Technician License Course
Chapter 3

Lesson Plan Module 5 –
Ohm’s Law, Power, and the Metric System

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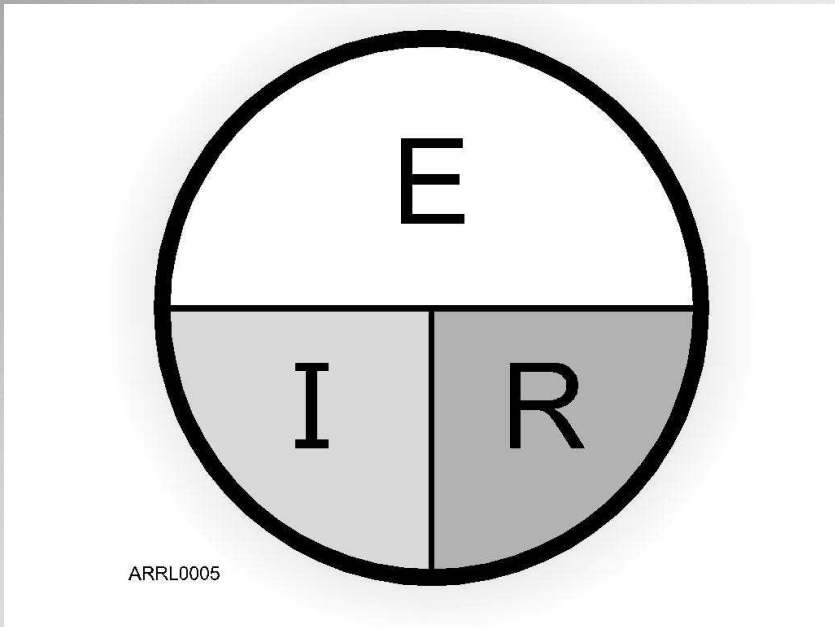
Ohm's Law



- E represents voltage
  - Units – volts (V)
- I represents current
  - Units – amperes (A)
- R represents resistance
  - Units – ohms (Ω)

$$R = E / I$$

$$I = E / R$$

$$E = I \times R$$

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Practice Questions

What formula is used to calculate current in a circuit?

A. Current (I) equals voltage (E) multiplied by resistance (R)

B. Current (I) equals voltage (E) divided by resistance (R)

C. Current (I) equals voltage (E) added to resistance (R)

D. Current (I) equals voltage (E) minus resistance (R)

T5D01 HRLM (3-4)

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What formula is used to calculate current in a circuit?

A. Current (I) equals voltage (E) multiplied by resistance (R)

B. Current (I) equals voltage (E) divided by resistance (R)

C. Current (I) equals voltage (E) added to resistance (R)

D. Current (I) equals voltage (E) minus resistance (R)

T5D01 HRLM (3-4)

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What formula is used to calculate voltage in a circuit?

A. Voltage (E) equals current (I) multiplied by resistance (R)

B. Voltage (E) equals current (I) divided by resistance (R)

C. Voltage (E) equals current (I) added to resistance (R)

D. Voltage (E) equals current (I) minus resistance (R)

T5D02 HRLM (3-4)

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What formula is used to calculate voltage in a circuit?

A. Voltage (E) equals current (I) multiplied by resistance (R)

B. Voltage (E) equals current (I) divided by resistance (R)

C. Voltage (E) equals current (I) added to resistance (R)

D. Voltage (E) equals current (I) minus resistance (R)

T5D02 HRLM (3-4)

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What formula is used to calculate resistance in a circuit?

A. Resistance (R) equals voltage (E) multiplied by current (I)

B. Resistance (R) equals voltage (E) divided by current (I)

C. Resistance (R) equals voltage (E) added to current (I)

D. Resistance (R) equals voltage (E) minus current (I)

T5D03 HRLM (3-4)

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What formula is used to calculate resistance in a circuit?

A. Resistance (R) equals voltage (E) multiplied by current (I)

B. Resistance (R) equals voltage (E) divided by current (I)

C. Resistance (R) equals voltage (E) added to current (I)

D. Resistance (R) equals voltage (E) minus current (I)

T5D03 HRLM (3-4)

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

A. 3 ohms

B. 30 ohms

C. 93 ohms

D. 270 ohms

T5D04 HRLM (3-5)

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

A. 3 ohms

B. 30 ohms

C. 93 ohms

D. 270 ohms

T5D04 HRLM (3-5)

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What is the resistance in a circuit for which the applied voltage is 12 volts and the current flow is 1.5 amperes?

