|  |  |
| --- | --- |
| **Lesson Title:** Marshmallow Catapult STEM Challenge |  |
| **Grade Level:** 2nd  | **Quarter:**2nd  |
| **Standards:** **S2P2. Students will identify sources of energy and how the energy is used.**a. Identify sources of light energy, heat energy, and energy of motion.b. Describe how light, heat, and motion energy are used.**S2P3. Students will demonstrate changes in speed and direction using pushes and pulls.** a. Demonstrate how pushing and pulling an object affects the motion of the object. b. Demonstrate the effects of changes of speed on an object. **Math****MGSE2.MD.1** Measure the length of an object by selecting and using appropriate tools such as rulers, yardsticks and measuring tapes. **MGSE2.MD.5** Use addition and subtraction within 100 to solve word problems involving lengths that are given in the same units, e.g., by using drawings (such as drawings of rulers) and equations with a symbol for the unknown number to represent the problem.  |
| **Lesson Essential Question:** How can I use what I know about energy and speed to create a catapult? How can I measure the length my marshmallow flew? How can I create word problems about the length of my marshmallow distances?  | **Vocabulary:**energy motion describe speed effects pushing object |
| **Lesson Materials*** craft sticks
* rubber bands
* spoon
* mini marshmallows

<http://www.physics4kids.com/files/motion_energy.html> | **Lesson Assessment:** Design Challenge OrganizerCatapult diagramCatapultMath story problems |
| **STEM Challenge Overview:**Our school (say name of your school) is having a Renaissance Fair and one of the main events is the marshmallow catapult competition. Today you will need to use your knowledge about energy and speed to create the best marshmallow catapult. Your class will have a competition to see whose catapult shoots marshmallows the furthest. You will have to be creative and work together!  |
| **Teacher Background:**You have been teaching all about different types of energy and how pushing and pulling affects the speed and motion of an object. This challenge combines students’ knowledge on energy and pushing and pulling.  |
| **INSTRUCTION** |
| 1. **Ask/Engage**

**Day 1: 30 minutes** |
| * This lesson was designed based upon: <http://www.devincollier.com/how-to-build-a-simple-small-marshmallow-catapult/>
* Play the video of the Human Catapult: <http://www.sciencechannel.com/tv-shows/outrageous-acts-of-science/videos/human-catapult-gets-serious-air.htm>
* Optional (students do not need to know either of these terms in 2nd grade) Have students discuss kinetic and potential energy. Use the examples from the video to help further explain what each concept. You could also demonstrate using any object (ball, toy, etc.)
* Have students discuss what they know about pushing and pulling and how it affects an object. Have them describe how the catapult affected the person.
* Then have students draw a diagram of how a catapult works (use notebook paper or dry erase boards, limit them 5 to 10 minutes). They should be able to describe how energy was used.
* Once all students demonstrate understanding, show them a bag of marshmallows and have them discuss what they think they are going to create.
* After students clarify that they will be making a “marshmallow catapult” read the STEM challenge.

**Challenge:**Our school (say name of your school) is having a Renaissance Fair. One of the main events is the marshmallow catapult competition. Today you will need to use your knowledge about energy and speed to create the best marshmallow catapult. Your class will have a competition to see which catapult shoots marshmallows the furthest. You will have to be creative and work together! Your job is to create a catapult that can launch marshmallows. You also need to be able to explain and write what type of energy is used and how you were able to affect the motion of your marshmallow. * Have students complete the “Ask” portion of their student journal.
* After students complete this give each student a marshmallow and a spoon and let them launch one using their hands to better understand the concept of a catapult.
 |
| 1. **Imagine/Brainstorm**

**Day 2: 30 to 45 minutes** |
| * Introduce the constraints of the design plan. Define the criteria for success. Ask each student to work independently to come up with 2 possible design solutions. Students should draw/label their designs.

**Criteria:**1. You will need to create a catapult that can successfully launch a marshmallow. 2. Your catapult must be able to launch from the ground. 3. Explain and write how your catapult works. 4. Measure the distance of each marshmallow launch. **Constraints:**1. You only have 2-3 days during your STEM time for construction!2. You may only use the provided materials3. You can’t take the materials home4. You must work together as a group to finish the project!* After each student completes their brainstorm have students form groups or have preselected teacher groups. (3-4 students)
 |
| 1. **Plan/Design**

**Day 2 continued** |
| * Each student presents their ideas to their team. Student teams collaborate to come up with final design plan. Students draw final design plan and make a list of needed supplies.
* Have each team get their group materials and have them place them into a plastic bag for building tomorrow.
 |
| 1. **Create / Test**

**Days 3-4 (45 minutes to 60 minutes)** |
| * Student teams build their design according to their design plan. Students test their design plan and record data.
* Have teams compete to see which catapult will launch a marshmallow the farthest distance.
* Have students create a class graph on the Smart Board that shows distance travelled data.
* Students will have to use the correct measuring tool to see how long each one of them went.
 |
| 1. **Evaluate/Improve –** and repeat Steps 1-5

**Day 4 (another day if needed)** |
| * Students evaluate their design for success. Did it meet the established criteria? Did their final design match their planned design? How would students improve their design?
* Give students time to improve their design or start a new catapult over if theirs didn’t work.
* Students will complete the student journal.
* To further extend the lesson have students use the class created graph to write story problems about the distances that each groups’ marshmallow traveled.
 |

Name\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Marshmallow Catapult STEM Challenge

 2nd Grade



Our school (say name of your school) is having a Renaissance fair and one of the main events is the marshmallow catapult competition. Today you will need to use your knowledge about energy and speed to create the best marshmallow catapult. Your class will have a competition to see which catapult shoots marshmallows the furthest. You will have to be creative and work together!

**Challenge**: Create a catapult that can launch marshmallows. Be able to explain and write what type of energy is used and how you were able to affect the motion of your marshmallow.

**Criteria:**

1. You will need to create a catapult that can successfully launch a marshmallow.
2. Explain and write how your catapult works.
3. Measure the distance of each marshmallow launch.

**Constraints:**

1. You only have 2-3 days during your STEM time for construction!
2. You may only use the provided materials
3. You can’t take the materials home
4. You must work together as a group to finish the project!
5. **ASK / ENGAGE:** What is the problem you are being asked to solve?

**\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

1. **IMAGINE/BRAINSTORM:** What are some possible solutions to the problem that you are trying to solve? After you brainstorm, draw and label your ideas below.

|  |  |
| --- | --- |
| **Idea #1** | **Idea #2** |

1. **PLAN/DESIGN:** Share your ideas with your group and collaborate to decide on a final design plan. Draw your team’s design below and make a list of the materials that you will need to complete your design.

|  |  |
| --- | --- |
| **Team Design Plan** | **Materials List** |

1. **CREATE/TEST**: Use your Final Design Plan to create and build your solution. Test your design. Did it work? Why or Why not?

**\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

1. **EVAULATE/IMPROVE:**  How well did your design work? Did your solution solve the problem within the given constraints?

**\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

How can you improve your design? How can you make it better? Draw and label your improved design below.

|  |
| --- |
| **Improved Design Plan** |