

ELECTRONICS

TRIMMING OF ELECTRICAL WIRES  
FOR RESIDENTIAL WIRING

**Subject Area:** ELECTRONICS      **Grade Levels:** SOPHOMORE      **Date:** TBA

Lesson Overview

Introduce Electrical wiring system in residential housing: Display Proper gauge determination of wires for its specific use, identify variations in color terminations, and using the Title 24 color coding for wires to learn how to assemble electrical 115 VAC wall sockets. Learn how to Calculate Voltage, Resistance, Current and Power using Ohms/Watts law and measure the electrical parameters using Digital Multi meter.

Materials Included in this Lesson

- 14/2 wire gauge solid wire
- 14/3 wire gauge solid wire
- Wire cutters
- Digital Multi Meter
- Duplex Receptacles

Other Materials for this Lesson

- Calculator
- Paper and Pencil
- Enthusiasm to learn
- Solder
- Soldering iron
- Rosin Flux

Skills the Student will Learn

1. Learn about electricity in terms of Voltage, Current, Resistance and Power.
2. Importance of Safety around Electricity
3. Learn about high voltages in residential homes
4. Learn Schematic symbols of 120 VAC and 240 VAC Voltage sockets
5. Trimming wires and assembling receptacles and switches
6. Color Coding of Residential wiring
7. Build their Digital meters using their soldering skills.
8. Use of Digital Multi Meter.

Student Deliverables

Assemble a 120Vac receptacle after trimming the wires  
Apply power to the receptacle using a power supply and check to see if the bulb lights up when the switch turns on or off.  
Demonstrate the effectiveness of their DMM by measuring the 120Vac sockets on the wall in the classroom.

## Length of Lesson: 3 Days

### Activity Day One

General Safety lesson, Introduction to different terminology in the Soldering Process, Demonstration on Soldering, Identification of electronic parts, Lecture on Electrical terms and its units, Ohms and Watts Law.

Hands On Project: Building the DMM using soldering skills and Project on House wiring

Take pictures of students working on projects

### Activity Day Two

Learn about high voltages in relation to use of different wire gauges, color coding for wires and screws with respect to receptacles in residential homes

Learn Schematic symbols of 120 VAC and 240 VAC Voltage sockets

Learn the color codes for wiring and also learn how to Trim wires to its proper specification.

Continue to work On Building DMM.

Take pictures of students working on projects.

### Activity Day Three

Lecture and Demonstration of how to use the DMM by measuring the 120Vac sockets on the wall in the classroom.

**Work on the House wiring project:** Assemble a Unit using the 9 volt battery instead of the AC voltage (safety issue) receptacle, wires and other parts mentioned in the project to build a circuit. Apply power to the receptacle using a 9 volt battery and check to see if the bulb lights up when the male plug is inserted in the receptacle (on or off).

Using the DMM measure the Applied voltage from the battery, voltage drop across the resistor and the LED.

IF All works well and the Led is “ON” it shows that students have understood the Color coding of wires and screws and series circuit concepts

**Students have to present what they learned through a power point presentation on “House Wiring”**

## Enrichment Suggestions

PowerPoint Presentation to explain the usages of different gauge wires used in residential wiring and a brief explanation of what they learned in the lesson.

Students will have a field trip or a Volunteer from the externship site give a presentation to the students.

Students will present a power point presentation at the Dec 4<sup>th</sup>, 2009 Externship dinner at Sacramento City College and show case the Project they built.

### Student Resources

( [www.contructionjob4u.org](http://www.contructionjob4u.org), [www.biaworkforce.com](http://www.biaworkforce.com), [www.carocp.org](http://www.carocp.org))

### State Standards Met

#### Physics Standards for Electricity:

- 5.A. Students know how to predict the voltage or current in simple direct current (DC) electric circuits constructed from batteries, wires, resistors, and capacitors.
- 5. B. Students know how to solve problems involving Ohm's law.
- 5. C. Students knows any resistive element in a DC circuit dissipates energy, which heats the resistor. Students can calculate the power (rate of energy dissipation) in any resistive circuit element by using the formula  $\text{Power} = IR$  (potential difference)  $\times I$  (current)  $= I^2 R$ .

