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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** | Engineering Mathematics |
| **Lesson/Unit Title** | Electrical Systems |
| **TEKS Student Expectations** | **130.413. (c) Knowledge and Skills**  (7) The student calculates electronic quantities and uses electrical measuring instruments to experimentally test their calculations. The student is expected to:  (A) apply common electronic formulas to solve problems  (B) use engineering notation to properly describe calculated and measured values  (C) compare and contrast the mathematical differences between a direct current and alternating current  (F) create a resistive capacitive timing circuit in a time-delay circuit |
| **Basic Direct Teach Lesson**  (Includes Special Education Modifications/Accommodations and  one English Language Proficiency Standards (ELPS) Strategy) | |
| **Instructional Objectives** | The students will be able to:   1. Understand the meaning of electricity 2. Understand Ohm’s Law 3. Understand the meaning of electrical systems 4. Understand the different types of electrical systems 5. Understand the careers and educational opportunities available in the electrical systems industry 6. Perform an energy audit of their school 7. Design a building/wing/floor that meets a certain power consumption criterion using conventional power sources (fossil fuels) and renewable power sources |
| **Rationale** | This lesson teaches students to calculate electronic quantities and use of electrical measuring instruments to experimentally test the calculations |
| **Duration of Lesson** | 19 days (45-minute class periods) |
| **Word Wall/Key Vocabulary**  *(ELPS c1a,c,f; c2b; c3a,b,d; c4c; c5b) PDAS II(5)* | **Electrical Systems -** Utilities that provides electricity; they are groups of electricalcomponents connected to carry out some operation  **Ohm’s Law -** The mathematical relationship among electric current, resistance, andvoltage; the principle is named after the German scientist Georg Simon Ohm  **Motor -** A machine, especially one powered by electricity or internal combustion thatsupplies motive power for a vehicle or for some other device  **Electrical Power -** Considered the presence as well as stream of an energy charge; thepower component of electricity may be found in various phenomena like static power, electro-magnetic spheres and even lightning  **Efficiency -** The state or quality of being efficient; i.e., "greater energy efficiency" |
| **Materials/Specialized Equipment Needed** | Instructional Aids:   * Electrical Systems Project handout * Energy Audit Assessment handout   Materials:   * Engineering Notebook * Team Contract Spreadsheet * Calculators * Pen and Pencil * 6-volt batteries * Resistors between 1kΩ and 100kΩ * Voltmeters * Ammeters * Ohmmeters * Build Design materials (to be determined by each student team)   Equipment:   * Computer * Overhead Projector |
| **Anticipatory Set**  (May include pre-assessment for prior knowledge) |  |
| **Direct Instruction \*** | 1. Electrical Systems 2. Information 3. Introduction/Course Description 4. Objectives and Results 5. Vocabulary 6. O\*Net [(www.onetonline.org](http://www.onetonline.org/)) 7. Electrical Systems 8. What is Electricity? 9. What is Ohm’s Law? 10. What are Electrical Systems? 11. Types of Electrical Systems 12. Practice: Ohm’s Law Exercise 13. Electrical Systems 14. Electrical Systems Project   *Individualized Education Plan (IEP) for all special education students must be followed. Examples of accommodations may include, but are not limited to:*  *NONE* |
| **Guided Practice \*** | Teacher will observe student teams as they work on the Ohm’s Law Exercise and the Electrical Engineering Project.  *Individualized Education Plan (IEP) for all special education students must be followed. Examples of accommodations may include, but are not limited to:*  *NONE* |
| **Independent Practice/Laboratory Experience/Differentiated Activities \*** | Have student teams evaluate everyone’s Electrical Systems Project and explain what they would change on their own for next time.  *Individualized Education Plan (IEP) for all special education students must be followed. Examples of accommodations may include, but are not limited to:*  *NONE* |
| **Lesson Closure** | **Review**  **Question:** Where and when was electricity discovered?  **Answer:** Answers will vary. One possible answer:  **Question:** Why is it important to know and use Ohm’s Law?  **Answer:** Again, answers will vary.  **Question:** What is an Energy Audit?  **Answer:** Again, answers will vary.  **Question: What were your energy audit experiences?**  **Answer:** Again, answers will vary.  **Question:** What renewable energy resources would you use to design your building/wing/floor? |
| **Summative/End of Lesson Assessment \*** | **Informal Assessment:**  The teacher will observe the students as they complete the Ohm’s Law Exercise and work on the Electrical Systems Project. Look for teamwork and professionalism.  **Formal Assessment:**   * Establish project team protocol. * Establish role contract. * Complete task contract. * Complete tasks listed on team contract including the Ohm’s Law exercise and the Electrical Systems Project. * Presentation of team’s Electrical Systems Energy Audit and Build Design.   *Individualized Education Plan (IEP) for all special education students must be followed. Examples of accommodations may include, but are not limited to:*  *NONE* |
| **References/Resources/**  **Teacher Preparation** | Teacher Preparation:   * Understand that students need to be creative with this lesson. Allow student teams to complete the contract spreadsheet and assign roles. Review the Microsoft PowerPoint and the Electrical Systems Project. Provide student teams with handouts and materials.   References:  Ohm’s Law – W&N created  DC and AC motors  DC motor  ACmotor  Schematic diagram  Ammeter, voltmeter |
| **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** | * Electrical Systems Vocabulary * Ohm’s Law Exercise Handout * Classroom Energy Assessment * Electrical Systems Project Handout * Team Contract Spreadsheet * Electrical Systems Project Rubric |
| **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)