Sample science-literacy lesson

Grades 6–8

Welcome to Amplify Science! This sample lesson is an excerpt from the Amplify Science Middle School unit *Force and Motion*.

The sample lesson contains:

- **Classroom Slides** with lesson notes
- PDF of student article, ***Designing Wheelchairs for All Shapes and Sizes***.
- Teacher reference: ***Force and Motion*** **Coherence Flowchart**

In this lesson, students are exploring the relationship between force, mass, and change in velocity. By engaging with hands-on exploration, reading, and discussions, they work to answer the question, *How do forces affect different objects?*

Specific instructions for teaching this lesson are on the following pages and detailed in the Classroom Slide notes.

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Unit Background and Overview

The full Amplify Science *Force and Motion* unit is 16 lessons long and designed to meet NGSS physical science standards in middle school as well as a number of CCSS-ELA standards for listening, speaking, reading, and writing. In this unit, students take on the role of student physicists to help solve a physics mystery from outer space. A pod returning with asteroid samples should have stopped and docked at the space station. Instead it is now moving back away from the station, and the video feed showing what happened in the seconds during which it reversed direction has been lost. Did the pod reverse before it got to the space station or hit the station and bounce off? Students explore principles of force, motion, mass, and collisions as they solve this mystery.

Amplify Science units are broken into chapters, with each chapter building on the one before it. This sample lesson is part of the Chapter 2 sequence where students are figuring out the following: *The thrusters on the space pod carrying samples exerted the same strength force as thrusters on other pods, so why did this pod move differently?* To answer this question, students gather and make sense of evidence by engaging in a hands-on investigation; investigating with the *Force and Motion* simulation; and completing assignments that involve reading, discussing, and creating models. They figure out ideas related to force, mass, and velocity, which they can apply back to the anchor phenomenon. This chapter-by-chapter storyline is represented in the *Force and Motion* **Coherence Flowchart**.

The Amplify Science Approach

In each Amplify Science unit, students figure out an anchor phenomenon by asking questions, gathering evidence, and coming up with an explanation of how the phenomenon works. Amplify Science is rooted in the research-based Do, Talk, Read, Write, Visualize model of learning, where students engage with science and engineering practices, figure out disciplinary core ideas, and utilize and apply crosscutting concepts in multiple modalities across thoughtful, structured lessons. As they progress through each unit, students work to figure out increasingly complex ideas and construct arguments and explanations about the anchor phenomenon.

Reading in Amplify Science is approached from an inquiry stance—students ask questions, make connections, evaluate information, search for evidence, and clarify difficult concepts as they read. Amplify Science provides students with well-written, grade-level-appropriate informational texts alongside explicit, embedded instruction on reading in science. Throughout the program, students are apprenticed into reading like scientists—that is, reading actively, curiously, and critically, with a focus on making meaning and using the text as a source of evidence. As students read science texts in conjunction with other multimodal experiences around a topic (doing, talking, visualizing, writing), they increase their skill in accessing these complex texts, as well as their understanding of the importance of text for finding information.

For more information about the full Amplify Science Approach and unit components see the **Amplify Science Program Guide**.

Getting ready to teach the sample lesson

This sample lesson is designed to take approximately 40 minutes in the classroom, with minimal preparation. Note that these activities are meant to be taught sequentially but do not need to be taught the same day.

Lesson Overview

- Activity 1: Exploring Forces on Different Objects (10 minutes)
  - Students engage with hands-on materials to explore how applying the same strength force to different objects can cause different changes in velocity.
- Activity 2: Active Reading: *Designing Wheelchairs for All Shapes and Sizes* (20 minutes)
  - Students practice the Active Reading approach while deepening their understanding of the relationship between mass, force, and velocity.
- Activity 3: Discussing Annotations (10 minutes)
  - Through a discussion of the reading, students address potential confusions about the relationship between mass, force, and velocity.

Materials & Preparation

Materials

- Golf balls (one per pair)
- Table tennis balls (one per pair)
- Printable article, *Designing Wheelchairs for All Shapes and Sizes*

Preparation

- Review the slides and slide notes.
- Make a plan for how you will project the slides for students.
- Gather the physical materials.
- Each pair of students will need one golf ball and one table tennis ball.
- If these particular materials are not available, have pairs of students use one heavier and one lighter ball; alternatively, have one set of materials for demonstration.
- Make one copy of the article for each student.

Standards addressed

Grades 6–8 (middle school) Standards

The unit *Force and Motion* was designed to meet the three-dimensional goals of NGSS middle school Standards. The activities in this sample lesson were derived from lessons that address the following Next Generation Science Standards (NGSS) and Common Core State Standards for English Language Arts (CCSS-ELA):

NGSS SCIENCE AND ENGINEERING PRACTICES

- Practice 3: Planning and Carrying Out Investigations
- Practice 4: Analyzing and Interpreting Data
- Practice 5: Using Mathematics and Computational Thinking

NGSS DISCIPLINARY CORE IDEAS

- PS2.A: Forces and Motion: The motion of an object is determined by the sum of the forces acting on it; if the total force on the object is not zero, its motion will change. The greater the mass of the object, the greater the force needed to achieve the same change in motion. For any given object, a larger force causes a larger change in motion. (MS-PS2-2)
- PS2.A: Forces and Motion: All positions of objects and the directions of forces and motions must be described in an arbitrarily chosen reference frame and arbitrarily chosen units of size. In order to share information with other people, these choices must also be shared. (MS- PS2-2)

NGSS CROSSCUTTING CONCEPTS

- Cause and Effect
- Scale, Proportion, and Quantity

CCSS-ELA ANCHOR STANDARDS

- CCSS.ELA-LITERACY.RST.6-8.1: Cite specific textual evidence to support analysis of science and technical texts.
- CCSS.ELA-LITERACY.RST.6-8.3: Follow precisely a multistep procedure when carrying out experiments, taking measurements, or performing technical tasks.
- CCSS.ELA-LITERACY.RST.6-8.4: Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context relevant to grades 6–8 texts and topics.
- CCSS.ELA-LITERACY.RST.6-8.9: Compare and contrast the information gained from experiments, simulations, video, or multimedia sources with that gained from reading a text on the same topic.
- CCSS.ELA-LITERACY.WHST.6-8.2.D: Use precise language and domain-specific vocabulary to inform about or explain the topic.
- CCSS.ELA-LITERACY.WHST.6-8.9: Draw evidence from informational texts to support analysis, reflection, and research.
- CCSS.ELA-LITERACY.CCRA.SL.1: Prepare for and participate effectively in a range of conversations and collaborations with diverse partners, building on others' ideas and expressing their own clearly and persuasively.
- CCSS.ELA-LITERACY.CCRA.L.4: Determine or clarify the meaning of unknown and multiple-meaning words and phrases by using context clues, analyzing meaningful word parts, and consulting general and specialized references materials, as appropriate.

Amplify.

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