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**In-Class Field Trip:**

**Rosie Revere’s Flying Machine**

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| **Estimated Time: 1 hour** |
| **GSE Standard and element(s):****S4P3. Obtain, evaluate, and communicate information about the relationship between balanced and unbalanced forces.** a. Plan and carry out an investigation on the effects of balanced and unbalanced forces on an object and communicate the results. b. Construct an argument to support the claim that gravitational force affects the motion of an object. c. Ask questions to identify and explain the uses of simple machines (lever, pulley, wedge, inclined plane, wheel and axle, and screw) and how forces are changed when simple machines are used to complete tasks. (Clarification statement: The use of mathematical formulas is not expected.) |
| **Science and Engineering Practices**Asking Questions and Defining ProblemsAsk questions that arise from careful observation of phenomena, models, or unexpected results, to clarify and/or seek additional information.  Constructing Explanations and Designing SolutionsConstruct an explanation that included qualitative or quantitative relationships between variables that predict and or describe phenomena.  | **Disciplinary Core Idea**PS2: Motion and Stability: Forces and InteractionsPS2.A: Forces and MotionEach force acts on one particular object and has both strength and a direction. An object at rest typically has multiple forces acting on it, but they add to give zero net force on the object. Forces that do not sum to zero can cause changes in the object’s speed or direction of motion. |
| **Crosscutting Concepts**Energy and MatterWithin a natural or designed system, the transfer of energy drives the motion and/or cycling of matter. Stability and ChangeExplanations or stability and change in natural or designed systems can be constructed by examining the changes over time and forces at different scales, including the atomic scale. |
| **Authentic Scenario (Phenomena):**Students will listen to the story Rosie Revere Engineer by Andrea Beaty read by NASA astronauts. Students will then work through the Engineering Design Process to design a flying machine for Rosie Revere. Students will build a simple “flying” machine as they investigate aspects of force and motion.  | **Vocabulary:*** balanced force
* unbalanced force
* gravity
* simple machines
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| **Guiding Questions:**What do you need to add to make sure your flying machine stays together?If your flying machine didn’t travel all the way down the zip line, what could you do different? Do you need to blow more or less air in the balloon to make the rocket go further?  |
| **Materials Needed:**For the whole class:* string for the zip line

For each student (minimum):* balloon
* straw
* tape

A variety of household materials such as: * pipe cleaners
* toilet paper rolls
* tissue paper
* scissors
* popsicle sticks
 | **Safety Considerations:*** Students should use caution when working with scissors.
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|  **Technology Integration:*** Device with Internet access
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| **Literacy Connections:*** *Rosie Revere, Engineer* by Andrea Beaty
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| **5E Stage** | **Student Activities**How will students engage actively in the three dimensions throughout the lesson?**Teacher Activities**How will the teacher facilitate and monitor student learning? |
| **Engage** | Have students listen to the story *Rosie Revere, Engineer by Andrea Beaty*, read by Astronaut Kate Rubins.  <https://storytimefromspace.com/rosie-revere-engineer-2/>Discuss with the students Rosie’s challenges and how she fought through those challenges.  Discuss the failure and embarrassment she felt from one of her inventions and how Great Aunt Rose encouraged her to begin inventing again.  |
| **Explore** | Have students research balloon rockets and other things that fly on zip lines.  Have students jot down answers to the following questions. 1. How will you design your flying machine so that it travels all the way down the zip line?
2. How will you make sure your flying machine will stay together until the end of its flight down the zip line?
3. How will you design the wings for your flying machine?
4. How will you attach the flying machine to the zip line?
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| **Explain** | Plan/Create/Test1. Brainstorm ideas regarding how you plan to build your flying machine.
2. Sketch your plan and list the materials that you would like to use.
3. Follow your plan and build your flying machine.
4. Construct your zip line.
5. Test your flying machine along the zip line.
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| **Elaborate** | ImproveAfter evaluating the results of your flying machine traveling down the zip line, discuss ways that you could improve your flying machine. Make at least one improvement and re-test to see if it was beneficial. |
| **Evaluate** | * Did your flying machine stay together?
* Did your flying machine travel all the way down the zip line?
* What did you do to improve your design?
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**Teacher Notes:**

**Background:**

Rosie Revere had a dream to become a great engineer.  Where most people see trash, Rosie Revere would see inspiration.  Secretly in her room, Rosie would construct great inventions from objects lying around.  She created hot dog dispensers, helium pants, and python-repelling cheese hats.  However, in the beginning, she wouldn’t let anyone see them.  She gave an invention as a gift and was embarrassed by her uncle.  Afraid of failure, Rosie hides all her inventions under her bed. After that, shy Rosie decided she had failed and wouldn’t invent any more.  Her great-aunt arrived and encouraged her to start building again.  Great Aunt Rose helps Rosie realize that her first flop isn’t something to fear: it is something to celebrate.  Help your students celebrate their inventions.