Ohms Law

Technician Exam Preparation Class
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Session 20

Roland K. Smith
Call Sign: K7OJL

rolandksmith@gmail.com
(435) 849-1946

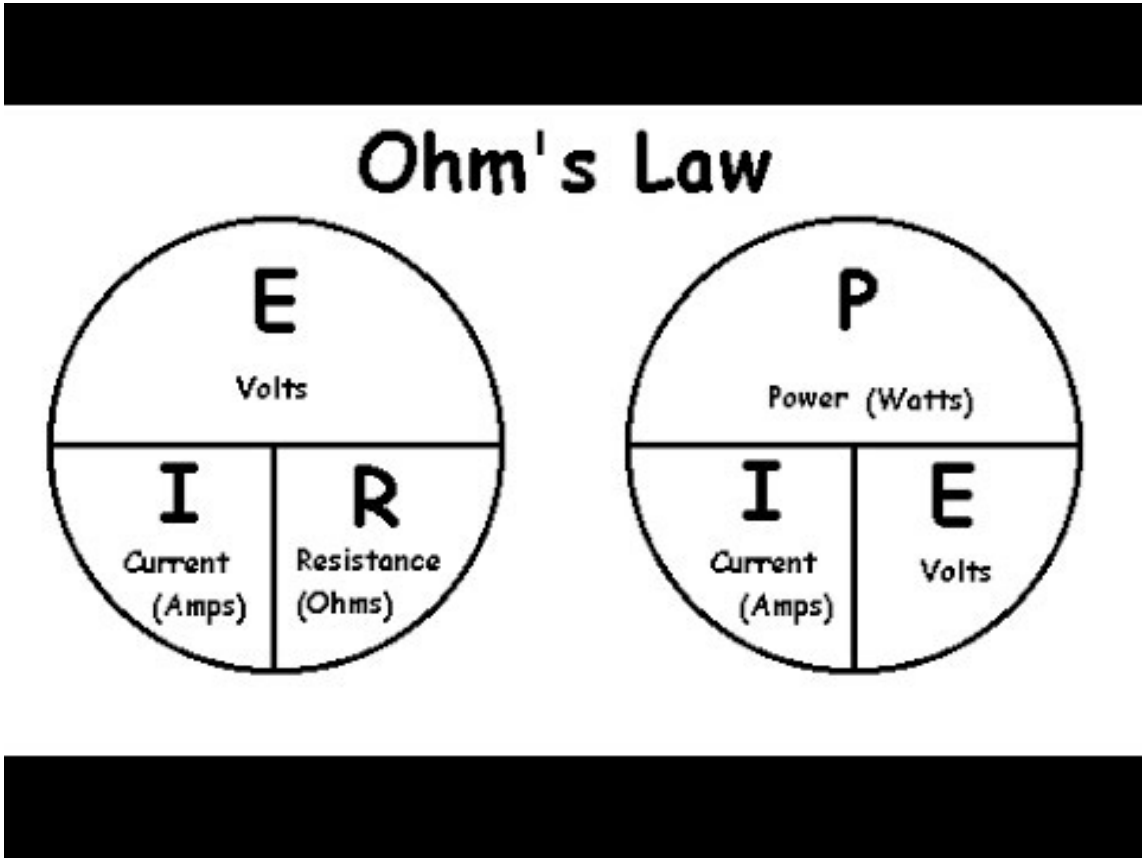
Ohms Law Defined

- Ohms Law defines the relationship among Electromotive Force (measured in Volts and depicted as ‘E’), Resistance (measured in ohms and depicted as ‘R’) and Current (measured in amperes and depicted as ‘I’)
- It further defines the relationship among Power (measured in Watts and depicted as ‘P’), Electromotive force (measured in Volts and depicted as ‘E’) and Current (measured in amperes and depicted as ‘I’)

The Magic Circles

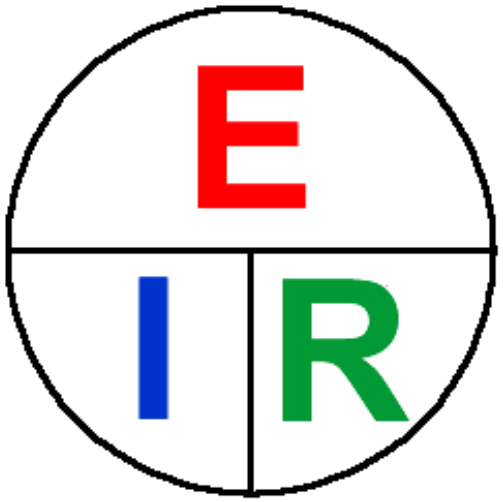
E (volts) = I (amperes) * R (ohms)