A. 18 ohms

B. 0.125 ohms

C. 8 ohms

D. 13.5 ohms

T5D05 HRLM (3-5)

What is the resistance in a circuit for which the applied voltage is 12 volts and the current flow is 1.5 amperes?

A. 18 ohms

B. 0.125 ohms

C. 8 ohms

D. 13.5 ohms

T5D05 HRLM (3-5)

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What is the resistance of a circuit that draws 4 amperes from a 12-volt source?

A. 3 ohms

B. 16 ohms

C. 48 ohms

D. 8 ohms

T5D06 HRLM (3-5)

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What is the resistance of a circuit that draws 4 amperes from a 12-volt source?

A. 3 ohms

B. 16 ohms

C. 48 ohms

D. 8 ohms

T5D06 HRLM (3-5)

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What is the current flow in a circuit with an applied voltage of 120 volts and a resistance of 80 ohms?

A. 9600 amperes

B. 200 amperes

C. 0.667 amperes

D. 1.5 amperes

T5D07 HRLM (3-5)

What is the current flow in a circuit with an applied voltage of 120 volts and a resistance of 80 ohms?

A. 9600 amperes

B. 200 amperes

C. 0.667 amperes

D. 1.5 amperes

T5D07 HRLM (3-5)

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What is the current flowing through a 100-ohm resistor connected across 200 volts?

A. 20,000 amperes

B. 0.5 amperes

C. 2 amperes

D. 100 amperes

T5D08 HRLM (3-5)

What is the current flowing through a 100-ohm resistor connected across 200 volts?

A. 20,000 amperes

B. 0.5 amperes

C. 2 amperes

D. 100 amperes

T5D08 HRLM (3-5)

What is the current flowing through a 24-ohm resistor connected across 240 volts?

A. 24,000 amperes

B. 0.1 amperes

C. 10 amperes

D. 216 amperes

T5D09 HRLM (3-5)

What is the current flowing through a 24-ohm resistor connected across 240 volts?

A. 24,000 amperes

B. 0.1 amperes

C. 10 amperes

D. 216 amperes

T5D09 HRLM (3-5)

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What is the voltage across a 2-ohm resistor if a current of 0.5 amperes flows through it?

A. 1 volt

B. 0.25 volts

C. 2.5 volts

D. 1.5 volts

T5D10 HRLM (3-5)

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What is the voltage across a 2-ohm resistor if a current of 0.5 amperes flows through it?

A. 1 volt

B. 0.25 volts

C. 2.5 volts

D. 1.5 volts

T5D10 HRLM (3-5)

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What is the voltage across a 10-ohm resistor if a current of 1 ampere flows through it?

A. 1 volt

B. 10 volts

C. 11 volts

D. 9 volts

T5D11 HRLM (3-5)

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What is the voltage across a 10-ohm resistor if a current of 1 ampere flows through it?

A. 1 volt

B. 10 volts

C. 11 volts

D. 9 volts

T5D11 HRLM (3-5)

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What is the voltage across a 10-ohm resistor if a current of 2 amperes flows through it?

A. 8 volts

B. 0.2 volts

C. 12 volts

D. 20 volts

T5D12 HRLM (3-5)

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What is the voltage across a 10-ohm resistor if a current of 2 amperes flows through it?

A. 8 volts

B. 0.2 volts

C. 12 volts

D. 20 volts

T5D12 HRLM (3-5)

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Power - Electrons Doing Work and Expending Energy

- Any time energy is expended, power is consumed.
- Electrons moving through resistance expend electrical energy and consume power.
- Power is the rate at which energy is consumed.
- Power is measured in units of watts (W).

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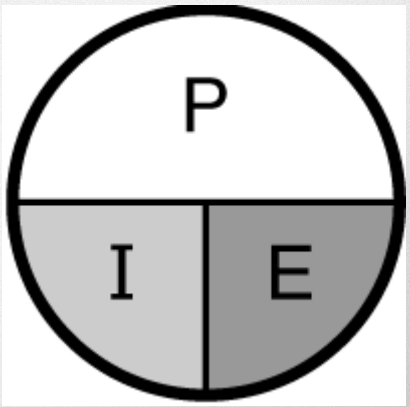
Power Equation

- Power is calculated as the product of voltage and current

  P = E x I

  E = P / I

  I = P / E



- Like Ohm's Law, if you know two of the values, you can calculate the third.

