

Program 2: EV Car Repair and Maintenance

Instructional Modules

40 hours

Recommended Reading Level: ABE 4 or above

Module #1: Introduction to Electric Cars			
Objective: Provide an overview of electric vehicle (EV) components, their functionality, and safety protocols.			
Instructional Materials: YouTube video, online articles			
Lesson Plan			Standards/ Aligned Text
Week 1, Day 1 2.5 Hours	Introduction	Getting to know EV's and classmates	
	Literacy, Contextualized Industry Skills, Workplace Readiness	<p>Collaborative Learning: EV Pair and Share(20 mins) Discuss Questions: What is your experience with electric vehicles (EV), car repair, or anything related? What is your goal in taking this class?</p> <p>Watch video and complete discussion questions: (30 mins) Watch Video: “Electric Cars: The Future of Transportation - EV Components: CCS, OBC, HV Battery” Discussion Questions: What are three differences between an EV and an internal-combustion-engine (ICE)? What do you think will be the greatest challenge for drivers that are operating an EV for the first time? As a class, create a venn diagram to chart the differences and similarities.</p> <p>Present slide deck explaining the key differences between an ICE and EV, using vehicles and parts in the lab, as possible (20 mins)</p> <p>12V Batteries & EV's: Reflect on prior experience and watch video about traditional 12V batteries (30 mins) Reflection Question: What experience do you have with car batteries, changing batteries, etc?</p>	

		<p>Watch Video: “How a Car Battery Works - Basic Working Principle”</p> <p>Discussion: Did the video confirm or deny your prior experience and knowledge?</p> <p>Active Reading Activity (40 mins) Read “Why Do Electric Cars Still Use 12-Volt Batteries?” for understanding by using Cornell note taking strategies to identify unknown vocabulary on the left and notes on the right. As a class, review the unknown vocabulary and clarify for understanding:</p> <ul style="list-style-type: none"> Electrons Volts PHEV Propulsion Circuit Powertrain ECU Internal-combustion EPA Cargo Traction 	
	Assessment	<p>Exit Ticket (10 mins) Check for understanding and learning with an “exit ticket”. On a 3x5 card or half sheet of paper, students must write down one thing that they already knew about EV’s, one fact that they learned that was surprising, and one thing they would like to ask in the next class</p>	
<p>Week 1, Day 2 2.5 Hours</p>	Introduction	Understanding automotive and EV terminology for context	<p>2.5 Hours</p>
	Activity	<p>Introductory Reading (30 mins) Read the article “The Language of Electric Vehicles” and track new terminology in the following format:</p> <ul style="list-style-type: none"> ● Term: Any term students identify as unknown, unfamiliar, or relevant to the topic ● Definition: Dictionary or textbook definition ● Example: Short example of how it’s used in the article or textbook ● Context: What, if anything, is it related to? Is it connected to another familiar automotive/EV system <p>Terminology List:</p> <ul style="list-style-type: none"> ● Volts ● amps 	

		<ul style="list-style-type: none"> ● kW ● kWh ● miles/kWh ● Internal combustion engine ● Battery-electric vehicle (BEV) ● Traction battery ● plug-in hybrid electric vehicle (PHEV) ● hybrid-electric vehicle (HEV) ● Electrons ● Circuit breaker ● Range <p>Fleet Maintenance & Care Sharing: (30 mins) Read the article "Maintaining an Electric Car" as a class. Active Reading: While classmates are reading, take notes on unknown and/or important terminology, differences between EV and ICE vehicles, and things that will still need to be checked or replaced in an EV. Discuss Questions: (20 mins) What are some things you don't need to worry about when maintaining an electric car, compared to a gasoline car? Why is it important to check the tires on an electric car? What can happen if they are not checked? What types of parts in an electric car still need to be checked or fixed, even though electric cars have fewer parts than gasoline cars?</p>	
	Assessment	<p>15 Question review for Module 1 (15 mins)</p> <p>What is one of the biggest benefits of owning an electric car compared to a gasoline car?</p> <p>Which of the following is NOT something you need to maintain in an electric car?</p> <ol style="list-style-type: none"> a) Oil changes b) Tire pressure c) Windshield wiper fluid d) Spark plugs <p>What part of an electric car needs to be checked regularly to ensure it is running well?</p> <ol style="list-style-type: none"> a) Fuel tank b) Air conditioning filter c) Spark plugs d) Exhaust system <p>What does "EV" stand for?</p> <ol style="list-style-type: none"> a) Electric Vehicle 	

