



Drexel-SDP GK-12 ACTIVITY

Activity: Rockets - Blast Off!

Subject Area(s) Astronomy
Associated Unit Space, module 3
Associated Lesson embedded
Activity Title Rockets – Blast Off!
Grade Level 6 (3-8)
Activity Dependency None
Time Required 50 minute lessons
Group Size 2
Expendable Cost per Group approx. \$0.50

Summary

Rocket building challenge comparing the rocket and fin design of a store bought rocket (the “NASA” model) to student made paper rockets. Using an altitude tracking device (measuring the angle of ascent) the students learned about geometry, right triangles, and altitude as well.

Engineering Connection

Space exploration would not be possible were it not for the work of engineers. In this activity, students will explore some of the principles involved in the design of rocket design, and will engage in the process of designing and testing a rocket, comparing their model against a store-bought model.

Keywords

Space, rocket, astronomy, space exploration, mechanical engineer, aeronautical engineer

Educational Standards

3.1.7 B Describe the use of model as an application of scientific or technological concepts.

3.2.7 A,B,C & D Inquiry & Design

3.4.7 C. Identify and explain the principles of force and motion

3.6 C. Explain physical technologies of structural design, analysis and engineering, personal relations, financial affairs, structural production, marketing, research and design.

3.7 A Describe the safe and appropriate use of tools, materials and techniques to answer questions and solve problems.

3.7 B Use appropriate instruments and apparatus to study materials.

3.7C Explain and demonstrate basic computer operations and concepts

3.7 D Apply computer software to solve specific problems.

Pre-Requisite Knowledge

None.

Learning Objectives

Students will learn:

The basics of Newton's laws of motion

Trigonometry to calculate the altitude of the rocket by measuring the angle of ascent.

To construct their own model rockets to compare to a store bought model rocket design.

Materials List

2 *Stomp rocket kit from Fisher Scientific, Catalog # S68064

Includes stomp rocket launcher and four rockets each.

Construction paper

Paper fasteners

Weights/washers

String

Scissors

Tape

For each student/group:

Space-SA-4.1-4.7

Introduction / Motivation

Space exploration would not be possible were it not for the work of engineers. In this activity, students will explore some of the principles involved in the design of rocket design, and will engage in the process of designing and testing a rocket, comparing their model against a store-bought model.

Review the background material with the students, discuss the vocabulary, then begin the activity.

Vocabulary / Definitions

Word	Definition
Aeronautical engineer	An engineer concerned with the design and construction of aircraft.
Astronaut	A scientist who is trained to travel in a spacecraft.
Rocket	A vehicle propelled by an engine which makes use of Newton's Third Law of Motion by expelling burned fuel as exhaust at a high rate.

Procedure

Background

Students will be introduced to the basics of Newton's laws of motion and trigonometry using a fun hands on example. Students will construct their own model rockets to compare to a store bought model rocket design. Student will calculate the altitude of the rockets by measuring the angle of ascent.

Before the Activity

Collect and distribute materials.

With the Students

Procedure:

1. Preliminary lesson:
2. Students design their own paper rockets
3. Students build their altitude measurement device and wheel.
4. Review how to work the altitude measurement with students:
Based on a right triangle (Pythagorean theorem)

Space Lesson 4

- a. You a measuring the angle of the rocket's ascent from your observation site
 - b. You know the distance from your sight to the launch site, so you can calculate the altitude by using the TANGENT.
 - c. Use altitude wheel to find the tangent for known distance from launch site (5, 15 or 30 meters)
5. Class gathers "rockets" (paper & store bought), Trial Launch Data Log worksheet, measuring tape, and launch equipment (2 sets for a larger class is preferable).
 6. Set up launch stations and mark observation station (5, 15 or 30 meters away).
 7. Launch first rocket.
 8. While one group member launches rocket, other two group members should be at the observation point. One holds the altitude device and looks through "scope" to see rocket. The other group member reads the angle the string reads on the altitude device and records it.
 9. Each rocket should be launched two times
 - a. The "NASA" rocket (store bought)
 - b. Group design (paper rocket)
 10. Once each group has launched both their rockets twice, the class should move back inside.

11. Using their altitude wheel, students should find the altitude their rockets launched from their angle of lift off from as seen from the observation station.
12. Student should fill out final assessment/reflection form at the end.
13. Discuss how their designs could be improved.
 - Did they work? What worked best? What could be better?
 - Did they fly straight? Why or why not?

Safety Issues

- Ensure students are not in the path of a launched rocket

Troubleshooting Tips

Help students to navigate the NASA website to the pertinent information.

Investigating Questions

See Activity Embedded Assessment

Assessment

Pre-Activity Assessment

None

Activity Embedded Assessment

Print the following questions into a student worksheet:

BLAST OFF!

Space Lesson 4

Team Name:

Date:

Rocketeer's challenge:

Your team's challenge is to build a better rocket than your competitors so NASA will purchase your design. NASA needs a rocket that will fly to Mars and so it needs to fly FAR and it needs to go STRAIGHT. In order for them to consider your design they will need your design sketches as well as your test launch data to prove that it is better than their current design.

Supplies:

Construction paper
Tape
Scissors

Team NOTES:

Sketch your rocket design:

Mark where you think the center of gravity is

Your FIN Design:

Number of fins:

Space SA-4.1

BLAST OFF!

Team Name:

Date:

TEST LAUNCH DATA LOG

NASA Rocket:

Test flight #1:

Notes:

Angle:

Altitude:

Test flight #2:

Notes:

Angle:

Altitude:

OUR ROCKET:

Test flight #1:

Notes:

Angle:

Altitude:

Test flight #2:

Notes:

Angle:

Altitude:

Space SA-4.2

Altitude Tracker DIRECTIONS

1. Cut out the altitude tracker
2. Curl the B edge of the pattern to the back until it lines up with the A edge.
3. Staple together
4. Punch a small hole through the top of the protractor (at the black dot) using your pencil
5. Slip a string with through the hole and tie a knot at the other end
6. Tie a washer to the bottom of the string.

Altitude Calculator DIRECTIONS

1. Cut out both pieces of the altitude calculator
2. Punch a hole in the middle of both
3. Attach with a paper fastener

How to track the altitude:

1. Tracking station should be 15meters away from the rocket launch site
2. As rocket launches follow the rocket with your eye looking through the site tube on the altitude tracker.
3. A second team member should read the angle the string makes on the protractor.
4. Record the angle.
5. Use the altitude calculator to find the altitude of rockets in meters. Record.

Post-Activity Assessment

Evaluation will be based upon teacher observation of students during lesson & activity as well as completion of the student activity sheets.

Activity Extensions

Further information can be found at www.nasa.gov

To explain how these model rockets can be extended to the rockets NASA builds. Further extensions could be to use a liquid or solid propellant (for example the alka-seltzer rockets)

Owner

Drexel University GK-12 Program

Contributors

Noelle Comolli & Eric Gallo

Copyright

Copyright 2007 Drexel University GK12 Program. Reproduction permission is granted for non-profit educational use

Version: Mar 2007