GK–2

LESSON 2 — Motion and Force: Pushes and Pulls

MODULE OVERVIEW

Module Title: **Vroom! Vroom! What Makes Cars Go?**

Module Description: Students explore gravity, friction, and energy using objects and model cars. They investigate and define the concepts of motion, force, and energy, using simple hands-on activities with vehicles as well as online interactives and videos. At the end of the module, students apply the knowledge they have acquired about force, motion, energy and friction to design a functioning model car. Then, students share the cars with their classmates in a model car show.

Module Project: Students develop a model and/or diagram of a car and explain what causes the car to move, ways to keep it moving, and what makes it speed up or slow down.

LESSON OVERVIEW

Lesson Time: 40 minutes

Before students can determine what makes a car move, they must have a good understanding of movement and force. In Lesson 2, students will learn that a force is needed to cause motion. They will define *force* as "a push or pull." They will also discover that heavier things require more force to move than lighter things. Finally, students will observe that a greater force will move an object farther than a weaker force.

BACKGROUND FOR TEACHERS

In order for an object to begin moving, a force must be applied. All movement requires the force of a push or pull. The greater the force applied to an object, the greater the change in motion will be. Heavier objects take more force to push or pull. They take more force, and therefore more energy, to move and keep moving. They also take more force to stop once they start moving.

Teacher Preparation: A reminder: at the end of this module, you will want to have all the materials ready for the students to build their model vehicle. These are simple materials, but you may wish to begin collecting them now to be sure they are all ready by Lesson 6. See Lesson 1 for suggestions.

LESSON OBJECTIVES

By the end of this lesson, students should be able to:

- Describe what causes motion.
- Give examples of *force* in simple terms of push and pull.
- Explain that heavier objects require more force to move.
- Explain that a stronger force will make an object move farther than a weaker force.

Please see *Standards Addressed in GK-2* for a list of the applicable science, technology, engineering, and math standards, as well as the 21st Century Skills.

Lesson Essential Questions:

1. What causes motion?
2. What is force?
3. How is moving a heavy object different from moving a lighter object?
4. How can you use force to make an object go farther?

Key Vocabulary (appropriate for a word wall):

push, *pull*, *force*, *heavier*, *lighter*, *weight*, *stronger*, *weaker*, *greater*, *bigger*, *smaller*, *larger*, *harder*, *softer*, *easier*, *farther*

RESOURCES

Materials needed:

- Crayons; one per student
- Paper; one sheet per student
- Pencils; one per student
- Chalkboard and chalk, whiteboard (or interactive whiteboard, if available), or chart paper
- Glossary created in Lesson 1
- KWL chart paper or transparency created in Lesson 1
- A variety of 5–7 large, small, heavy, and light objects that students can move safely (ex. student chairs, books, backpacks, pencils, erasers, paperclips)
- Overhead transparency and transparency marker (or use an interactive white board, if available)
- A transparency of the *Moving Objects* student worksheet (if using overhead)
- At least one student computer with Internet access
- Engineering Notebook for each student

Resources from FuelOurFutureNow.com:

- Interactive Fun-damental: from *Making Things Move,* see *Pushing and Pulling*

Student Worksheets Required:

- *Moving Objects* (one copy per student, plus transparency)
- *Moving Day* (one copy per student)
- *Pushing and Pulling* (one copy per student)

What skills do students need for this lesson?

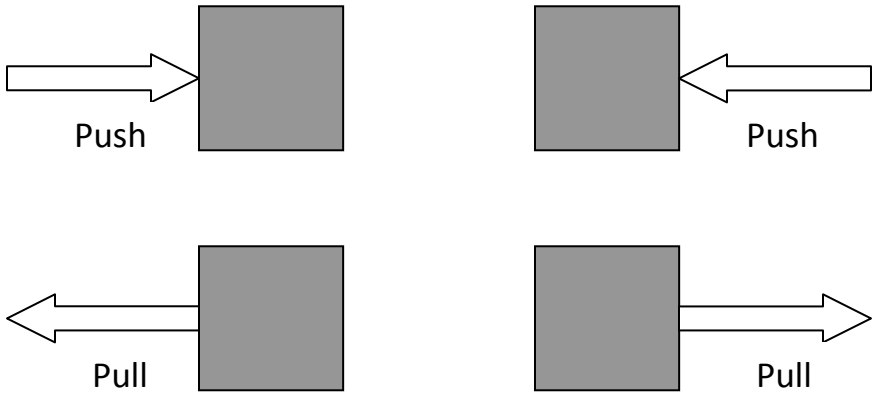
- Some experience using charts, graphic organizers, and tables
- Some experience using a computer mouse to point and click