P (watts) = I (amperes) * E (volts)

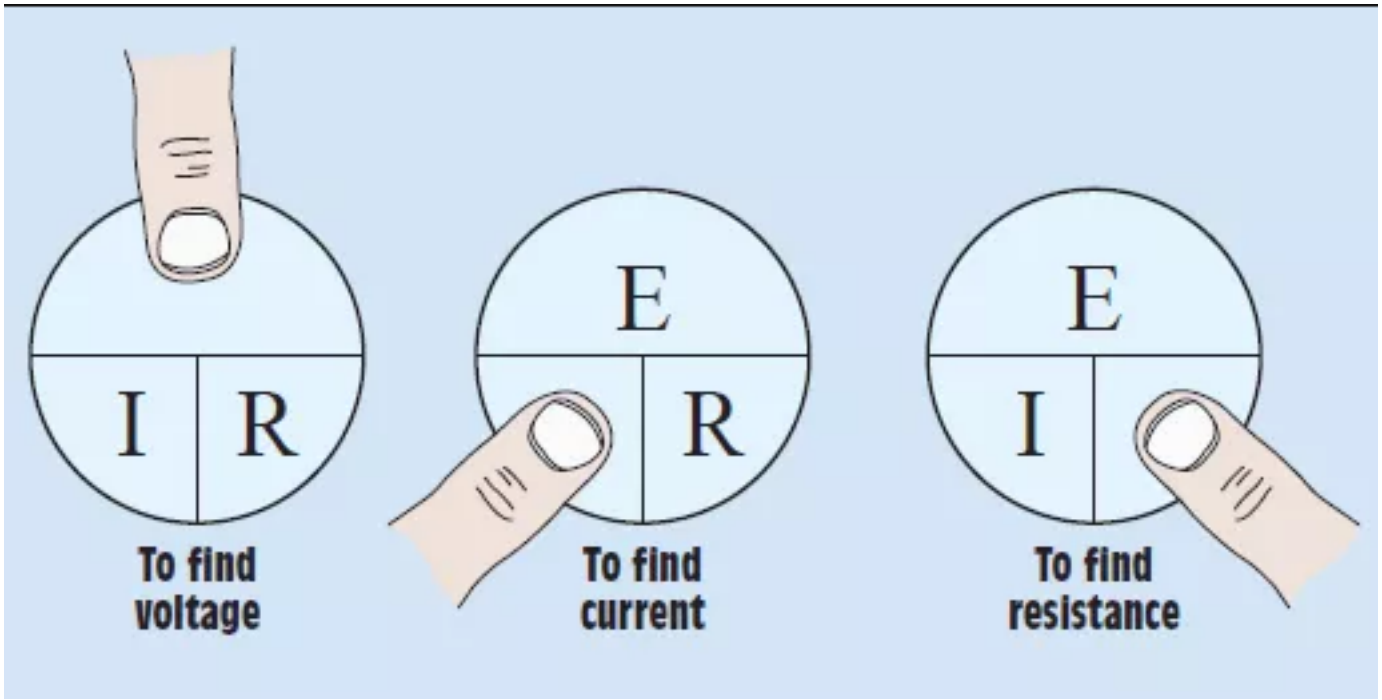


How To Use the Magic Circle for Volts, Ohms, Amperes

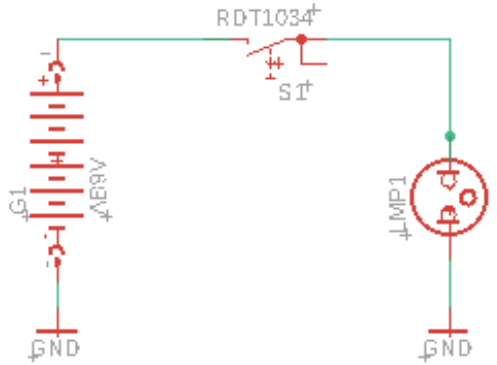
- There are three elements in the equation, volts, amps, ohms
  - Two are known, one is the unknown
- Cover the unknown and then solve the equation



