4th Grade Mystery Science Energy Transfer Lesson

Alignment and Support

Salt Lake City School District 2020

Mystery Science Lesson Rationale:

Mystery Science Lesson Rationale: Mystery Science Lessons seek to promote engagement and inspire excellence in students' mastery of science and engineering. The lessons support our vision and mission of equity and access in elementary science. The sequence of Mystery Science Full Lessons and Mini-Lesson below support fourth grade students' sense-making with respect to Energy using three-dimensional instruction. The sequenced Mystery Science Lessons support fourth grade teachers in implementing the new Utah SEEd Standards about organisms identified specifically in the Prioritized SEEd Pacing Guide. Lessons include a video focused on an organism-based phenomenon, a hands-on activity, and an assessment. The lessons are designed to take students approximately 60 minutes to complete. Most lessons use minimal materials, such as paper printouts and pencils. Additionally, most paper printouts can be downloaded individually from the Mystery Science Lessons websites in the form of an editable document that can be assigned through Canvas. Some lessons suggest markers, group work, or demonstrations. Teachers can make easy modifications to these lessons based on students' and teachers' resources.

Note: Use a Science Notebook or print the Mystery Science PDF Booklet for students to complete the lesson series below! You can also print individual lesson materials by following the links in the ***Materials per Student and Assessments***.

Strand 4.2: Energy Transfer

Energy is present whenever there are moving objects, sound, light, or heat. The faster a given object is moving, the more energy it possesses. When objects collide, energy can be transferred from one object to another causing the objects' motions to change. Energy can also be transferred from place to place by electrical currents, heat, sound, or light. Devices can be designed to convert energy from one form to another.

Standard 4.2.2: Colliding Objects

Ask questions and make observations about the changes in energy that occur when objects collide. Emphasize that energy is transferred when objects collide and may be converted to different forms of energy. Examples could include changes in speed when one moving ball collides with another or the transfer of energy when a toy car hits a wall. (PS3.B, PS3.C)

Standard 4.2.3: Energy Transfers Heat, Light, Sound

Plan and carry out an investigation to gather evidence from observations that energy can be transferred from place to place by sound, light, heat, and electrical currents. Examples could include sound causing objects to vibrate and electric currents being used to produce motion or light. (PS3.A, PS3.B)

Mystery Science Lesson	Suggested Date and SEEd Alignment	Materials and Assessments	Remote Learning Modifications

Anchor Phenomenon Lesson Rube Goldberg Machine The anchoring phenomenon for this unit is an intricate Rube Goldberg machine. Students generate observations and questions about the phenomenon and create an initial conceptual model to explain what is happening.	**Teachers note:** Make sure to turn on the Mystery Science anchoring phenomenon in the Energizing Everything unit **Mystery Science Handouts Pdf**	**Materials per student:** • **See-Think-Wonder chart** • **Rube Goldberg machine model**	
Lesson 1: How is your body similar to a car? In this lesson, students learn that we use the energy from food to make our bodies move just like cars use the energy from gasoline to move. In the activity, Twist-o-matic Tester, students build paper models of an amusement park ride called the Twist-o-Matic. The ride stores energy in rubber bands and spins around when the energy is released. Students compare the speed of the spins when they use a thin rubber band versus a thick rubber band.	**January 25** **Disciplinary Core Ideas**: PS3.B, Foundational for PS3.A **Science and Engineering Practice:** analyze and interpret data, develop, and use models, plan and carry out and investigation **Crosscutting Concept:** Energy & Matter, Systems & system models	**Materials per Student:** • **Twist-O-Matic Challenges Answer Key** teacher-only resource • **Twist-O-Matic Challenges** worksheet • **Twist-O-Matic** printout Students working alone will need 2 copies of this template. • Crayons • Hardcover books • Rulers • Scissors • Rubber bands (#16) • Rubber bands (#62) • Small binder clips (3/4”) **Reading:** Newsela Articles for Mystery 1 **Assessment:** Mystery 1 assessment Answer Key	**Teacher demo recommended** **Students at home** Set up two Twist-o-matics to demonstrate the activity over video conference. Students need the *Twist-o-matic Challenges* worksheet (printed or digital) to record their ideas and observations. **Students at school** Set up two Twist-o-matics to use as you demonstrate the activity for your students. Each student needs a copy of the Twist-o-matic Challenges worksheet so they can record their ideas and observations
Anchor Phenomenon Lesson Rube Goldberg Machine		**Materials per student:** • **See-Think-Wonder chart**	All students update their Rube Goldberg machine model