TEACH

Engage

- Remind students of what they learned in Lesson 1. Ask students to define rolling, sliding, and bouncing, and to give examples of objects that demonstrate each kind of motion.
- If you had students answer the question about which shape is easiest to move and didn't complete a discussion, have them share their ideas out loud now.
- Ask students to think about a moving car. Does the car roll, slide, or bounce along the road? Have students write and/or draw their answers in their Engineering Notebooks. Then ask students to think about what causes the car to move down the road. Students will probably not be able to make much more than a loose association between moving and the car engine. Tell students that in this lesson they will be learning about what causes things such as cars to move.
- Give each student a crayon and a piece of paper.
- Tell students that they will be moving the crayons. Set ground rules, such as no throwing, but encourage students to try a variety of ways to move each one. Explain to students that you would like them to focus on *how* they moved each crayon. Remind them to think about what they had to do to move each one.
- Walk around and observe students as they work, providing assistance as needed. Ask questions about what they are doing and listen to their thinking. Model the language you want them to use in describing what is going on using the terms *force* and *motion*. Try drawing for them individually a sketch with arrows that indicate pulling objects and pushing objects to see if they are ready for this idea.
- After a few minutes, ask students to stop. Have volunteers describe how they moved the crayons. Guide students to determine that they used only pushes or pulls. For example, if a student says, "I picked up the crayon," ask her how she did it—was it a push or pull?

- For older children, before they record their ideas and if you feel students are ready, this is a good time to introduce the idea of using arrows to draw a force. Draw a simple box or a crayon image on the board. (See drawing below.) Place an object or the crayon on the table or floor where children can see it. As you push it, model how you can represent this with an arrow going toward the object to show force is being applied to it – it is being pushed. Draw a second object. (Do not use the first or the arrows will show both pulling and pushing.) Pull the actual object to demonstrate. Draw an arrow pointing away from the image to indicate that it is being pulled. You may need to practice having them recognize the push and pull symbols in relation to the object. Demonstrate the use of large/longer arrows for greater force vs. small/shorter arrows for less force (if age appropriate).



- Following the activity, have students draw in their Engineering Notebooks their actions and the resulting movement of the crayon as a push or a pull.
- Explain that they caused movement, or motion, by pushing and pulling things. Motion is caused by force. Pushes and pulls are forces. Give examples using responses students gave earlier in the lesson. For example, you could say: *When Angel rolled the crayon on the desk, she pushed it. She used the force of pushing. When Dominic picked up the paper, he pulled it up off the tabletop. He used the force of pulling.*
- Check students' understanding of the concepts. Write the following focus questions on the board and read them aloud: *What causes motion? What is force?* Have students whisper answers to a neighbor. Then have volunteers respond, and write their responses on the board. Read the questions and responses aloud with the class. Students should copy the questions into their Engineering Notebooks and write the answers (forces; a push or a pull) next to the questions.
- Call students' attention to the Glossary they began in Lesson 1. Reread the definition of *motion* together. Write "2. Force — a push or pull" on the chart and read it with students. If appropriate, have them write the definition in their Engineering Notebooks.

Explore

- Display the *Moving Objects* transparency on the overhead (or use the PDF version on an interactive whiteboard).

