

***CTE Standards Unpacking
Electronics***

Course: Electronics

Course Description: The Introduction to Electronics course is designed to provide a basic understanding electronics which include how to design and create components, diagnose, troubleshoot and repair electronic components. Through classroom study and hands-on experience, students prepare for work within the electronics field using current technology, safety and ethical procedures.

Career Cluster: STEM

Prerequisites: None

Program of Study Application: This is a pathway course in the STEM cluster Electronics pathway. It is recommended that the course be preceded by a series of foundation courses and a cluster course in STEM, and followed by a more specialized pathway course such as Robotics.

INDICATOR #E 1: Determine general technical literacy skills		
SUB-INDICATOR 1.1 (Webb Level: 1 Recall): Employ appropriate units and abbreviations in electronics.		
SUB-INDICATOR 1.2 (Webb Level: 2 Skill/Concept): Determine unknown values in multiple types of electronic circuits		
SUB-INDICATOR 1.3 (Webb Level: 1 Recall): Identify proper terminology in electronics		
Knowledge (Factual): Appropriate units and abbreviations Electronic exponential expressions Calculation methods for different types of electronic circuits Ratings of resistors based on color bands Parts of a circuit Scientific Notation	Understand (Conceptual): - Using formulas and known measures, it is possible to make calculations related to current, resistance, voltage, and power - Schematic diagrams are used to efficiently represent the design of a circuit -Color bands are used to represent the value of a resistor	Skills (Application): - Convert expressions using scientific notation and electronic exponential expressions - Create a schematic diagram for a given circuit - Calculate resistor values based on color bands - Build a parallel and series circuit

<p>Similarities and differences of Parallel and series circuit</p>		<p>- Find missing values related to current, resistance, voltage, and power using formulas</p> <p>-Create a parallel and series circuit with correctly labeled parts</p>
--	--	--

Benchmarks

Students will be assessed on their ability to:

- Draw a parallel and series circuit and label the parts correctly
- Apply appropriate formula to solve for unknown values in a variety of circuits
- Draw a schematic drawing of a circuit using the correct abbreviations

Academic Connections

ELA Literacy and/or Math Standard (if applicable, Science and/or Social Studies Standard):

CCSS.MATH.CONTENT.HSA.CED.A.4
 Rearrange formulas to highlight a quantity of interest, using the same reasoning as in solving equations. *For example, rearrange Ohm's law $V = IR$ to highlight resistance R .*

CCSS.MATH.CONTENT.HSN.Q.A.3
 Choose a level of accuracy appropriate to limitations on measurement when reporting quantities.

Sample Performance Task Aligned to the Academic Standard(s):

Solve a set of problem solving questions related to current, voltage, resistance, and power. Give a mix of problems with a variety of given information.

--	--

INDICATOR #E 2: Demonstrate proficiency in electronic safety		
SUB-INDICATOR 2.1 (Webb Level: 2 Skill/Concept): Determine physiological responses to electrical shock		
SUB-INDICATOR 2.2 (Webb Level: 1 Recall): Demonstrate proper safety procedures in the use of soldering and electronics testing equipment		
Knowledge (Factual): -Effects of electric shock on the human body -Safety procedures for soldering -Safety procedures for electronics testing equipment	Understand (Conceptual): -Safety protocols are essential for the protection of those working with electrical equipment -Accidents may occur when safety protocols are not followed and significant physical consequences can occur	Skills (Application): -Study the safety protocols of soldering and working with electronics testing equipment -Examine the outcomes of electrical shock -Determine methods of reducing the severity of an electric shock and initial treatment of a victim -Identify possible safety concerns within working environments
Benchmarks <i>Students will be assessed on their ability to:</i> <ul style="list-style-type: none"> • Describe the possible causes and results of an electric shock. • Pass an assessment that demonstrates knowledge of the safety rules based on <i>Occupational Safety and Health Administration</i> (OSHA) standards leading to OSHA certification • List safety concerns when given a workplace scenario 		

<i>Academic Connections</i>	
<p>ELA Literacy and/or Math Standard (if applicable, Science and/or Social Studies Standard): 11-12.W.2. Write informative/explanatory texts to examine and convey complex ideas, concepts, and information clearly and accurately through the effective selection, organization, and analysis of content.</p>	<p>Sample Performance Task Aligned to the Academic Standard(s): Write an informative essay describing the possible causes and results of an electric shock.</p>