		<ul style="list-style-type: none">b) Engine Vehiclec) Electric Vand) Energy Vehicle <p>True or False: Amperage refers to the flow of electricity through a wire.</p> <ul style="list-style-type: none">a) Trueb) False <p>Which type of charger allows you to charge your electric vehicle the fastest?</p> <ul style="list-style-type: none">a) Level 1 chargerb) Level 2 chargerc) Level 3 chargerd) Solar charger <p>True or False: A Level 1 charger uses more electricity than a Level 2 charger.</p> <ul style="list-style-type: none">a) Trueb) False <p>What is the equivalent of "gallons" in an electric car?</p> <ul style="list-style-type: none">a) Kilowatts (kW)b) Kilowatt-hours (kWh)c) Amperes (A)d) Volts (V) <p>What does "kWh" stand for in the context of electric vehicles?</p> <ul style="list-style-type: none">a) Kilowatt-hoursb) Kilowatts per hourc) Kilowatt-heavyd) Kilowatt-header <p>What is one way to improve an electric car's range?</p> <ul style="list-style-type: none">a) Replace the tires with low rolling resistance tiresb) Use more fuelc) Charge it with a 110V chargerd) Lower the car's speed <p>Which unit is used to measure the strength of the electric current in a circuit?</p> <ul style="list-style-type: none">a) Volts (V)b) Amps (A)c) Kilowatts (kW)d) Joules (J) <p>What does MPGe stand for when measuring the efficiency of an electric vehicle?</p> <ul style="list-style-type: none">a) Miles per gallon equivalentb) Miles per kilowatt energyc) Miles per electrical charge	
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		<p>d) All of the above</p> <p>Short Answer: What is the main difference between a Level 2 charger and a Level 1 charger? –</p> <p>Which of the following is part of a battery-electric vehicle (BEV)?</p> <p>a) Electric motor(s) b) Internal combustion engine c) Charging system d) All of the above</p> <p>Review answers and check for understanding (15 mins)</p>	
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Module #2: Routine Maintenance and Repairs			
Objective: Understand the importance of regular vehicle inspections and apply the workforce skills to conduct a 20 point inspection of electric fleet vehicles.			
Instructional Materials: YouTube video, online articles, Routine Vehicle Inspection Checklist			
Lesson Plan			Standards/ Aligned Text
Week 2, Day 1 2.5 Hours	Introduction	The importance of regular vehicle inspections including activities that reinforce digital literacy for quality control.	
	Activities	<p>Contextualizing Workplace Skills: (1 hour) Checking brakes, tires, fluid levels, and onboard systems “Electric Vehicle Repair Safety, Part 1” AirPro Diagnostics</p> <p>Watch Part 1, taking notes on each step for inspection, repair, and safety</p> <ul style="list-style-type: none"> • Discuss as a class <p>“Electric Vehicle Repair Safety, Part 2” AirPro Diagnostics Watch Part 2, taking notes on each step for inspection, repair, and safety.</p> <ul style="list-style-type: none"> • Discuss as a class <p>Inquiry-based learning: “What’s Next” Activity (1 hour) Group students into small groups. Using vehicles or trainers in the lab, each group will complete the Routine Vehicle Inspection activity included. Instructor’s should assist students, walking them through how to complete an inspection. After the</p>	

		<p>inspections are complete, the students should assess and note what repairs should be completed and complete the discussion questions:</p> <ul style="list-style-type: none"> • What repairs can be completed by your group? • What repairs should be completed by a licensed technician or by a licensed shop? • What steps will you follow in order to refer the vehicle for repairs? 	
	Assessment	<p>Contextualized Industry Skills: (30 mins) Observe each student’s demonstration of 20 point inspection and ability to troubleshoot issues/repairs and refer the vehicle for further services.</p>	
Week 2, Day 2 2.5 Hours	Introduction:	Fixing flats and ensuring optimal tire performance	
	Activities	<p>Active Reading: (1 hour) Provide students with the readings “How to Change a Flat Tire” or “Tire Safety and Maintenance” to read in pairs. Students will take notes on the steps for changing a flat tire or tire safety. After reading, each group will find another group that read the other article and will teach them the steps learned from each.</p> <p>Experiential Activity - Contextualization of Workplace readiness skills: After sharing with the groups, all students will observe the instructor changing a tire and checking for any codes that need to be reset in the sample EV fleet vehicle. After observing, the students will work in teams to practice changing a tire following all required safety standards.</p> <p>Discussion: (10 mins) As a class, reflect on the readings and experience. Was there any new terminology? What did you experience while changing a tire?</p> <p>Computational Thinking Activity: Troubleshooting Map (1 hour) On their own, students will use their prior knowledge to create a troubleshooting flowchart that leads to two outcomes:</p> <ol style="list-style-type: none"> 1. Fleet maintenance or referral for a more comprehensive repair. 2. Tire change or allowable repair is completed. <p>Digital Literacy: Students can use Microsoft Word, Exel, or PowerPoint to design a troubleshooting map.</p> <p>Materials needed: Computer or device equipped with Microsoft Office or Google Suite. Sufficient time for students to access programs and receive assistance.</p>	