		• **Rube Goldberg machine model**	
Lesson 2: What makes Roller coasters go so fast? In this lesson, students explore how energy can be stored as height. In the activity, Bumper Coasters (Part I), students build paper roller coasters. Students release marbles down the roller coaster track to understand height energy and energy transfer.	**February 1** **Disciplinary Core Ideas**: PS3.A **Science and Engineering Practice:** analyze and interpret data, develop, and use models **Crosscutting Concept:** Energy & Matter	**Materials per Student:** • **Alligator** printout • **Bumper Coaster Part I Answer Key** teacher-only resource • **Bumper Coaster Part I Tracks** printout • **Collision Experiments** worksheet • **Distance & Height Experiments** worksheet • Box • Pencil • Rulers • Scissors • File Folder labels (Stickers) • Paper clips • Small marbles **Reading:** Newsela Articles for Mystery 2 What Goes Up Must Come Down describes energy transformations during a roller coaster ride. **Assessment:** Mystery 2 assessment Answer Key	**Teacher demo recommended** **Students at home** Set up Bumper Coasters (Part 1) (with foam tubing or paper) to demonstrate over video conference. Watch **this video** to see how to make a paper bumper coaster in about 10 minutes. Each student needs the *Distance & Height Experiments* and the *Collision Experiments* worksheets (printed or digital) to record their observations **Students at school** Set up Bumper Coasters (Part 1) (with foam tubing or paper) as a teacher demonstration. Watch **this video** to see how to make a paper bumper coaster in about 10 minutes. Students need the *Distance & Height Experiments* and the *Collision Experiments* worksheets to record their observations
Anchor Phenomenon Lesson Rube Goldberg Machine		**Materials per student:** • **See-Think-Wonder chart** • **Rube Goldberg machine model**	All students update their Rube Goldberg machine model

Lesson 3: Why is the first hill of a rollercoaster always the highest? In this lesson, students will explore how high the hills of a roller coaster can be. In the activity, Bumper Coasters (Part II), students add hills to the Bumper Coaster they built in Lesson 2 and experiment to build a deeper understanding of hills and energy.	**February 8** **Disciplinary Core Ideas**: PS3.B **Science and Engineering Practice:** Plan and carry out an investigation & analyze and interpret data **Crosscutting Concept:** Energy & Matter	**Materials per Student:** • **Bumper Coaster Hill Tracks** printout • **Bumper Coaster with Hills** worksheet • **Bumper Coaster with Hills Answer Key** teacher-only resource • **Low Hills, Medium Hills, and Hill Holder** printout • Bumper Coaster Tracks and Alligator from Energizing Everything Lesson 2 • Box • Pencil • Rulers • Scissors • File Folder labels (Stickers) • Paper clips • Small marbles **Reading:** Newsela Articles for Mystery 3 **Assessment:** Mystery 3 assessment Answer Key	**Teacher demo recommended** **Students at home** Set up Bumper Coasters (Part 2) (with foam tubing or paper) to demonstrate over video conference. Students need the *Bumper Coaster with Hills* worksheet (printed or digital) to record their observations. **Students at school** Set up Bumper Coasters (Part 2) (with foam tubing or paper) as a teacher demonstration. Students need the worksheets to record their observations.
Anchor Phenomenon Lesson Rube Goldberg Machine		**Materials per student:** • **See-Think-Wonder chart** • **Rube Goldberg machine model**	All students update their Rube Goldberg machine model
Lesson 4: Could you knock down a building using only dominoes? In this lesson, students construct an explanation of how energy is stored, released, and transferred in chain	**February 15** **Disciplinary Core Ideas**: PS3.A, PS3.C, ETS1.A **Science and Engineering Practice:**	**Materials per Student:** • **Chain-Reaction Starter Kit** printout • **Marble Corral** printout • Markers • Rulers • Scissors • File Folder labels (Stickers) • Paper clips • Small marbles	**Ready to teach** **Students at home** Each student needs: 1 marker, 1 ruler, a pair of scissors, 1 Dixie cup, 1 8oz paper cup, paper clips, 3 stickers (or pieces of tape), 1 rubber band and 1 marble. To