- Show students the group of objects they will be using (ex. student chairs, books, backpacks, pencils, erasers, paperclips).
- Tell students that they will be working in small groups to move each object.
- Read the directions on the transparency to students. Model how to complete a row on the worksheet by using a piece of chalk as a sample object.
- Divide students into small groups. Provide each group with one set of objects to share, but provide each student a copy of their own *Moving Objects* worksheet to complete. Instruct students to first fill in the first column by drawing or writing the names of their objects. Then have them place checks in the appropriate boxes as they push and pull each object.

Explain

- Have students share their findings with the class. Then ask them to tell if some of the things were harder to move than others. Have them tell which objects were harder to move and why they think this is.
- Guide students to conclude that heavier objects are harder to move, and therefore require more force to push or pull.
- Use an example of a student response to explain that heavier objects require more force to move. For example, say: *Kyle said that he had to pull harder in order to move the chair when Tyler was in it.* Say: *Are heavier objects harder to move than lighter objects?* Ask students to raise their hands if they think heavier objects are harder to move than lighter objects.
- Guide students to conclude that a stronger force will move an object farther than a weaker force. Have children bring a pencil and spread out on the floor. Ask students to lay their pencils on the floor and push them gently. Then have students retrieve their pencils and give them a harder push.
- Use an example of a student response to explain that a stronger force will move an object farther than a weaker force. Ask students to raise their hands if they think a harder push will cause an object to move farther than a lighter push.

Extend

- Have students respond in their Engineering Notebooks to the following question: *Which kind of car would be easiest to move: a small car or a big car?* They can draw or write their responses.
- Write the following questions on the board and read them aloud: *How is moving a heavy object different from moving a lighter object? How can you use force to make an object go farther?* Have students whisper answers to a neighbor. Then have volunteers respond, and write their responses on the board. Read the questions and responses aloud with the class. Students should copy the questions into their Engineering Notebooks and write the answers. (More force is needed to move heavy objects. Using a stronger force makes objects go farther.)

Evaluate

- Have students complete the *Moving Day* worksheet by first drawing something that is easy to move and something that is harder to move. Then have them circle the correct words to complete sentences about the objects they drew.
- You may choose to do the following as computer center work during other work time or do it with small groups depending on computer availability.
- Tell students that while they are working on their *Moving Day* worksheets, you will also be calling over students to use the computer(s) to complete an interactive activity called *Pushing and Pulling*. (The number of students called will vary based on the number of classroom computers you have, but should be no more than two students per computer.) Have students complete the *Pushing and Pulling* worksheet. If necessary, point out that the interactive has audio support for reading. (To activate, click on the audio icon in the upper-right corner of the interactive.)

Wrap-Up

- Show students the KWL chart from Lesson 1. Ask students if any of their questions were answered in this lesson. If so, write those answers in the "Learned" column. Then read the students the title of the next lesson (The Force of Gravity) and ask students if they have any new questions that might be answered going forward.
- Reread the definition of *force* together.
- Preview Lesson 3. Say: *Today we learned that* force *causes* motion*. We learned that a* force *is a push or pull. We also learned that a greater force will move an object farther than a smaller force, and that heavier objects require more force to move than lighter objects. Since cars are very heavy objects, we will need to produce a very large force to move them, as we will learn. In addition, we will learn about powerful forces that we must overcome if we are going to move a car forward. In Lesson 3, we will learn about one such powerful force—the force called* gravity*.*

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Name: _____

Moving Objects

Directions: 1. Draw or write the names of your objects in the "Objects" column.
2. Write a √ in each box after you push and pull your objects.

Objects	I Can Move It By Pushing	I Can Move It By Pulling

Name: _____

Moving Day

Directions: 1. Draw something that is easy to move and something that is hard to move.
2. Circle the words to complete the sentences about your pictures.

Easy to Move	Hard to Move
I am light/heavy**.** **I need a** small/large **force to move me.**	**I am** light/heavy**.** **I need a** small/large **force to move me.**

Name: _____

Pushing and Pulling

1. Record what you see in the *Pushing and Pulling* interactive.

	Where is the force applied?	**Is the force a push or a pull?**
Wagon		
Bulldozer		
Motorboat		

2. Draw a picture of a person opening a door. On the drawing, show where the force is that is moving the door. Label the force as a push or pull.