		Simplified lesson: Students design a map using paper, pens, markers, etc.	
	Assessment	Workplace Readiness: (30 mins) Observe each student's demonstration of 20 point inspection and ability to troubleshoot issues/repairs and refer the vehicle for further services.	

Module #3: Interior and Exterior Maintenance			
Objective: Cleaning and ensuring fleet readiness.			
Instructional Materials: YouTube video, online articles			
Lesson Plan			Standards/ Aligned Text
Week 3, Day 1 2.5 Hours	Introduction	Steps for cleaning and ensuring EV fleet readiness	
	Activities	<p>Reading Comprehension: (30 min) Provide students with the reading, "How to Clean Your Car Interior Like a Pro". Display the reading on the board, and read aloud as a class. Have students identify information about: Cleaning chemicals, cleaning equipment, and steps. Discuss as a class the customer service implications of fleet cleanliness.</p> <p>Experiential Learning Activity - Vehicle Report (1 hour 45 mins) Step 1: Form pairs or small groups (3-4 students). Each group will select or be assigned a fleet vehicle to inspect.</p> <p>Step 2: Create the Vehicle Report Interior Detailing Needs: Identify at least three items that require cleaning, restoration, or detailing inside the vehicle. For example, you could note dirty upholstery, dust buildup on vents, or sticky dashboard surfaces. Exterior Detailing Needs: Identify at least three items on the exterior that require attention, such as dirt buildup on the body, bird droppings, worn-out tires, or dirty windows. Damage or Issues Beyond Detailing: Identify at least one issue that falls outside of detailing (e.g., a dent, scratch, broken facia, cracked windshield, or malfunctioning part).</p>	

		<p>For each item listed, provide a description of the damage or issue.</p> <p>Step 3: Detailing and Repair Plans For each item listed in your report, explain how it would be cleaned or detailed: What tools, products, or techniques would you use to clean or restore the item? Include any special instructions or steps to ensure proper care (e.g., "Use leather conditioner to treat the upholstery"). For the damage or issues that require repair (outside of detailing): Explain how you would refer this issue to a qualified technician. For example, "The dent on the rear bumper will need to be referred to our body shop for a professional repair." Be specific about the steps or processes you would follow to escalate this issue.</p>	
	Assessment	<p>Reflections & Questions (15 mins) On a 3x5 card, ask students to write one thing they learned today and one question they have. Select as many questions as there is time to answer before the end of the session.</p>	
Week 3, Day 2 2.5 Hours	Introduction:	(Continued) Steps for cleaning and ensuring EV fleet readiness	
	Activity	<p>Activity Continued: (2 hours) Step 4: Customer Communication Imagine that a customer has called and expressed concern about the issues you've identified. In teams, students will role-play a phone conversation where they explain how each issue will be handled:</p> <ul style="list-style-type: none"> • What would you say to reassure the customer that their concerns are being taken seriously? • How will you explain the detailing process for each of the interior and exterior items? • How will you explain the non-detailing issues (such as the dent or scratch) and let the customer know that they will be referred to the appropriate technician? <p>Step 5: Presentation (Flipped Classroom) Students present their findings to the class:</p> <ul style="list-style-type: none"> • Share your vehicle report, detailing the interior and exterior needs, as well as the damage. • Explain your plans for detailing the items and referring any non-detailing issues to a technician. • Role-play the customer call, demonstrating how you would communicate effectively and professionally with a customer. 	
	Assessment	Application of Workplace Knowledge: (30 mins)	

