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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** | Parallel Resistive Circuits Part 2 |
| **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(C) The student is expected to demonstrate an understanding of magnetism and induction as they relate to electronic circuits(D) The student is expected to perform electrical-electronic troubleshooting assignments(9) The student applies the concepts and skills to simulated and actual work situations(A) The student is expected to measure and calculate resistance, current, voltage, and power in series, parallel, and complex circuits(A) The student is expected to use tools and laboratory equipment in a safe manner to construct and repair circuits(B) The student is expected to use precision measuring instruments to analyze circuits and prototypes(A) The student is expected to interpret industry standard circuit schematics(D) The student is expected to sketch schematics |
| **Basic Direct Teach Lesson**(Includes Special Education Modifications/Accommodations and one English Language Proficiency Standards (ELPS) Strategy) |
| **Instructional Objectives** | * Identify a parallel resistive circuit
* Use current loops to determine electrical polarity
* Apply Kirchhoff’s Voltage Law to parallel circuits
* Apply Kirchhoff’s Current Law to parallel circuits
* Use Kirchhoff’s Law to derive circuit analysis tools
* Analyze circuits and calculate a variety of electrical values using the information given for a parallel circuit
* Recite the formulas in the parallel circuit tool kit from memory
* Describe a step-by-step problem-solving process used for solving parallel circuit problems
* Solve a two resister parallel circuit for total resistance and total current
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| **Rationale** | Workers in electronics should be able to apply Kirchoff’s law to determine voltage, current, and resistance in a parallel circuits. At the end of the lesson, students will demonstrate the ability to apply problem solving and analytical techniques to calculate parallel circuit electrical values. |
| **Duration of Lesson** | 100 minutes |
| **Word Wall/Key Vocabulary***(ELPS c1a,c,f; c2b; c3a,b,d; c4c; c5b) PDAS II(5)* | * **Parallel Circuit-** a circuit with more than one path for current flow
* **Parallel Resistive Circuit-** a parallel circuit containing only resistors
* **Ohm’s Law-** a formula that shows the mathematical relationship between current, voltage, andresistance
* **Kirchhoff’s Voltage Law-** the sum of all voltages in a closed loop equals zero
* **Kirchhoff’s Current Law-** the sum of the currents into a node is equal to the sum of the currentsleaving the node
* **Node-** a branching point where current splits or combines
* **Series Circuit-** a circuit with only one path for current flow
* **Voltage Drop-** a voltage difference measured across a device
* **Total Resistance-** the equivalent resistance of the circuit; the resistance the battery sees
* **Reciprocal-** inverse; the one divided by x function
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| **Materials/Specialized Equipment Needed** | * *Tool Kit for Solving Parallel Circuit Problems Handout*, summary of the “tool kit” and thetroubleshooting method (coming soon)
* *Sample Problems With Two Resistors Worksheet*, two resistor sample problems for guided andindependent practice (and key) (coming soon)
* *Sample Problems With Three Resistors Worksheet*, three resistor sample problems for guided andindependent practice (and key)
* *Parallel Resistive Circuits Quiz* (and key) (coming soon)
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| **Anticipatory Set**(May include pre-assessment for prior knowledge) | None listed |
| **Direct Instruction \*** | *Individualized Education Plan (IEP) for all special education students must be followed. Examples of accommodations may include, but are not limited to:*1. More Complex *Parallel Resistive Circuits* (slides 1-5)
	* 1. Looks at circuits with three paths for current flow.
		2. Follow the same procedure as the lesson with two paths for current flow.
		3. Apply Kirchhoff’s Law and solve first for voltage dropped in each path, then for current in each path.
		4. Each path for current flow is separate and independent.
	1. Parallel Resistive Circuit Equations (slides 6-7)
		1. One more term is added to each equation.
		2. The concepts are exactly the same as a circuit with two resistors.
		3. Current from each parallel path adds to form total current.
		4. Parallel path voltage values are the same.
		5. Resistance basically divides, but the major concept is that total resistance goes down each time a parallel path is added.
		6. These concepts can be contrasted with the way voltage works in a series circuit.
	2. Understanding Resistance in a Parallel Circuit (slides 8-11)
		1. Lights are used to show how current increases and resistance decreases in a parallel circuit.
		2. This is like turning on lights in different rooms in a house.
		3. Turning on lights in one room does not affect the lights in another room.
		4. This is the same as the example from *Part 1* except it shows a third switch and light.
		5. Total current is three times the current for one light and total resistance is one-third the resistance of one light.

