STEM Connections

Straw Rockets

Below are ideas for connecting the Straw Rocket activity to STEM concepts and principles. For more ideas and detailed STEM lessons, consult the *Straw Rockets Teacher's Guide*.

ACTIVITY OVERVIEW

Students build and launch rockets constructed from kit materials (straws, modeling clay, and index cards). Students use the Pitsco Straw Rocket Launcher to launch their rockets, typically in a gym or hall with a tall ceiling. The launch force and launch angle can be varied by the student, affecting the flight of the rocket.

SCIENCE

The Independent Variable

Have students build a straw rocket and launch at 45° and at four different launch forces (as measured by marks on the launch rod of the launcher). Students measure and record the range (the distance the rocket traveled horizontally) in a data table.

Have students choose one variable to change about their rockets. This might be the amount of clay on their nose cones, the length of the straw, the number of fins (be sure the size and shape does not change), or other design features of their rockets.

Talk about the need to isolate one variable during experiments so that there is only one thing that could cause any change in measured data.

Have students relaunch their rockets after changing their one variable, again launching at 45° and the same four launch forces as before. Students should measure and record the range for each launch and compare (analyze) the data before and after changing one variable.

Students consider and express possible explanations for the change in data due to the change in the one variable.

ENGINEERING

The Design Loop

Have students build a straw rocket. Allow them to launch their rockets several times at various launch angles and launch forces. They should keep a record of the results of the range for each launch.

Set a bucket 4.5 m from the launcher. Each student has one shot to get the rocket in the bucket. If they miss, they must go through an iteration of the design loop (research, brainstorm solutions, pick a solution, prototype the solution, test, and analyze the solution).

Students must document each step of the iteration and provide a brief explanation of what change they are making to meet the challenge.

If the rocket goes in the bucket when students test their solution for that iteration, then they have completed the challenge. Limit the number of iterations they must go through, either by a set number or a set time frame for completion.

A rubric can be established for grading and might include partial points for within certain distances of getting in the bucket. Emphasis should be on what steps are within the design process (loop) and how this process can be used to solve problems and design solutions.

TECHNOLOGY

Using Instruments to Measure Data

Have students build a straw rocket and launch the rocket at 15°, 30°, 45°, 60°, and 75° – all with the same amount of launch force (launch rod pulled up to the same mark each time).

Have students measure the range (the distance the rocket traveled horizontally) using several different methods and instruments and record the results in a data table.

Here are some ideas for various measurement methods:

- Measure by the number of feet (their feet, that is) by walking off the distance.
- Use a standard English measuring tape.
- Use a metric measuring tape.
- Use a meterstick.
- Use a 12" ruler.
- Use an ultrasonic tape measure.

Have students compare and contrast the ease and accuracy of each measurement method.

Discuss with students about the need for different measuring devices for different magnitudes of measurements and/or different environments (underwater, space, hazardous areas, and so on).

MATH

Graphing Linear Functions

Have students build a straw rocket and launch at 35° with six different launch forces (as measured by marks on the launch rod of the launcher).

Depending on their prior knowledge and experiences, students can make their own data table for recording the results of their launches, or a standard data table can be provided to them to fill in.

Students launch their rockets and then measure and record the range (the distance the rocket traveled horizontally) for each launch force.

The range of the rocket is directly proportional to the launch force (i.e., a larger launch force will result in a proportionally longer range). When student data is graphed, the resulting plot should be very close to a straight line.

Have students graph their data for their rockets and connect the data points. Have them describe the resulting line.

If grade appropriate, talk about lines of best fit and how greater accuracy could be obtained by launching the rocket at 10 or 15 different launch forces. If time allows, have students further develop that concept and do launches (possibly as teams to be time efficient) to demonstrate the difference in the resulting graph.

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