		<p>Completeness of Report: Did you identify at least three interior and three exterior detailing needs? Did you include one non-detailing issue?</p> <p>Detailing Plan: Are the steps for cleaning or detailing the items well-explained and realistic?</p> <p>Repair Referral: Is the referral process for non-detailing issues clear and professional?</p> <p>Customer Communication: Is the role-play of the customer call professional, empathetic, and clear?</p>	
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Module #4: OSHA & Safety Precautions			
Objective: Understanding and preparation for OSHA 10 certification			
Instructional Materials: YouTube video, online articles, OSHA.gov website			
Lesson Plan			Standards/ Aligned Text
Week 4, Day 1 2.5 Hours	Introduction	OSHA 10 & Safety Precautions	
	Activities	<p>OSHA 10 Background (1 hour 30 mins) Use OSHA 10 Electrical Training materials found on the OSHA.gov website to prepare students for the OSHA 10 certification.</p> <p>Q&A (30 mins) After reviewing the materials, have students discuss via Q&A with the instructor (or OSHA 10 certified guest speaker) After the Q&A divide the class into two groups. Group A will create dangerous scenarios that violate electrical OSHA safety standards and Group B will create 10 dangerous scenarios that violate automotive OSHA safety standards.</p>	
	Assessment	<p>Active Learning Assessment: (30 mins) Students will demonstrate knowledge through examples of safety and training using scenarios.</p>	

<p>Week 4, Day 2 2.5 Hours</p>	<p>Introduction:</p>	<p>OSHA Contextualization</p>	
	<p>Activities</p>	<p>Active Reading: (2 hours) As a class, read and review the PPE & OSHA Safety guide for Automotive and Electrical Work: OSHA PPE Article</p> <p>In Groups: Split the class into small groups and assign each group the activities:</p> <ul style="list-style-type: none"> ● Create a venn diagram to outline the similarities and differences between the PPE required for electrical and automotive work. ● Discussion: After completing their venn diagrams, students will respond to the following questions: ● What PPE do you think is necessary for a car share organization? ● What risks and dangers might be present in a car share workplace? 	
	<p>Assessment</p>	<p>OSHA Quiz & Review: (30 mins) Students will complete a 5 question quiz that is based on the basics of electrical safety</p> <p>1. What is the primary purpose of the Lockout/Tagout (LOTO) procedure in electrical safety? A) To prevent the accidental operation of machinery during maintenance B) To ensure electrical equipment is energized for testing C) To identify malfunctioning electrical equipment D) To provide a visual warning to workers about potential electrical hazards</p> <p>2. Which of the following is a common electrical hazard in the workplace? A) Tripping over electrical cords B) Exposed wires C) Overloaded circuits D) All of the above</p> <p>3. When working with electrical equipment, what is the minimum recommended distance from an energized electrical source? A) 1 foot B) 3 feet</p>	

		<p>C) 10 feet D) 15 feet</p> <p>4. What type of protective equipment should be used when working on or near electrical circuits? A) Safety glasses and gloves B) Hard hat and steel-toed boots C) Rubber insulating gloves and protective face shield D) Hearing protection and reflective vest</p> <p>5. Before beginning work on electrical systems, employees should ensure that: A) All equipment is properly grounded B) All electrical systems are energized C) Personal protective equipment is not required D) Power sources are locked out and tagged out</p> <p><i>Answer Key:</i> A) To prevent the accidental operation of machinery during maintenance D) All of the above B) 3 feet C) Rubber insulating gloves and protective face shield D) Power sources are locked out and tagged out</p>	
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Module #5: Foundational Electrical Concepts			
Objective: Learn basic electrical vocabulary, concepts and safety standards.			
Instructional Materials: YouTube video, online articles			
Lesson Plan			Standards/ Aligned Text
Week 2, Day 1 2.5 Hours	Introduction	Ohm's Law, Electrical Terminology, & Principles	
		Warm up: (20 mins) As students to respond to the following question in paragraph format, then discuss responses:	

- Now that we have discussed electrical and automotive safety, why do you think that it's important that we understand basic electrical principles next?
- Why do you think understanding electrical components, terminology, and principles will help you work in a car share organization?
- Responses should include discussion of charging stations, understanding how electric cars charge and maintain/lose power, and understanding dangers that may arise at charging stations.

Ohm's Law (2 hours):

Introduction to OHM'S Law: Watch the [Ohm's Law Explained](#) video or [read the article](#) and, as a class, work through the terminology and theory:

1. Ohm's Law:

A fundamental principle in electrical engineering that states the relationship between voltage (V), current (I), and resistance (R). It can be expressed as:

- Voltage = Current x Resistance
- Current = Voltage / Resistance
- Resistance = Voltage / Current

2. Voltage (V):

The electric potential difference between two points, which drives the flow of current in a circuit. It's often referred to as the "pressure" that pushes electrons through a conductor.

