



Electric Vehicles Toolkit

ADVENTURE THROUGH AN ELECTRIC VEHICLE

MIDDLE SCHOOL SCIENCE

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Adventure Through An Electric Vehicle

How does an electric vehicle work?

Lesson Overview	Career Highlight
Students will identify parts of an electric vehicle, determine their various functions through a webquest, and then use these EV parts to write a script for an episode in a children's animated TV series where a science teacher takes their students on adventures to discover times, places, and scientific things.	Technical Communications Manager

STEM Course Connections	21st Century Skills	CTE Alignment
Middle School Physical Science Middle School Earth Science	Creativity and Innovation	Career Readiness

Engineering Activity	
Science and Engineering Practice #2	Students will write a story (model) that explores the parts of an electric vehicle.

Materials
<ul style="list-style-type: none">• Student handout• Storyboard Template


Essential Questions
<ol style="list-style-type: none">1. How does an electric vehicle work?2. What are the different components to an electric vehicle?3. How is energy transferred?

Background Information
Unlike a gasoline car, the electric vehicle only has one moving part, the electric motor. The electric motor's sole purpose is to convert electrical energy into mechanical energy, which then moves the vehicle. The electrical energy comes from the battery of the car. But an issue arises: electric motors use alternating current (AC) while the battery holds direct current (DC). To switch the battery's DC to AC, an inverter is used. The inverter is placed between the battery and motor. The inverter switches the direction of DC current rapidly, ultimately creating an AC output. The controller manages the flow of electricity that goes from the battery to the inverter. For example, when you press on the accelerator pedal, the controller will adjust the inverters amplitude, delivering more

torque. Finally, the wheels begin moving when the transmission transfers the mechanical energy from the electric motor to the wheels.

Mission Prep

Engage (10 mins)

1. Show students the following video clip about how electric vehicles work:
 [How do electric cars work? | Made in Germany](#)
2. After watching the “How Do Electric Cars Work?” video, have students journal about in their [student handout](#) :
 - *What is the role of a battery for an electric vehicle?*
 - *What is the role that magnets play in the function of an electric vehicle?*
 - *What is a limitation to electric vehicles currently?*

Explore (10 mins)

1. Parts of An Electric Vehicle Webquest
Have students gather information from these two websites: [How Electric Vehicles Work](#) and [How Do All-Electric Cars Work?](#) and record their findings on the [attached handout](#) ([Key](#)).

Launch

Explain (10 mins)

1. [Electric Vehicle Parts Matching](#)
Using the information found through their webquest, students should [visit Desmos](#) and complete this matching activity to demonstrate mastery of part identification.

Elaborate (60 mins)

1. EV Adventure Story Introduction
Students will write an “Adventure Story” script for a children’s animated TV episode called “Adventure through an Electric Vehicle,”imagining this episode script is part of a series in which a science teacher takes their students on different adventures to discover times, places, and scientific things. This particular episode should be about traveling through the parts of an electric vehicle. Students should incorporate all of the parts of the electric vehicle identified in the prior activity and their role in the function of the vehicle.
2. Storyboard Template
Once introduced, students can use this [storyboard template](#) to brainstorm their adventure story.
3. Final Draft
Students create their final draft in modality of teacher’s choosing (digital through sites like Google Slides or Canva) or on paper.
4. Adventure Story Grading Rubric

Exploration

Evaluate (15 mins)

1. Share Out

Students should exchange their adventure story with a partner. As they read through their partner's story, they can complete the peer reflection in the [student handout](#).

Extend (10 minutes)

The Importance of Communication

After students have had the chance to read one another's adventure stories and reflect, conclude the class with a conversation on the importance of developing strong communication skills.

- Show the SEMI career profile [video](#) of Jennifer, a Technical Communications Manager for Entegris.
- In small groups, have students discuss Jennifer's role, her impact on the company's success, and what skills she is using to fulfill her job.
- Follow up questions to the small groups (or individual reflection): How did we use communication skills in this lesson? What communication skills do you feel are your strengths? What communication skills would you like to continue to develop?

CA NGSS Standards

- MS-PS3-5. Construct, use, and present arguments to support the claim that when the kinetic energy of an object changes, energy is transferred to or from the object.
- PS3.B: Conservation of Energy and Energy Transfer - When the motion energy of an object changes, there is inevitably some other change in energy at the same time.
- MS-ESS3-3. Apply scientific principles to design a method for monitoring and minimizing a human impact on the environment
- ESS3.C: Human Impacts on Earth Systems - Human activities have significantly altered the biosphere, sometimes damaging or destroying natural habitats and causing the extinction of other species. But changes to Earth's environments can have different impacts (negative and positive) for different living things.

CTE Alignment

- EA 2.5 Communicates information and ideas effectively to multiple audiences using a variety of media and formats.
- EA 4.1 Use electronic reference materials to gather information and produce products and services.
- EA 5.3 Use systems thinking to analyze how various components interact with each other to produce outcomes in a complex work environment.

Resources

"How Do Electric Cars Work? | Made in Germany." YouTube, 10 Aug. 2016, www.youtube.com/watch?v=x1ystf-nnE8&ab_channel=DWNNews.

Padia, Nicole. *"Parts of an Electric Vehicle Matching Activity."* Desmos Classroom Activities, teacher.desmos.com/activitybuilder/custom/648b5c477aef886296570006. Accessed 7 July 2023.

"How Electric Vehicles Work." Sustainable Energy Authority Of Ireland, www.seai.ie/technologies/electric-vehicles/what-is-an-electric-vehicle/how-electric-vehicles-work/. Accessed 7 July 2023.

"How Do All-Electric Cars Work?" Alternative Fuels Data Center: How Do All-Electric Cars Work?, afdc.energy.gov/vehicles/how-do-all-electric-cars-work. Accessed 7 July 2023.

Hydro, BC. "Inside an EV: Grade 6-8." BCHydro Power Smart for Schools, schools.bchydro.com/activities/sustainability/inside-an-ev. Accessed 7 July 2023.

"Solar Integration: Inverters and Grid Services Basics." Energy.Gov, www.energy.gov/eere/solar/solar-integration-inverters-and-grid-services-basics#:~:text=Inverters%20are%20just%20one%20example,input%20becomes%20an%20AC%20output. Accessed 7 July 2023.