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Practice Questions

Electrical power is measured in which of the following units?

A. Volts

B. Watts

C. Ohms

D. Amperes

T5A02 HRLM (3-5)

Electrical power is measured in which of the following units?

A. Volts

B. Watts

C. Ohms

D. Amperes

T5A02 HRLM (3-5)

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Which term describes the rate at which electrical energy is used?

A. Resistance

B. Current

C. Power

D. Voltage

T5A10 HRLM (3-5)

Which term describes the rate at which electrical energy is used?

A. Resistance

B. Current

C. Power

D. Voltage

T5A10 HRLM (3-5)

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What is the formula used to calculate electrical power in a DC circuit?

A. Power (P) equals voltage (E) multiplied by current (I)

B. Power (P) equals voltage (E) divided by current (I)

C. Power (P) equals voltage (E) minus current (I)

D. Power (P) equals voltage (E) plus current (I)

T5C08 HRLM (3-5)

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What is the formula used to calculate electrical power in a DC circuit?

A. Power (P) equals voltage (E) multiplied by current (I)

B. Power (P) equals voltage (E) divided by current (I)

C. Power (P) equals voltage (E) minus current (I)

D. Power (P) equals voltage (E) plus current (I)

T5C08 HRLM (3-5)

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How much power is being used in a circuit when the applied voltage is 13.8 volts DC and the current is 10 amperes?

A. 138 watts

B. 0.7 watts

C. 23.8 watts

D. 3.8 watts

T5C09 HRLM (3-5)

How much power is being used in a circuit when the applied voltage is 13.8 volts DC and the current is 10 amperes?

A. 138 watts

B. 0.7 watts

C. 23.8 watts

D. 3.8 watts

T5C09 HRLM (3-5)

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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. 4.8 watts

B. 30 watts

C. 14.5 watts

D. 0.208 watts

T5C10 HRLM (3-5)

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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. 4.8 watts

B. 30 watts

C. 14.5 watts

D. 0.208 watts

T5C10 HRLM (3-5)

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How many amperes are flowing in a circuit when the applied voltage is 12 volts DC and the load is 120 watts?

A. 0.1 amperes

B. 10 amperes

C. 12 amperes

D. 132 amperes

T5C11 HRLM (3-5)

How many amperes are flowing in a circuit when the applied voltage is 12 volts DC and the load is 120 watts?

A. 0.1 amperes

B. 10 amperes

C. 12 amperes

D. 132 amperes

T5C11 HRLM (3-5)

Metric Prefixes

Table 2-1

International System of Units (SI)—Metric Units

Prefix	*Symbol*	*Multiplication Factor*
Tera	T	10^{12} = 1,000,000,000,000
Giga	G	10^{9} = 1,000,000,000
Mega	M	10^{6} = 1,000,000
Kilo	k	10^{3} = 1000
Hecto	h	10^{2} = 100
Deca	da	10^{1} = 10
Deci	d	10^{-1} = 0.1
Centi	c	10^{-2} = 0.01
Milli	m	10^{-3} = 0.001
Micro	μ	10^{-6} = 0.000001
Nano	n	10^{-9} = 0.000000001
Pico	p	10^{-12} = 0.000000000001

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Electrical Units

Electrical Units and Their Namesakes

Unit	*Measures*	*Named for*
Ampere	Current	Andree Marie Ampere (1775 – 1836)
Coulomb	Charge	Charles Augustin Coulomb (1736 – 1806)
Farad	Capacitance	Michael Faraday (1791 – 1867)
Henry	Inductance	Joseph Henry (1797 – 1878)
Hertz	Frequency	Heinrich Hertz (1857 – 1894)
Ohm	Resistance	George Simon Ohm (1787 – 1854)
Watt	Power	James Watt (1736 – 1819)
Volt	Voltage	Alessandro Giuseppe Antonio Anastasio Volta (1745 – 1827)

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How many milliamperes is 1.5 amperes?