3. Current (I):

The flow of electric charge (electrons) through a conductor, typically measured in amperes (A). It represents the amount of charge passing a point in a circuit per second.

4. Resistance (R):

The opposition to the flow of electric current in a circuit. It is measured in ohms (Ω) and determines how much current will flow for a given voltage.

5. Amperes (A):

The unit of electric current, representing one coulomb of charge passing a point in a circuit per second.

6. Ohms (Ω):

The unit of electrical resistance. It represents the resistance of a conductor through which a current of one ampere flows when subjected to a voltage of one volt.

7. Electromotive Force (EMF):

		<p>Another term for voltage, representing the energy provided by a source like a battery or generator to drive current through a circuit.</p> <p>8. Ohm's Triangle: A mnemonic device used to help remember Ohm's Law formulas. It is a triangle with Voltage (V), Current (I), and Resistance (R) arranged in such a way that covering one of the letters helps derive the formula for the missing quantity.</p> <p>9. Ampere (A): A standard unit for measuring electric current. Named after André Ampère, a French physicist who worked on the theory of electromagnetism.</p> <p>10. Power (P): The rate at which electrical energy is transferred by an electric circuit. Power is the product of voltage and current ($P = V \times I$).</p> <p>11. Resistor: A component in an electrical circuit used to control the flow of current by providing a specific amount of resistance.</p> <p>12. Multimeter: A tool used to measure voltage, current, and resistance in electrical circuits. It is essential for troubleshooting and verifying the behavior of circuits.</p> <p>13. Direct Proportional: A relationship between two quantities where an increase in one results in an increase in the other (e.g., current is directly proportional to voltage in Ohm's Law).</p> <p>14. Inverse Proportional: A relationship between two quantities where an increase in one results in a decrease in the other (e.g., current is inversely proportional to resistance in Ohm's Law).</p> <p>15. Electrons: Subatomic particles with a negative charge that move through a conductor to create electric current.</p> <p>16. LED (Light Emitting Diode): A semiconductor device that emits light when current flows through it. LEDs require careful control of current, often through resistors, to prevent damage.</p>	
	<p>Assessment</p>	<p>Exit Ticket: (10 mins)</p>	

		<p>Students will pick one term and write down a key fact that was learned in today's lesson:</p> <ul style="list-style-type: none"> ● Voltage ● Current ● Ampere ● Power ● Multimeter 	
Week 2, Day 2 2.5 Hours	Introduction	Basic Electrical Math Principles Part 1	
	Activities	<p>Basic Electrical Math (2 hours 15 mins)</p> <p>Using Mike Holt's Electrician's Math and Basic Electrical Formulas text, work through Chapter 4, Unit 10, Basic Math.</p> <p>As a class, walk through each unit, taking time to complete the examples in pairs, sharing answers along the way.</p> <p>Electrical Concepts:</p> <ul style="list-style-type: none"> ● Whole Numbers ● Fractions ● Decimals ● Percentages ● Parentheses ● Squaring a number ● Square Root ● Kilo ● Rounding ● Surface Area of a Rectangle or Square ● Surface Area of a Circle ● Volume ● Reciprocal 	
	Assessment	Checking for Understanding (15 mins) Students will be assigned	

Module #6: Inverters and Reading a Multimeter
Objective: Part 2 of Electrical Mathematical Principles and an introduction to inverters, multimeters
Instructional Materials: YouTube video, online articles