INDICATOR #E 3: Demonstrate proficiency in circuit assembly		
SUB-INDICATOR 3.1 (Webb Level: 2 Skill/Concept): Construct a circuit using schematic symbols for identified components		
SUB-INDICATOR 3.2 (Webb Level: 2 Skill/Concept): Construct circuit boards using correct soldering principles and techniques		
SUB-INDICATOR 3.3 (Webb Level: 3 Strategic Thinking): Determine cause of non-operational circuits		
<p>Knowledge (Factual):</p> <ul style="list-style-type: none"> -Meaning of resistor color bands -Methods of determining polarity of electrolytic capacitors -Symbols of a schematic diagram -Proper handling of 	<p>Understand (Conceptual):</p> <ul style="list-style-type: none"> -Using a schematic drawing it is possible to construct an operational circuit -Creating a circuit board requires proper handling of components and an understanding of the principles of soldering 	<p>Skills (Application):</p> <ul style="list-style-type: none"> -Learn the meaning of the color bands on a resistor -Explore the polarity of different electrolytic capacitors -Recognize symbols used in a schematic drawing

<p>components</p> <p>-Circuit board troubleshooting procedures</p>	<p>-There is a process for analyzing a non-operational circuit and applying testing equipment to lead to repair</p>	<p>-Determine procedures for troubleshooting non-operational circuits</p>
--	---	---

Benchmarks

Students will be assessed on their ability to:

- Apply resistor color code to identify proper resistor values
- Determine proper polarity for electrolytic capacitors
- Distinguish components correctly in relation to a schematic diagram
- Connect components in proper position on circuit board
- Show ability to handle components carefully
- Determine proper amounts of solder to cover the connection
- Assess a non-operational bread-board circuit
- Draw conclusions to select proper test equipment for repair of faulty circuits
- Investigate and repair circuit board

Academic Connections

ELA Literacy and/or Math Standard (if applicable, Science and/or Social Studies Standard):

Math Practice Standards:
CCSS.MATH.PRACTICE.MP1 Make sense of problems and persevere in solving them.

CCSS.MATH.PRACTICE.MP2 Reason abstractly and quantitatively.

Science and Engineering Practices:
Planning and Carrying out Investigations
Constructing Explanations and Designing Solutions

Sample Performance Task Aligned to the Academic Standard(s):

Given a set of components and a schematic drawing have students construct a working circuit board. After assessing the operation of the circuit board, have students create a “problem” in their circuit board and exchange with a partner. Students should then troubleshoot the board and identify the problem and repair the board.

--	--

INDICATOR #E 4: Determine proper use of electronic test equipment

SUB-INDICATOR 4.1 (Webb Level: 1 Recall): Measure resistance, voltage, and current in circuits

SUB-INDICATOR 4.2 (Webb Level: 1 Recall): Classify equipment for signal analysis

Knowledge (Factual):	Understand (Conceptual):	Skills (Application):
-Correct operation of meter for measuring resistance, voltage, and current in circuits -Units assigned to resistance, voltage, and current -Purpose of signal analysis equipment	- A meter is used to determine measurements for resistance, voltage, and current in circuits -Measurements obtained from a meter for resistance, voltage, and current should always be reported with correct units -Equipment is used to generate signal outputs and measure signals -There are two types of signals, analog and digital, that can be classified using the signal equipment	-Determine the proper procedure to use of a meter to measure resistance, voltage, and current in a circuit -Recognize the different units that apply to the measurements of resistance, voltage, and current -Understand the purpose of signal analysis equipment and its application

Benchmarks
Students will be assessed on their ability to:

- Use a meter to measure the resistance, voltage, and current of a circuit and report those results using correct units
- List the type of equipment that provides signal outputs and equipment that measures signals
- Analyze signal outputs and identify the type of signal represented

Academic Connections

ELA Literacy and/or Math Standard (if applicable, Science and/or Social	Sample Performance Task Aligned to the Academic Standard(s):
--	---

<p>Studies Standard):</p> <p>CCSS.MATH.CONTENT.HSF.IF.C.7.E Graph exponential and logarithmic functions, showing intercepts and end behavior, and trigonometric functions, showing period, midline, and amplitude.</p>	<p>Analyze the behavior of analog signals by identifying frequency/period, midline, and amplitude.</p>
---	--