An Easier Way (slides 12-16)* 1. Use the reciprocal button of a calculator to simplify calculation of total resistance.
	2. The reciprocal button is the one over x button.
	3. The button is a little different among calculators, but every calculator will have this button in one form or another.
	4. The first example is a two resistor example from *Part 1* to show that this method calculates exactly the same value as before.
	5. The second example uses three resistors and mathematically demonstrates the total resistance from the three light example.
1. Example Problems 1 and 2 (slides 17-25)
	1. These problems are designed to allow students to practice the easier method for calculating total resistance.
	2. Example one is the same example from *Part 1*; students should get exactly the same value.
	3. These problems are also designed to reinforce the logical, step-by-step process to solve a problem.
	4. Allow students to perform the calculation themselves before showing the solution.
	5. Always start by writing down what the problem is asking for and the equations needed to solve for that value.

VI. Example Problem Three (slides 26-32)1. This is a slightly more difficult problem.
2. This example will reinforce the process that students must take to solve a problem.
3. Again, prompt students to say the steps of the process and the equations needed to solve it.
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| **Guided Practice \*** | *Individualized Education Plan (IEP) for all special education students must be followed. Examples of accommodations may include, but are not limited to:** *Sample Problems With Two Resistors Worksheet* (Problems 3, 5, 7, and 10) and *Sample Problems With Three Resistors Worksheet* (Problems 1, 5, 7, and 9)
* Each of the problems listed is the first problem of a new type.
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| **Independent Practice/Laboratory Experience/Differentiated Activities \*** | *Individualized Education Plan (IEP) for all special education students must be followed. Examples of accommodations may include, but are not limited to:** *Sample Problems With Two Resistors Worksheet* (Problems 1, 2, 4, 6, 8, 9, 11-14) (the problems getprogressively harder)
* *Sample Problems With Three Resistors Worksheet* Problems (2-4, 6, 8, 10-14)
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| **Lesson Closure** | * Recite the formulas in the parallel circuit tool kit from memory.
* Describe a step-by-step, problem-solving process used for solving parallel circuit problems.
* Have students work problems of each type using independent practice.
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| **Summative/End of Lesson Assessment \***  | **Informal Assessment**The teacher will observe students solving problems and getting correct answers during independent practice.**Formal Assessment**The teacher will give the *Parallel Resistive Circuits Quiz*.*Individualized Education Plan (IEP) for all special education students must be followed. Examples of accommodations may include, but are not limited to:*It is important that lessons accommodate the needs of every learner. These lessons may be modified to accommodate your students with learning differences by referring to the files found on the Special Populations page of this website. |
| **References/Resources/****Teacher Preparation** | **Preparation*** Cover *Parallel Resistive Circuits Part 1* as a prerequisite
* *Parallel Resistive Circuits Part 1 and Part 2* are designed to be presented together
* Review the *Parallel Resistive Circuits Part 2* slide presentation and lesson documents prior to each class
* Review and become familiar with the terminology and the example problems
* Have handouts and worksheets ready prior to the start of the lesson

**References*** Roberts, Gerrish, and Dugger. (1999). *Electricity & electronics*. Tinley Park, Illinois: Goodheart-Willcox Company.
* Mitchel E. Schultz. (2007). *Grob’s* *basic electronics fundamentals of DC and AC circuits*. Columbus, Ohio: McGraw Hill.
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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) |  |
| **Family/Community Connection** |  |
| **CTSO connection(s)** | SkillsUSA, Technology Student Association (TSA) |
| **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)