Lesson Plan			Standards/ Aligned Text
Week 2, Day 1 2.5 Hours	Introduction	Ohm's Law & Watt's Law - Math Principles	
	Activities	<p>Electrical Math Principles (2 hours 15 mins)</p> <p>Using Mike Holt's Electrician's Math and Basic Electrical Formulas text, work through Chapter 5, Unit 12: Ohm's Law, and Unit 14: Watt's Law</p> <p>As a class, walk through each unit, taking time to complete the examples in pairs, sharing answers along the way.</p> <p>Ohm's Law:</p> <ul style="list-style-type: none"> ● The Electrical Circuit ● Electromotive Force (Pressure) ● Circuit Resistance ● Circuit Intensity ● Ohm's Law ● Ohm's Law Formula Circle <p>Watt's Law:</p> <ul style="list-style-type: none"> ● Watt's Law ● Power Formula Circle ● Power Changes with the Square of Voltage 	
	Assessment	<p>Practice Question (15 mins):</p> <p>Provide sample values for Ohm's Law and Watt's Law. Students will provide their answers to another group to be graded and must show their work.</p>	
Week 2, Day 2 2.5 Hours	Introduction	<p>Inverters and Multimeters Continued</p> <p>Warm Up Discussion: (15 mins)</p> <p>Ask students to name off any and all electrical components and terminology they know.</p>	
	Activities	<p>Residential vs Commercial Electrical (45 mins)</p> <p>Introduce additional electrical terminology using a PowerPoint presentation including examples for both residential and commercial devices. Topics include:</p> <ul style="list-style-type: none"> ● GFCI ● EV Chargers ● Fuses ● AC/DC ● Circuit Breaker ● Electrical Panel 	

		<p>Multimeter Practical Use (1 hour) Provide each team with a multimeter and demonstrate how to measure voltage, current, and resistance in a circuit. Have students test the voltage across a battery, check the resistance of a resistor, and measure the current through a simple circuit.</p> <ul style="list-style-type: none"> ● Activity Challenge: <ul style="list-style-type: none"> ○ Each group should measure and record the voltage of a DC battery and the AC outlet. ○ Then, they should measure the current flowing through a working electrical device (e.g., a fan) and calculate the power consumption. <p>Materials: The following materials can be included if participants are going to prepare for a career in EV repair and/or electrical. Ugly's Electrical References (HD) 2023 Edition - Includes formulas and circuits for further learning.</p> <p>Independent Learning: (1 hour) As a class watch the following video on electrical currents: Electrical Current Explained - AC DC, fuses, circuit breakers, multimeter, GFCI, ampere</p> <p>While watching the video, students take notes on terminology and topics they think are important.</p> <p>Digital Literacy Unit: Students independently research the terms and topics they noted while watching the video. Students can also take notes in a Google Doc or Word Doc and email their findings to their instructor.</p> <p>Materials: The following materials can be included if participants are going to prepare for a career in EV repair and/or electrical. Ugly's Electrical References (HD) 2023 Edition - Includes formulas and circuits for further learning</p> <p>Understanding Inverters: (30 mins) Pre-work: Students will discuss the following items in pairs: <ul style="list-style-type: none"> ● One thing you know about inverters, one thing you want to learn about inverters, and a theory about how inverters are related to electric vehicle fleet maintenance. <p>Watch Power Inverters Explained video as a class and discuss it for understanding.</p> <p>Peer Work: In pairs, look back at the pre-work activity to see if you answered your question and discuss what you learned that might be surprising.</p> </p>	
	<p>Assessment</p>	<p>Exit Ticket & Review: (5 mins)</p>	

		<p>On a 3x5 card, students will answer the following questions before leaving class:</p> <ul style="list-style-type: none"> • What does a multimeter measure? • What is the function of a circuit breaker? • How does a GFCI outlet help prevent electrical hazards? 	
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Module #7: Power & EV Systems			
Objective: Understanding EV's and calculating EV power usage			
Instructional Materials: YouTube video, online articles			
Lesson Plan			Standards/ Aligned Text
Week 2, Day 1 2.5 Hours	Introduction	Calculating power usage and efficiency in EV systems	
	Activities	<p>Flipped Classroom: (1 hour) In groups, students will read the U.S. Department of Energy article "Electricity Basics"</p> <ul style="list-style-type: none"> • Complete a vocabulary word search. Students will write down the definitions of the terms they find. <p>Discussion: Groups will share the terms they found along with the definitions. If there are new or unknown terms, ask students to share and problem solve with the students to find the definition, modeling computational thinking.</p> <p>Active Reading & Contextualized Workplace Skills: (1 hour) As a class, read the United States Environmental Protection Agency article "Fuel Economy and EV Range Testing" and read "How to Estimate Charging Time and Power for Your Electric Vehicle"</p> <ul style="list-style-type: none"> • After reading the article, ask students to calculate, using sample values, to practice calculating the range of EV vehicles. 	
	Assessment	<p>Pair and Share: (30 mins) In pairs, ask students to discuss the complication of EV fleet vehicles charging in public spaces. How long will it take to charge an EV fleet vehicle that has no charge remaining? What are some complications they predict will take place when operating EV's in the community?</p>	

