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| **Lesson Title :** Storing Energy is Necessary to Control When It’s Used | **Unit #:**  **1** | **Lesson #:**  **1** | **Activity #:**  **1** |
| **Activity Title:** Apply the Hook and Brainstorm “Essential Quesitons” |

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| **Estimated Lesson Duration:** | 3 Days |
| **Estimated Activity Duration:** | 1 Day |

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| **Setting:** | St. Xavier HS faculty parking lot and room 1556 |

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| **Activity Objectives:** |

Given the topic of Energy Use without Fossil Fuels, students will develop the primary “Essential Question” through brain-storming.

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| **Activity Guiding Questions:** |

1. How fast do they think a 2015 Chevy Volt can go?
2. How quickly do they think it can accelerate?
3. What do they think its towing power is?
4. How long do they think it takes to charge?
5. How far do they think a charge takes a person?
6. How does it stop?
7. Why is there a gasoline engine?

| **Next Generation Science Standards (NGSS)** | |
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| **Science and Engineering Practices (Check all that apply)** | **Crosscutting Concepts (Check all that apply)** |
| ☒ Asking questions (for science) and defining problems (for engineering) | ☐ Patterns |
| ☐ Developing and using models | ☐ Cause and effect |
| ☒ Planning and carrying out investigations | ☐ Scale, proportion, and quantity |
| ☐ Analyzing and interpreting data | ☒ Systems and system models |
| ☐ Using mathematics and computational thinking | ☒ Energy and matter: Flows, cycles, and conservation |
| ☒ Constructing explanations (for science) and designing solutions (for engineering) | ☐ Structure and function. |
| ☐ Engaging in argument from evidence | ☐ Stability and change. |
| ☒ Obtaining, evaluating, and communicating information |  |

| **Ohio’s Learning Standards for Science (OLS)** |
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| **Expectations for Learning - Cognitive Demands (Check all that apply)** |
| ☒ Designing Technological/Engineering Solutions Using Science concepts **(T)** |
| ☒ Demonstrating Science Knowledge **(D)** |
| ☐ Interpreting and Communicating Science Concepts **(C)** |
| ☐ Recalling Accurate Science **(R)** |

| **Ohio’s Learning Standards for Math (OLS) and/or**  **Common Core State Standards -- Mathematics (CCSS)** | |
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| **Standards for Mathematical Practice (Check all that apply)** | |
| ☒ Make sense of problems and persevere in solving them | ☐ Useappropriate tools strategically |
| ☒ Reason abstractly and quantitatively | ☐ Attendto precision |
| ☐ Construct viable arguments and critique the reasoning of others | ☒ Look for and make use of structure |
| ☐ Model with mathematics | ☒ Look for and express regularity in repeated reasoning |

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| **Unit Academic Standards (NGSS, OLS and/or CCSS):** |

From *Course Outcomes for Regular Physics*, November 19, 2015.

4. Defend the use of 1st principles, assumptions, formulae, and graphs to accurately predict the outcome of a described physical phenomenon.

8. Analyze the current and future behavior of physical systems using the idea of kinetic and potential energy as well as the laws of conservation of energy and conservation of momentum.

10. Calculate the current, voltage and/or resistance in an electrical circuit.

11. Design and build electrical circuits using a single power source and resistors.

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| **Materials**: (Link Handouts, Power Points, Resources, Websites, Supplies) |

stxavier.instructure.com (Canvas Discussion will be used)

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| **Teacher Advance Preparation:** |

Create the Canvas Discussion. Make sure car will have enough charge to get through day.

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| **Activity Procedures:** |

1. Take students on “class trip” to faculty parking lot.
2. Explain how Volt gets power and powertrain differences.
3. Demonstrate driving on electric.
4. Present **Activity Guiding Questions** to them and have them right them down.
5. Return to class and have them brainstorm potential **Essential Questions** dealing with storing and using energy using the Canvas discussion board.

**Formative Assessments:** Link the items in the Activities that will be used as formative assessments.

Observe classroom discussion to encourage full participation.

Make certain everyone gets a voice and that they are thinking on-track.

**Summative Assessments:** These are optional; there may be summative assessments at the end of a set of Activities or only at the end of the entire Unit.

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| **Differentiation:** Describe how you modified parts of the Lesson to support the needs of different learners.  Refer to Activity Template for details. |

All students can participate in brainstorming. They can work to their own level, asking more basic or more constructed and detailed questions as they feel comfortable.

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| **Reflection:** Reflect upon the successes and shortcomings of the lesson.  Both a success and a shortcoming was that the discussion led to literally hundreds of responses. I did not know what to do with them, as I was hoping to have a small set of questions that we could optimize to come to my Essential Question. It was clear that the students kept using certain phrases, and that led me to think to put it into a word cloud. That helped me manage the onslaught of data well. |