reactions, such as falling dominoes. In the activity, Build a Chain Reaction (Part I), students are presented with an engineering design challenge to create their own chain reaction machine--a project they will continue in Lesson 5. Students experiment with a "Chain-Reaction Starter Kit." This kit includes a lever and a ramp, which serve as the first two steps of a chain-reaction machine.	Constructing explanations and designing solutions **Crosscutting Concept:** Energy & Matter	• Dixie cups (3oz) • Paper cups (8 oz) • Rubber bands (#32) **Reading:** Newsela Articles for Mystery 4 **Assessment:** End of Unit Assessment Answer Key	make the activity easier for students working at home, we have created new versions of **Step 8b** and **Step 9b** in the activity. **Students at school** Students can build their chain reaction machine while working solo, but there are a few partner steps in the activity. To make solo work easy, we have created new versions of **Step 8b** and **Step 9b** in the activity.
Anchor Phenomenon Lesson Rube Goldberg Machine		**Materials per student:** • **See-Think-Wonder chart** • **Rube Goldberg machine model**	All students update their Rube Goldberg machine model
Lesson 5: Can you build a chain reaction machine? In this lesson, students learn about storing, releasing, and transferring energy. In the activity, build a Chain Reaction (Part II), students complete the chain-reaction machine they started building in Energizing Everything Lesson 4.	**February 22** **Disciplinary Core Ideas**: PS3.A, PS3.C, ETS1.A **Science and Engineering Practice:** Constructing explanations and designing solutions **Crosscutting Concept:** Energy & Matter	**Materials per Student:** • **Chain-Reaction Starter Kit** printout • **Pop-Up Sign** printout • Lever from Energizing Everything Lesson 4 • Ramp from Energizing Everything Lesson 4 • Hardcover books • Markers • Scissors • Dixie Cups (3oz) • File Folder labels (Stickers) • Index cards (3x5) • Paper clips (Jumbo) • Small marbles **Reading:** Newsela Articles for Mystery 5 **Assessment:** End of Unit Assessment Answer Key	**Adjust supplies** **Students at home** Have students build their own chain reaction machines at home (for even more fun!). You'll need to double the supply quantities listed below for the Dixie cups, stickers, index cards, paper clips and pop-up signs. Watch **this video** with students to get started, and encourage them to watch **our inspiration videos**.

Anchor Phenomenon Lesson Rube Goldberg Machine		**Materials per student:** • **See-Think-Wonder chart** • **Rube Goldberg machine model**	All students update their Rube Goldberg machine model
Lesson 6: What if there were no electricity? In this lesson, students are introduced to electricity as a form of energy. In the activity, build a Flashlight, students investigate how electrical energy requires a circuit and make their own mini flashlights from LEDs, button batteries, and strips of aluminum foil. Along the way, they'll learn about the anatomy of a battery, begin to see how circuits work, and discover how handy an on-off switch can be.	**March 1** **Disciplinary Core Ideas**: PS3.B, ETS1.A **Science and Engineering Practice:** Constructing explanations and designing solutions **Crosscutting Concept:** Energy & Matter	**Materials per Student:** • **Flashlight Maker** worksheet • **Scissors** • Aluminum foil • File Folder labels (Stickers) • Index cards (3x5) • Batteries (3V 2032 button) • LEDs **Reading:** Newsela Articles for Mystery 6 **Assessment:** Mystery 6 Assessment Answer Key	**Ready to teach** **Students at home** Each student needs: 1 battery, 1 LED, 1 index card, a sheet of aluminum foil (4"x12"), and stickers. Students also need the *Flashlight Maker* worksheet (printed or digital)
Anchor Phenomenon Lesson Rube Goldberg Machine		**Materials per student:** • **See-Think-Wonder chart** • **Rube Goldberg machine model**	All students update their Rube Goldberg machine model
Lesson 7: How long did it take to travel across the country before cars and planes?	**March 8** **Disciplinary Core Ideas**: PS3.B, PS3.D **Science and**	**Materials per Student:** • **Do Not Touch The Light Bulb!** printout You need 1 sign for each Heat Spinner Station with a lamp. • **Get to Know Your**	**Teacher demo recommended** **Students at home** Set up Heat Spinners (Part 1 of the activity). Have students make