		After completing their discussion, ask groups to summarize their thoughts and share.	
Week 2, Day 2 2.5 Hours	Introduction:	EV Battery Systems	
	Activities	<p>Active Reading with Digital Literacy: (2 hours 20 mins) Materials Needed: Computer or devices with access to Microsoft Office or Google Suite.</p> <p>Collaborative Slide Deck: Divide the U.S. Department of Energy article “Batteries for Electric Vehicles” article into short pieces so each student receives one section. Ask each student to read their section and create a Google Slides page. Once the entire class has completed their assignment, review the shared, group Google Slide with the class, clarifying as needed and summarizing as a class on the final slide.</p> <p>Collaborative Learning: Dividing the class into small groups, read the U.S. Department of Energy article “Electric Vehicles for Fleets”</p> <ul style="list-style-type: none"> ● Students will outline the article on a presentation sticky or shared Word Doc. ● Note important and new terminology, researching new terms and concepts. ● Students will report back to the class three important facts and one new concept they learned. <p>Class Discussion: How do the three articles from this week impact an EV car sharing fleet? What did you learn that would be important to a EV fleet manager?</p>	
	Assessment	<p>Exit Ticket (10 mins) What impact do you think EV’s have on the environment and community? Do you think that understanding the impact of EV’s on the environment and community is important to a car sharing program?</p>	

Module #8 Types of EV Chargers and Troubleshooting Charging Issues

Objective: Recognize the differences in EV chargers and practice simple troubleshooting steps

Instructional Materials: YouTube video, online articles

Lesson Plan			Standards/ Aligned Text
Week 2, Day 1 2.5 Hours	Introduction	Types of EV Chargers	
	Activities	<p>Pre-work KWL (20 mins) Students will complete a K-W-L chart prior to reading about EV chargers and charging stations as a class. K: What you already know W: What you want to learn L: What you learned</p> <p>Active Reading (1 hour) As a class, read "Electric Vehicle charging Stations" on the U.S. Department of Energy website.</p> <p>Active Reading: (1 hour) In the "L" section, students will note important terminology, concepts that are new, and draw labeled diagrams of the different chargers.</p>	
	Assessment	<p>Quick Quiz (10 mins) Using unlabeled visuals, check for understanding by asking students to write their answers to your questions on a piece of paper and hold it up when answered.</p>	
Week 2, Day 2 2.5 Hours	Introduction:	Troubleshooting Charging Issues	
	Activities	<p>Instruction (40 mins) Present a slide deck with images and instructions for troubleshooting charging issues.</p> <p>Discussion: (20 min) In pairs, students will discuss the following questions and report back to the larger group:</p> <ul style="list-style-type: none"> Based on what you learned in the lecture, what are some charging issues that might occur with a car sharing fleet vehicle versus a residential charging station. 	

		<ul style="list-style-type: none"> Write down three to four issues/problems a car share customer might have about a charging station? We will continue to explore for the remainder of the session. <p>Lab Work (1 hour) Using lab based EV cars or trainers, split students into pairs to identify charging issues and troubleshoot solutions.</p> <p>Discussion: (10 mins) As a class, students will report back their findings.</p> <ul style="list-style-type: none"> What issues occurred? How were they solved? What could this look like in the field for a car sharing organization? 	
	Assessment	<p>Evaluation of understanding (20 mins) Review students' responses and observations. Complete an evaluation based on their demonstration of knowledge while in the lab and connection to the larger car sharing project.</p>	

Module #9 Troubleshooting EV Systems			
Objective: Understanding key principles to troubleshoot EV charging systems and internal systems in the field.			
Instructional Materials: YouTube video, online articles			
Lesson Plan			Standards/ Aligned Text
Week 2, Day 1 2.5 Hours	Introduction	Using diagnostic software to identify and address system malfunctions	
	Activities	<p>Instruction (40 mins) Present a slide deck with images and instructions for diagnosing software to identify and address system malfunctions.</p> <p>Discussion: (20 min) In groups, students will discuss the following questions and report back to the larger group:</p> <ul style="list-style-type: none"> Based on what you learned in the lecture, what are some charging issues that might occur with a car 	

