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| **TEXAS CTE LESSON PLAN**[www.txcte.org](http://www.txcte.org) |
| **Lesson Identification and TEKS Addressed** |
| **Career Cluster** | Science, Technology, Engineering & Mathematics |
| **Course Name** | AC/DC Electronics |
| **Lesson/Unit Title** | Electrical Power |
| **TEKS Student Expectations** | **130.405. (c) Knowledge and skills**(8) The student implements the concepts and skills that form the technical knowledge of electronics using project-based assessments. The student is expected to:(A) Apply Ohm's law, Kirchhoff's laws, and power laws to actual or simulated circuits(9) The student applies the concepts and skills to simulated and actual work situations. The student is expected to:(A) Measure and calculate resistance, current, voltage, and power in series, parallel, and complex circuits(10) The student learns the function and application of the tools, equipment, and materials used in electronics through project-based assignments. The student is expected to:(A) Use tools and laboratory equipment in a safe manner to construct and repair circuits(B) Use precision measuring instruments to analyze circuits and prototypes |
| **Basic Direct Teach Lesson**(Includes Special Education Modifications/Accommodations and one English Language Proficiency Standards (ELPS) Strategy) |
| **Instructional Objectives** | The student will be able to:* Match terms associated with power and measurement to their definitions.
* Match power abbreviations with their terms.
* State three versions of the formula used to compute electrical power.
* Arrange in proper sequence the procedures for power measurement using a DC wattmeter
* Select true statements concerning resistor wattage rating.
* List electrical power safety precautions
* Distinguish between direct and inverse proportions involved in power formulas
* Demonstrate the ability to compute current using the power formula
* Determine the power used in a resistive circuit
* Determine the function of fuses and resistor power ratings
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| **Rationale** | Students need to understand Ohm’s Law, Kirchoff’s Law, power laws to determine electrical consumption, sizing of circuit components, and size of overcurrent devices. This lesson is the first step in gaining that understanding. |
| **Duration of Lesson** | This lesson should take 90 minutes. Allow a 45-minute class for the lab. Allow a 45-minute class for student to work problems and take the quiz. |
| **Word Wall/Key Vocabulary***(ELPS c1a,c,f; c2b; c3a,b,d; c4c; c5b) PDAS II(5)* | * **Mechanical power** - the rate at which work is being done.
* **Electrical power** - the rate of electrical energy used by an electrical circuit.
* **Watt** - the unit of measurement for power; one-volt*times*one amp.
* **Kilowatt** - 1,000 watts.
* **Kilowatt hours** - a unit of electrical energy.
* **Fuse** - a non-resettable electrical device which protects a circuit from excessive power or current; ablown fuse must be replaced.
* **Circuit breaker** - a resettable electrical switch which protects a circuit from excessive power or current.
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| **Materials/Specialized Equipment Needed** | * Lab #1 – Compute Current Using the Power Formula worksheet
* Lab #2 – Determine Power Used in a Resistive Circuit worksheet
* Lab #3 – Determine the Function of Fuses and Resistor Power Rating worksheet
* Answer key for Lab #1 – Compute Current Using the Power Formula worksheet
* Answer key for Lab #2 – Determine Power Used in a Resistive Circuit worksheet
* Answer key for Lab #3 – Determine the Function of Fuses and Resistor Power Rating worksheet
* Student Activity – Compute Power from the Power Formula worksheet
* Answer key for Student Activity – Compute Power from the Power Formula worksheet
* Power Exam #1
* Answer key for Power Exam #1
* Power Exam #2
* Answer key for Power Exam #2
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| **Anticipatory Set**(May include pre-assessment for prior knowledge) | * **Show**: A light bulb.
* **Say**: Most of you have heard something like, “This is a 60-watt bulb.”
* **Ask**: Do any of you know what that means?
* **Say**: Yes, it does have something to do with the amount of light the bulb will produce, but “60 watts” is actually the power rating of the bulb, representing how much electrical power the light bulb will consume.
* **Ask**: Does anyone know what happens when you leave a light on all day when you are not in the room?
* **Say**: Correct! Your electric bill will increase because you have used electrical power over a long period of time. To understand how that works, we need to understand electrical power. Let’s get started.
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| **Direct Instruction \*** | Outline | Instructor Notes |
| I. Electrical Power A. Rate descriptionB. Energy consumptionC. Energy conversionD. Electron movementE. Voltage explanationII. Power and Energy A. Comparing units of energy and powerB. Converting electricity into useful energyC. Identifying useful energy around housesD. Associating power formulas with Ohm’s LawIII. Wattmeter and Wattage RatingA. Using a wattmeterB. Measuring wattsC. Wattage rating of resistorsIV. Practice Problem 1 – Power in a Series Circuit A. Use a problem-solving sequenceB. Study the problem firstC. Identify the missing informationD. Solve the problemV. Practice Problem 2 – Power in a Parallel Circuit A. Calculate powerB. Determine which formulaC. Solve the problemVI. Review Power, Terms, and SafetyA. Practice Watt’s LawB. Terms and definitionsC. Safety PrecautionsVII. Power LabsA. Lab #1 – Compute Current Using the Power Formula worksheetB. Lab #2 – Determine Power Used in a Resistive Circuit worksheetC. Lab #3 – Determine the Function of Fuses and Resistor Power Rating worksheetVIII. Student Activity –Compute Power from the Power Formula worksheetIX. AssessmentA. Power Exam #1B. Power Exam #2 | * Establish a good foundation before continuing.
* Note that a higher wattage resistor is physically larger.
* The problem-solving sequence in Problem 1 is consistent with the problem-solving process given in other lessons.
* Problem 2 shows two methods using different versions of the power formula.
* Have students complete as an independent practice.
* Use some of the worksheets for guided practice and others for independent practice.
* Ensure students work many problems before they take the exams.
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| **Guided Practice \*** | The teacher may conduct Lab #3 as a demonstration. Lab #1, Lab #3, and the discussion questions after Lab #2 can be guided practice - especially if supplies are limited. The first couple of problems from Student Activity should also be teacher-led. Use some of the worksheets for guided practice and others for independent practice. |
| **Independent Practice/Laboratory Experience/Differentiated Activities \*** | Lab #2, the rest of the problems from Student Activity are independent practices. |
| **Lesson Closure** | Go over the lab worksheets to reinforce concepts and check for understanding.* How did you know that your resistors were ½-watt resistors? Explain.
* How much power was applied to the 1,000-ohm resistor? (P=I2R)
* Explain why the fuse blew when 10-volts were applied to the 10-ohm resistor.
* Explain what happened to the resistor. How much power was being applied after you shorted the fuse?
* If you had to use a 10-ohm resistor with 10-volts applied, what would you do?
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| **Summative/End of Lesson Assessment \***  | **Informal Assessment:*** The teacher will ask questions and encourage student feedback. The teacher will also monitor each student or small group as they individually work to complete the assignments.

