

FUEL OUR FUTURE NOW

G3–5

MODULE OVERVIEW – Designed for Efficiency

MODULE OVERVIEW

Module Description: Students conduct experiments, explore with online interactives, and watch videos that will help them answer the question: *How do transportation vehicles such as cars, trucks, and buses move?* Students will determine what it means for a vehicle to be efficient. They use what they learn about efficiency to analyze the performance of actual vehicles. Finally, students demonstrate their understanding by designing efficient vehicles of their own.

Module Project: Students work individually or collaboratively to design a moving vehicle that uses energy efficiently. Depending on the available resources, their designs may take the form of working models, multimedia presentations, or letters to automotive executives.

Module Objectives:

- Develop an operational definition of *efficiency* as it relates to transportation vehicles.
- Identify design features of transportation vehicles that contribute to reduced friction.
- Describe how the energy in fuel or other energy sources is converted into vehicular motion.
- Design and describe efficient transportation vehicles.

Relevant STEM Topics:

- Forces and Motion
- Energy and Efficiency
- Engineering Design
- Collecting and Recording Data
- Conducting Experiments
- Making Calculations

Please see *Standards Addressed in G3-5* for a list of the applicable science, technology, engineering, and math standards, as well as the 21st Century Skills.

Total Time: 2–3 weeks

LESSON PLANS

Lesson 1 – Force and Motion

Students are introduced to the module project. They apply what they already know about force and motion to begin their exploration into vehicle design.

Lesson 2 – That Force Called Friction

Students conduct an experiment to help them relate the concepts of force, motion, and friction. They investigate ways of reducing the effect of friction on vehicle movement.

Lesson 3 – Air Resistance as a Frictional Force

Students use blow dryers to simulate the effect of air resistance on vehicle movement. They continue to consider how various forces contribute to or reduce a vehicle's efficiency.

Lesson 4 – What Keeps Vehicles Moving? Energy

Students learn about different kinds of energy and energy sources, both natural and technological, by observing various objects in motion.

Lesson 5 – Where Does Energy for Motion of a Vehicle Come From?

Students compare and contrast racecars in order to determine how different engines and energy sources affect vehicle efficiency and performance.

Lesson 6 – What Is Efficiency in a Vehicle?

Students explore the concept of vehicle efficiency by using marbles to represent energy units. They also collect and manipulate data to help them calculate the miles per gallon ratio for a variety of vehicles.

Lesson 7 – Designing an Energy-Efficient Vehicle

After reviewing the main concepts developed in the first six lessons of this module, students work individually or collaboratively to design their own energy-efficient vehicles. Students will have an opportunity to present their designs to their classmates in such forms as a working model, a multimedia presentation, or a letter to an automobile executive.

Acknowledgment: This material is based upon work supported by the Department of Energy, National Energy Technology Laboratory under Award Number DE-FG26-08NT03077.

Disclaimer: This Curriculum was prepared as an account of work sponsored by an agency of the United States Government. Neither the United States Government nor any agency thereof, nor any of their employees, makes any warranty, express, or implied, or assumes any legal liability or responsibility for the accuracy, completeness, or usefulness of any information, apparatus, product, or process disclosed, or represents that its use would not infringe privately owned rights. Reference herein to any specific commercial product, process, or service by trade name, trademark, manufacturer, or otherwise does not necessarily constitute or imply its endorsement, recommendation, or favoring by the United States Government or any agency thereof. The views and opinions of authors expressed herein do not necessarily state or reflect those of the United States Government or any agency thereof.