In this lesson, students explore how heat is another form of energy that can make things go. In the activity, Heat Spinner, students first make a paper Heat Spinner and observe how air can create movement. Then, students use their Heat Spinners to experiment with a heat source (an incandescent bulb) and discover how heat energy can make the spinner move in different ways.	**Engineering Practice:** Plan and carry out an investigation **Crosscutting Concept:** Energy & Matter	**Spinner** worksheet • **Heat Spinners** printout • **Inventing a Heat Engine** worksheet • Desk lamp • Rulers • Scissors • Paper cups (8oz) • Pencils with erasers • Pipe cleaners • Push pins • Rubber bands (#32) • Incandescent bulbs (40 W) **Reading:** Newsela Articles for Mystery 7 **Assessment:** Mystery 7 Assessment Answer Key	observations as you do Part 2 of the activity and demonstrate over video conference. Students need the *Inventing a Heat Engine* worksheet (printed or digital). **Students at school** Set up Heat Spinners (Part 1 of the activity) and demonstrate the activity. Have your students make observations as you demonstrate (Part 2 of the activity). Students need a copy of the *Inventing a Heat Engine* worksheet to record their observations.
Unit Review & Performance Task: Can you turn on a flashlight without touching it? In the Performance Task, students will design a Rube Goldberg machine that utilizes energy transfers and conversions to turn on a flashlight.	**Disciplinary Core Ideas**: PS3.A, PS3.B, PS3.C, PS3.D **Science and Engineering Practice:** constructing explanations and designing solutions **Crosscutting Concept:** Energy & Matter	**Step 1: Plan ahead** In this performance task, students apply what they've learned about storing, releasing, and transferring energy by building their own Rube Goldberg machine to turn on the flashlight they created in Mystery 6. To complete the performance task, students will need the ramps, levers, and various classroom materials from Mystery 4 and 5. They will also need their flashlight (with a switch) from Mystery 6. Students may bring in materials and objects from home to use in their machines. **Step 2: Gather supplies** Students will work in groups to build a Rube Goldberg Machine. Each group will need: • Scissors • At least four stickers or strips of masking tape • Dixie cup	**Ready to teach** **Students at home** Send supplies for students to complete the activity at home.

		• Up to four **jumbo paper clips** about 1¾ inches long (you can use small ones, but you'll need twice as many) • One of the ramps built in Mystery 4 • One of the levers from Mystery 4 (or the ruler, marker, and rubber band used to make it) • 3 x 5 card • A few books to stack for height • Table or desks to work on • Small **1/2-inch or 5/8-inch marble** • A marker to write with Students can also add a variety of materials to extend their chain-reaction machines. You can ask them to bring things in or gather some basic materials to keep in the classroom. See the list below for items we recommend having on hand. Or, for more ideas, watch **"Inspiration for Chain Reaction Builders"** in Extras to see some possibilities. • Extra printouts of the **"Chain-Reaction Starter Kit" handout** from Mystery 4 (in case students want to make more ramps) • Card stock for making custom-built ramps • Paper cups to serve as ramp supports • Books and boxes to add height • Dominoes or objects that will topple like dominoes (dominoes built of LEGO bricks, cassette tapes, paperback books, markers standing on end, etc.) • String • More stickers • Things that roll (empty cans, toy cars, rubber	

		balls, markers lying down, toilet-paper tubes) • Unconventional ramps (like empty binders) **Step 3: Print out classroom materials** Each student will need: • One **“Final Project” handout** • One **"Final Project Rubric" handout** • One **"Conceptual Model" handout** **Assessment:** End of Unit Assessment Answer Key	