For Example

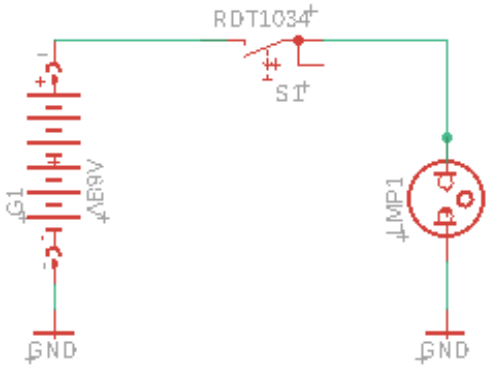


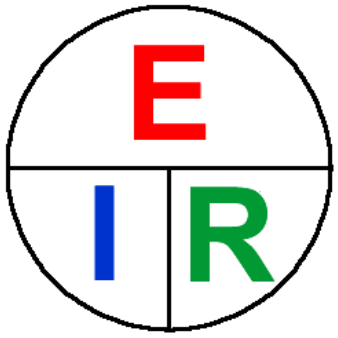
T5D01, T5D02, T5D03, T5D07, T5D08, T5D09



1. What is the voltage in this circuit where the current is 0.5 amperes and the resistance is 2 ohms?

2. What is the resistance in this circuit where the voltage is 2 volts and the current is 4 amperes?





1: 1 Volt
2: 0.5 Ohms

T5D04, T5D05, T5D06, T5D10, T5D11

Your Turn!

- What is the resistance of a circuit in which a current of 3 amperes flows through a resistor connected to 90 volts?
- What is the current through a 100-ohm resistor connected across 200 volts?

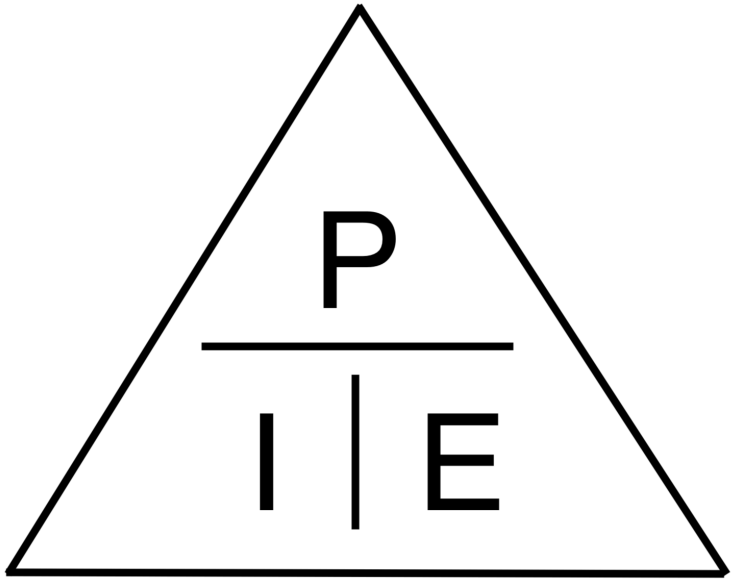
T4A10, T4A11, T4B05, T4B12

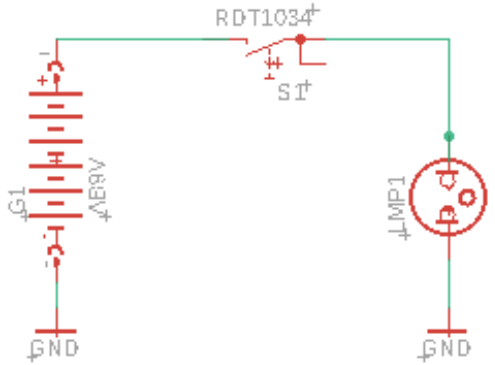
Your Turn!

- What is the resistance of a circuit in which a current of 3 amperes flows through a resistor connected to 90 volts?
  - 30 Ohms
- What is the current through a 100-ohm resistor connected across 200 volts?
  - 2 amps

Calculating Power (Watts)

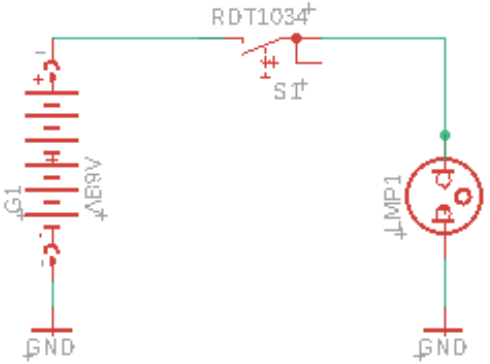
- Power is the rate at which electrical energy is used
- Power is measured in Watts and is often described in watt-hours
- The magic triangle works the same way as the ohms law circle

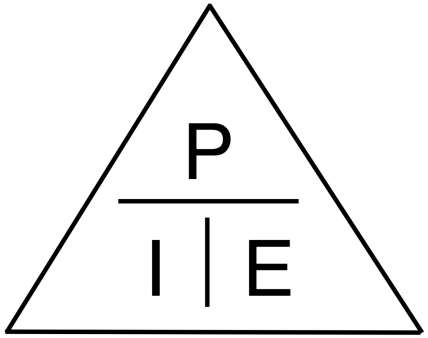




1. If the voltage in this circuit is 13.8 volts DC and the current is 10 amperes, how much power is being consumed?

2. If the voltage in this circuit is 12 volts DC and the load is 120 watts, how many amperes are flowing?





1: 138 Watts
2: 10 Amperes

T5C09, T5C10, T5C11, T5D11, T5D12

Your Turn!

