3-5 Engineering on a Dime - Marshmallow Catapults

During this engineering lesson, students will learn the key concepts of the Engineering Design Process and then apply that knowledge to help them design and create a catapult that will launch marshmallows.

3-PS2-1 Motion and Stability: Forces and Interactions
Plan and conduct an investigation to provide evidence of the effects of balanced and unbalanced forces on the motion of an object.

3-PS2-2 Motion and Stability: Forces and Interactions
Make observations and/or measurements of an object's motion to provide evidence that a pattern can be used to predict future motion.

3-5-ETS1-1 Engineering Design
Define a simple design problem reflecting a need or a want that includes specified criteria for success and constraints on materials, time, or cost.

3-5-ETS1-2 Engineering Design
Generate and compare multiple possible solutions to a problem based on how well each is likely to meet the criteria and constraints of the problem.

3-5-ETS1-3 Engineering Design
Plan and carry out fair tests in which variables are controlled and failure points are considered to identify aspects of a model or prototype that can be improved.

You will need to provide the following materials:
- Zip-loc bags (1 per/student)
- Craft Sticks (12/student) – these can be regular or jumbo (jumbo work best)
- Plastic Spoons (1/student)
- Rubber bands (5/student)
- Mini Marshmallows (5/student)
- White paper (1 sheet/student) – to draw designs
- Targets for use in launch area. I would suggest using disposable plates/bowls/containers/cups of varying sizes.
- Measuring tapes for use at launch area.

Teacher preparation prior to the lesson:

- Create Zip-loc baggie of above supplies for each student
- Make copies of Engineering Design Process and Let it Fly sheet attached to this packet (1 copy/student)
- Set up a launch area(s) in your classroom or hallway. Give students various targets to "hit" set at various distances...gradually getting harder to achieve. See above for target suggestions. See picture for example launch area.
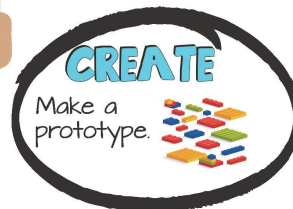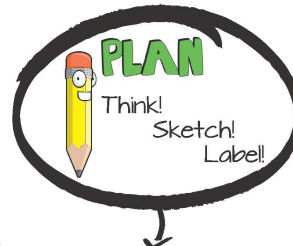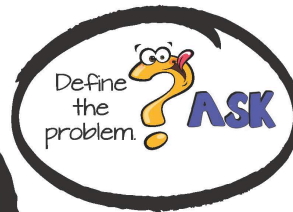

Teacher Launch Information:

After setting up your launch area, tell the students that this is a "Choose Your Challenge" launch area. Students will set up their catapult at the masking tape launch line. They will choose which target they are going to try for. Students will follow directions on the "Let it Fly" recording sheet provided. Encourage students to watch the motion of their flying marshmallows and how close they are to their target to make adjustments before their next launch. Remind them to only change 1 variable at a time. Can they consistently hit the given target over time? If they succeed, then have them try a more difficult target!

Note: You will need additional time after the Zoom lesson to finish catapult building and launching!

The Engineering Design Process

Define the problem. ASK

Brainstorm possible solutions. IMAGINE

PLAN
Think!
Sketch!
Label!

CREATE
Make a prototype.

IMPROVE
How can you modify your design to make it better?

Do a trial run.
TEST

SHARE

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Let it Fly!

1. Place your catapult just behind the launch line.
2. Choose your challenge! Pick which target you want to aim for. Measure the distance from the launch line to your target and record it here: _____(in or cm)
3. Launch your marshmallow at the target. Each time you launch, record the distance the marshmallow went on the chart below. Use your data (measurements) and motion (direction) of your marshmallow to make adjustments to the way you launch OR to your actual catapult, if needed, to hit your target! Remember; only change one variable at a time! Your goal it to be able to consistently hit your target 3 times in a row.

	Distance Traveled	Observations of Motion:
Launch 1		
Launch 2		
Launch 3		
Launch 4		
Launch 5		
Launch 6		
Launch 7		
Launch 8		
Launch 9		
Launch 10		

Program Connection Information

Please use an external microphone (conference style) rather than the integrated one in the computer for the audio for your class and locate it centrally in the room. It can be difficult for the Greenbush teacher to hear the students using the computer microphone and therefore it reduces the interactive nature of the lesson. It is fine to use the computer webcam for your video source.

All classes will take place using Zoom desktop video. If your building is already set up to use a desktop video application with a computer, simply open a browser and enter https://greenbush.zoom.us/j/2326746414 in the URL space. You may need to download Zoom launcher software (free download) if you don't already have it. This needs to be done in advance of the lesson.

If using a Polycom video conferencing unit (or any legacy type video conferencing unit) to connect to a ZOOM conference, make sure the unit is in "encrypted mode" then dial the following IP on the internet: 162.255.37.11 or 162.255.36.11 and once connected, they will ask for a MEETING ID: enter 232 674 6414 (for Lisa at Science Center).

It's always a good idea to touch base with your district technology facilitator prior to your program to make sure all systems/equipment are in place and operational and that there aren't any firewalls in place that might prevent you from connecting to Zoom.

Once you connect, you will enter a Zoom waiting room. Your Greenbush teacher will admit you into the final meeting room.

If you have questions, please call Lisa Little at Greenbush, 620-724-6281, or email at lisa.little@greenbush.org (best method of contact).