**Formal Assessment:*** The student will be assessed by the accuracy of the completed assignments. The teacher will divide the final assessment into the following two parts.
* A measurement test of a series of exercises using the breadboards, power supplies, and assorted loads or lamps to measure current, voltage, resistors, and power accurately.
* The scores on the formal exams (Exam 1 and Exam 2.)
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| **References/Resources/****Teacher Preparation** | **Preparation:*** Review the lesson document prior to the lesson
* Have worksheets, exams, and review materials ready before class begins
* Have calculators and other materials ready

**References:*** Buchla, D. & Floyd, T. (2005). *The science of electronics DC/AC*. (Chapter 4). Upper Saddle River, NJ: Pearson Prentice Hall.
* Floyd, T. (1993). *Principles of electric circuits: Electron flow version*. New York, NY: Macmillan Publishing Co.
* Robertson, L. (1980). *Basic electronics I*. Mid-American Vocational Curriculum Consortium, Inc.
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| **Additional Required Components** |
| **English Language Proficiency Standards (ELPS) Strategies** |  |
| **College and Career Readiness Connection[[1]](#footnote-1)** |  |
| **Recommended Strategies** |
| **Reading Strategies** |  |
| **Quotes** |  |
| **Multimedia/Visual Strategy****Presentation Slides + One Additional Technology Connection** |  |
| **Graphic Organizers/Handout** |  |
| **Writing Strategies****Journal Entries + 1 Additional Writing Strategy** |  |
| **Communication****90 Second Speech Topics** |  |
| **Other Essential Lesson Components** |
| **Enrichment Activity**(e.g., homework assignment) | * Using the wattmeter to accurately measure power becomes a vital part of the technical problem-solving skills needed in the workplace.
* Thinking through a problem to arrive at the answer and working past frustrations strengthens character.
* Developing leadership skills helps solve challenges throughout life. Leading and following creates a sense of accomplishment that also helps strengthen character.
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| **Family/Community Connection** |  |
| **CTSO connection(s)** | SkillsUSATechnology Student Association |
| **Service Learning Projects** |  |
| **Lesson Notes** |  |

1. Visit the Texas College and Career Readiness Standards at <http://www.thecb.state.tx.us/collegereadiness/CRS.pdf>, Texas Higher Education Coordinating Board (THECB), 2009. [↑](#footnote-ref-1)