A. 15 milliamperes

B. 150 milliamperes

C. 1,500 milliamperes

D. 15,000 milliamperes

T5B01 HRLM (2-2)

How many milliamperes is 1.5 amperes?

A. 15 milliamperes

B. 150 milliamperes

C. 1,500 milliamperes

D. 15,000 milliamperes

T5B01 HRLM (2-2)

What is another way to specify a radio signal frequency of 1,500,000 hertz?

A. 1500 kHz

B. 1500 MHz

C. 15 GHz

D. 150 kHz

T5B02 HRLM (2-2)

ARRL The national association for AMATEUR RADIO

What is another way to specify a radio signal frequency of 1,500,000 hertz?

A. 1500 kHz

B. 1500 MHz

C. 15 GHz

D. 150 kHz

T5B02 HRLM (2-2)

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How many volts are equal to one kilovolt?

A. One one-thousandth of a volt

B. One hundred volts

C. One thousand volts

D. One million volts

T5B03 HRLM (2-2)

How many volts are equal to one kilovolt?

A. One one-thousandth of a volt

B. One hundred volts

C. One thousand volts

D. One million volts

T5B03 HRLM (2-2)

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How many volts are equal to one microvolt?

A. One one-millionth of a volt

B. One million volts

C. One thousand kilovolts

D. One one-thousandth of a volt

T5B04 HRLM (2-2)

How many volts are equal to one microvolt?

A. One one-millionth of a volt

B. One million volts

C. One thousand kilovolts

D. One one-thousandth of a volt

T5B04 HRLM (2-2)

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Which of the following is equivalent to 500 milliwatts?

A. 0.02 watts

B. 0.5 watts

C. 5 watts

D. 50 watts

T5B05 HRLM (2-2)

Which of the following is equivalent to 500 milliwatts?

A. 0.02 watts

B. 0.5 watts

C. 5 watts

D. 50 watts

T5B05 HRLM (2-2)

If an ammeter calibrated in amperes is used to measure a 3000-milliampere current, what reading would it show?

A. 0.003 amperes

B. 0.3 amperes

C. 3 amperes

D. 3,000,000 amperes

T5B06 HRLM (2-2)

If an ammeter calibrated in amperes is used to measure a 3000-milliampere current, what reading would it show?

A. 0.003 amperes

B. 0.3 amperes

C. 3 amperes

D. 3,000,000 amperes

T5B06 HRLM (2-2)

If a frequency readout calibrated in megahertz shows a reading of 3.525 MHz, what would it show if it were calibrated in kilohertz?

A. 0.003525 kHz

B. 35.25 kHz

C. 3525 kHz

D. 3,525,000 kHz

T5B07 HRLM (2-2)

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If a frequency readout calibrated in megahertz shows a reading of 3.525 MHz, what would it show if it were calibrated in kilohertz?

A. 0.003525 kHz

B. 35.25 kHz

C. 3525 kHz

D. 3,525,000 kHz

T5B07 HRLM (2-2)

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How many microfarads are 1,000,000 picofarads?

A. 0.001 microfarads

B. 1 microfarad

C. 1000 microfarads

D. 1,000,000,000 microfarads

T5B08 HRLM (2-2)

How many microfarads are 1,000,000 picofarads?

A. 0.001 microfarads

B. 1 microfarad

C. 1000 microfarads

D. 1,000,000,000 microfarads

T5B08 HRLM (2-2)

Which of the following frequencies is equal to 28,400 kHz?

A. 28.400 MHz

B. 2.800 MHz

C. 284.00 MHz

D. 28.400 kHz

T5B12 HRLM (2-2)

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Which of the following frequencies is equal to 28,400 kHz?

A. 28.400 MHz

B. 2.800 MHz

C. 284.00 MHz

D. 28.400 kHz

T5B12 HRLM (2-2)

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If a frequency readout shows a reading of 2425 MHz, what frequency is that in GHz?

A. 0.002425 GHz

B. 24.25 GHz

C. 2.425 GHz

D. 2425 GHz

T5B13 HRLM (2-2)

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If a frequency readout shows a reading of 2425 MHz, what frequency is that in GHz?

A. 0.002425 GHz

B. 24.25 GHz

C. 2.425 GHz

D. 2425 GHz

T5B13 HRLM (2-2)

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