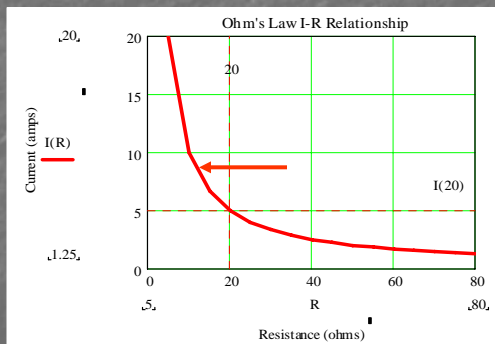
The equation $E = RI$ is shown with an orange arrow pointing from the variable I to the label x and another orange arrow pointing from the variable E to the label y .

As current, I increases, voltage, V increases proportionally.



Ohm's Law Current-Resistance Relationship

Current, I , is inversely proportional to R , Resistance



$$I = V \left(\frac{1}{R} \right)$$

The equation $I = V \left(\frac{1}{R} \right)$ is shown with an orange arrow pointing from the variable R to the label x and another orange arrow pointing from the variable I to the label y .

As resistance decreases current increases quickly

Note: $R=0$ is short circuit



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Coming Next: Basic Electric Circuits- Series
Connections

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