<p>INDICATOR #E 5: Troubleshoot circuits for proper operation</p>		
<p>SUB-INDICATOR 5.1 (Webb Level: 2 Skill/Concept): Calculate voltage, current, and power solutions in circuits</p>		
<p>SUB-INDICATOR 5.2 (Webb Level: 2 Skill/Concept): Troubleshoot solutions to analyze circuit operation</p>		
<p>Knowledge (Factual): -Formulas and laws applied to calculating voltage, current, and power, in circuits -Estimation of values of components within a circuit Circuit parameters</p>	<p>Understand (Conceptual): -Expected measurements of circuit function can be calculated using formulas. -A comparison of expected values and actual measurements can identify faulty circuit operation</p>	<p>Skills (Application): -Choose formulas to calculate the predicted voltage, current, and power in a circuit design -Determine methods for measuring values within a circuit -Use mathematical models to compare expected and actual values and analyze circuit function</p>
<p>Benchmarks <i>Students will be assessed on their ability to:</i></p> <ul style="list-style-type: none"> • Apply formulas to calculate voltage, current, and power within a circuit • Use proper measurement values when reporting calculations • Identify faulty circuits based on calculations • Graph calculated and measured values. Analyze the graph and determine if the circuit is within circuit parameters 		
<p style="text-align: center;">Academic Connections</p>		
<p>ELA Literacy and/or Math Standard (if applicable, Science and/or Social</p>	<p>Sample Performance Task Aligned to the Academic Standard(s):</p>	

<p>Studies Standard): Science and Engineering Practices: -Analyzing and interpreting data</p> <p>CCSS.MATH.CONTENT.HSS.ID.A.1 Represent data with plots on the real number line (dot plots, histograms, and box plots).</p> <p><u>CCSS.MATH.CONTENT.HSN.Q.A.3</u> Choose a level of accuracy appropriate to limitations on measurement when reporting quantities.</p> <p>CCSS.MATH.PRACTICE.MP1 Make sense of problems and persevere in solving them.</p> <p>CCSS.MATH.PRACTICE.MP2 Reason abstractly and quantitatively.</p> <p>CCSS.MATH.PRACTICE.MP4 Model with mathematics.</p> <p>CCSS.MATH.PRACTICE.MP6 Attend to precision.</p>	<p>Presented with a circuit, calculate the expected measurements and measure the actual values. Analyze the values using a graphical approach. Report the findings and recommend a solution.</p>
---	--

<p>INDICATOR #E 6: Explore electronics career options</p>		
<p>SUB-INDICATOR 6.1 (Webb Level: 3 Strategic Thinking): Research career opportunities in electronics fields</p>		
<p>SUB-INDICATOR 6.2 (Webb Level: 1 Recall): Explore career outlook for robotic applications</p>		
<p>Knowledge (Factual): -Possible career opportunities in the electronics field</p>	<p>Understand (Conceptual): -There are many different levels of careers in the</p>	<p>Skills (Application): -Using career exploration software, investigate careers in the electronics</p>

<p>-The evolution of robotics and its effect on specific careers</p>	<p>electronics field.</p> <p>-Robotics applications have and will continue to have an impact on electronics related jobs.</p>	<p>field identifying education requirements and career implications</p> <p>-Research the impact of robotics on the job market identifying emerging careers and those becoming irrelevant</p>
--	---	--

Benchmarks

Students will be assessed on their ability to:

- Report a career of interest, list the education requirements, and career criteria
- Identify jobs that will be created/eliminated by robotics
- List new robotics related careers

Academic Connections

ELA Literacy and/or Math Standard (if applicable, Science and/or Social Studies Standard):	Sample Performance Task Aligned to the Academic Standard(s):
<p>Science and Engineering Practice: Obtaining, Evaluating, and Communicating Information</p> <p>11-12.W.2. Write informative/explanatory texts to examine and convey complex ideas, concepts, and information clearly and accurately through the effective selection, organization, and analysis of content.</p> <p>11-12.SL.4 Present information, findings, and supporting evidence, conveying a clear and distinct perspective, such that listeners can follow the line of reasoning, alternative or opposing perspectives are</p>	<p>Research careers in the electronics field that are impacted by robotics applications. Include careers that are being altered and those that are emerging. Using this information, write an essay on the impact robotics technology has on education and careers.</p> <p>Choose a career of interest in the electronics field. Research the education path that leads to that career, the function of the career, and the future outlook of the career. Create a presentations to communicate findings in a whole group setting.</p>

<p>addressed, and the organization, development, substance, and style are appropriate to purpose, audience, and a range or formal and informal tasks.</p> <p>9-12.G.6.3 - Explain the ways technology expands the human capacity to use and modify the physical environment</p>	
---	--

Additional Resources

Please list any resources (e.g., websites, teaching guides, etc.) that would help teachers as they plan to teach these new standards.