#### **Investigation And Experimentation:**

1. Scientific progress is made by asking meaningful questions and conducting careful investigations. As a basis for understanding this concept and addressing the content in the other four strands, students should develop their own questions and perform investigations. Students will:
  - a. Select and use appropriate tools and technology (such as computer-linked probes, spreadsheets, and graphing calculators) to perform tests, collect data, analyze relationships, and display data.
  - b. Identify and communicate sources of unavoidable experimental error.
  - c. Identify possible reasons for inconsistent results, such as sources of error or uncontrolled conditions.
  - d. Formulate explanations by using logic and evidence.
  - f. Distinguish between hypothesis and theory as scientific terms.
1. Analyze situations and solve problems that require combining and applying concepts from more than one area of science.

### Lesson Plan Relevance To Externship

Students will be aware of the importance of the Title 24 color coding rules in relation to house wiring. Safety precautions on using electricity. The students will learn how to wire a 120VAC receptacle, Have knowledge of what it takes to be an electrician and what the employers expect of entry level employees or interns.

## Rubric for the Electronics Project

Student Deliverables	4 Exceeds Expectations	3 Meets Expectations	2 Approaches Expectations	1 Fails to meet Expectations
Building of DMM and Project On house Wiring	Students will successfully follow soldering techniques, not be distracted, well focused, and have the ability to follow directions and complete a successful DMM and House wiring project on time.	Students will follow soldering techniques, minimally distracted, focused, and have the ability to follow directions and complete a successful DMM and House wiring project on time but needs some help troubleshooting project.	Students will follow soldering techniques, are distracted, not focused, and have minimum ability to follow directions and complete a successful DMM project and House wiring project on time but needs extra help troubleshooting.	Students did not follow soldering techniques, are distracted, not focused, and have no ability to follow directions and incomplete DMM and House wiring project.
Power Point presentation	Well spoken, uses appropriate maximum vocabulary that demonstrates comprehension of Electrical terms and usage. Includes all parts of Color coding according to Title 24 codes for Electrical wiring and Gauges. Includes schematic	Adequately spoken, uses appropriate vocabulary that demonstrates comprehension of Electrical terms and usage. Includes some parts of Color coding according to Title 24 codes for Electrical wiring and Gauges. Includes some schematic	Limited speaking skills, uses some appropriate vocabulary that demonstrates comprehension of Electrical terms and usage. Incorrect or insufficient information of some parts of Color coding according to Title 24 codes for Electrical wiring and	Poor speaking skills, uses inappropriate or no vocabulary that demonstrates comprehension of Electrical terms and usage. Incorrect or insufficient information of some parts of Color coding according to Title 24 codes for Electrical

	representation of electrical parts used with an excellent explanation.	representation of electrical parts used with a good explanation.	Gauges. Includes few schematic representation of electrical parts used with a minimal explanation.	wiring and Gauges. Includes no schematic representation of electrical parts used with a minimal explanation.
Trimming/continuity wiring to light bulb through a receptacle.	Excellent demonstration of trimming and demonstrates critical thinking skills in wiring the receptacle project, and uses problem solving skills to make the light bulb turn on the first time with no help from the teacher.	Good demonstration of trimming and demonstrates adequate critical thinking skills in wiring the receptacle project, and uses some problem solving skills to make the light bulb turn on with some help from the teacher.	Adequate demonstration of trimming and demonstrates some critical thinking skills in wiring the receptacle project, and uses few problem solving skills to make the light bulb turn on with a lot of help from the teacher.	Poor demonstration of trimming and demonstrates few critical thinking skills in wiring the receptacle project, and uses no problem solving skills to make the light bulb turn on and is completely dependent on the teacher.