		<p>sharing fleet vehicle versus a residential charging station.</p> <ul style="list-style-type: none"> • Write down three to four issues/problems a car share customer might have about a charging station? We will continue to explore for the remainder of the session. <p>Lab Work Part 1 (1 hour) Using lab based EV cars or trainers, split students into pairs to identify charging issues and troubleshoot solutions.</p> <p>Discussion: (10 mins) As a class, students will report back their findings.</p> <ul style="list-style-type: none"> • What issues occurred? • How were they solved? • What could this look like in the field for a car sharing organization? 	
	Assessment	Evaluate participation during group discussions and presentations. Review the detail and critical thinking in students' responses.	
<p>Week 2, Day 2 2.5 Hours</p>	Introduction:	Troubleshooting onboarding sensors, lights, and auxiliary systems	
	Activities	<p>Contextualized Slide Deck (30 mins) While walking students through a slide deck presentation, demonstrate each step on a lab-based EV car or trainer. Students should be taking notes while observing.</p> <p>Lab Work Part 2 (1 hour) Using lab-based EV cars or trainers, split students into pairs to identify and troubleshoot onboarding sensors, lights, and auxiliary systems.</p> <p>Troubleshooting Process Map During Lab Work (1 hour) After observing the troubleshooting steps and practicing through lab work, students will use their notes to build their own Troubleshooting Process Map.</p> <p>Digital Literacy Activity: Students can use Microsoft Word, PowerPoint, Google Docs or Google Slides to build a digital process map. Students will email their findings to their instructor.</p> <p>Materials: Computer, iPad, or tablet. Google account or access to Microsoft Office Suite.</p>	

	Assessment	Students will email a copy of the troubleshooting map created during lab hours. Students will be evaluated using a rubric.	
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Final Exam: Hands-On Practice and Assessments (6 hours)	
Real-world repair scenarios, including applying Ohm's and Watt's Laws to troubleshoot EV systems battery swaps, motor diagnostics, and charging station troubleshooting Practical assessments to evaluate understanding and readiness	Standards/ Aligned Text

Routine Vehicle Inspection Checklist

Routine Vehicle Inspection Checklist

Fleet Number:

Make/Model:

Vin Number:

Vehicle Mileage:

Exterior Check:

- Inspect for dents, scratches, or visible damage.
- Ensure all exterior light covers are in good condition.
- Check tire condition (tread depth, inflation, or visible damage).
 - Tire Pressure & Condition:
 - Left Front (LF):
 - Right Front (RF):
 - Right Rear (RR):
 - Left Rear (LR):
- Verify charging port cover is intact and functional.
- Visually inspect vehicle undercarriage (rust, broken covers, debris).

Observations:

Interior Check:

- Confirms seats and seatbelts are in good condition.
- Check cleanliness and any interior damage.
- Verify dashboard indicators (e.g., battery charge level, warning lights) are operational.
- Ensure all infotainment and control systems (e.g., touchscreen, navigation, climate control) are functioning correctly.

Observations:

Battery and Charging System:

- Check state of charge and ensure sufficient range for operation.
- Inspect charging port for dirt, debris, or damage.
- Test charging functionality at Level 1 or Level 2 stations (ensure connection is secure).
- Verify cables are free from fraying or visible damage.

Observations:

Under the Hood:

- Inspect coolant levels for battery and power electronics.
- Check brake fluid levels.
- Examine high-voltage cables for wear or damage (only visually, no handling).
- Verify condition of auxiliary 12V battery (connections and corrosion).

Observations:

Operational Test:

- Start the vehicle and check for any unusual noises.
- Test brakes, steering, and accelerator.
- Ensure all exterior lights (headlights, brake lights, turn signals, taillights) are functioning.
- Ensure regenerative braking system if functional.
- Confirm the air conditioning/heating system works correctly.

Observations:**Software and Connectivity:**

- Verify the vehicle's software is updated (if applicable).
- Test app-based connectivity (e.g., remote start, lock/unlock, range monitoring).
- Check navigation and any live data services (e.g., traffic updates).

Observations:**Documentation:**

- Record mileage:
- Current range:
- Note any issues or concerns identified during the inspection.

Observations:

EV Deployment Preparation Checklist

EV Deployment Preparation Checklist

Cleaning and Sanitation:

- Exterior washed and free of dirt/debris.
- Interior vacuumed and free of trash.
- High-touch surfaces sanitized (e.g., door handles, steering wheel).

Charging and Range:

- State of charge verified (at least 90% or as required).
- Charging port and cable inspected for damage.
- Range sufficient for next planned use.

System Updates and Connectivity:

- Software updates verified.
- Connectivity features tested (remote access, navigation, app functions).

Final Inspection:

- Lights and indicators are functional.
- Tires inflated and in good condition.
- Dashboard shows no warning lights.
- Status recorded in fleet management system.