How much power is being used in a circuit when the applied voltage is 12 volts DC and the current is 2.5 amperes?

Your Turn!

Q. How much power is being used in a circuit when the applied voltage is 12 volts DC and the current is 2.5 amperes?

A. 30 watts

Kirchoff's Laws

- **Voltage Law**: the sum of the voltages in a series circuit adds up to zero
  - Sources add voltages, components use (subtract) voltages
  - The voltage across two components in series depends on the value and type of components
- **Current Law**: the sum of currents entering a node must equal the sum of the currents leaving a node
  - In a series circuit the current is the same across all components
  - In a parallel circuit, the current divides proportionately at each junction
  - In all cases, the amount of current injected must equal the amount of current returned to the injection point

T5A13, T5A14, T5D13, T5D14, T5D15, T5D16

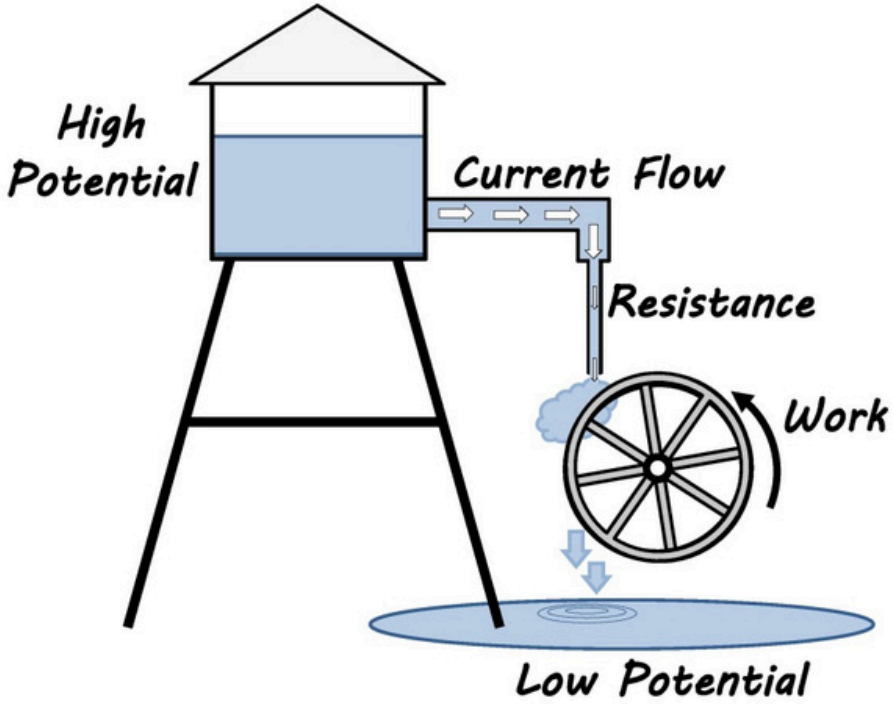
Kirchoff's Current Law

- What happens to current at the junction of two components in series? It is the same in both components (or, in other words, a series loop has only one path, so the same current goes through each component)
- In a parallel circuit, the current will divide at the junction point depending on the value of the components in each leg of the circuit, however voltage will be the same across all components in parallel.

T5A13, T5A14, T5D13, T5D14, T5D15, T5D16

The Water Analogy

- Electromotive Force = water pressure
- Current = the water flow
- Resistance = the constraints in the plumbing



The water pressure by the time all the water exits the tank, turns the wheel, and gets to the collection pond is zero … just as Kirchoff's Voltage Law states

The amount of water, however, in the collection pond will eventually equal the amount of water at the source (nothing is lost) … just as Kirchoff's Current Law states

The Five Equations

Converting between Wavelength in Meters and Frequency in MHz:
Wavelength in meters = 300 / frequency MHz
Frequency MHz = 300 / Wavelength in meters

Calculating the length of a dipole in feet:
Length in Feet = 468 / Frequency in MHz

Ohms Law:

E = I x R (where E=volts, I=amperes, and R=ohms). Draw the circle

Ohms Power Law:

P = I x E (where P=watts, I=amperes, and E=volts). Draw the circle

Jot down any questions you may have to ask during the online meeting