Lesson Plan: Rockets!

Emily Leake
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Lesson Duration: 2 hours 30 minutes (Approximate 1-2 class periods)

Grade/Program 4th & 5th Graders

Major Understanding Students will begin to understand the basic principles of motion through the design, construction, and testing of a variety of rockets. This lesson is designed to be used in sequence with a unit of Forces, Motion, & Energy.

Objectives

Ⓢ Students will be able to identify basic forces of motion and conditions affecting the distance traveled by a rocket.

Ⓢ Students will analyze and test a variety of rockets to determine ideal fin design, nose shape, body length, and amount of fins on a rocket through observation and experimentation.

Ⓢ Students will be able to design, build, and test a variety of rockets based on specific criteria.

SOL's

Science

4.1 The student will plan and conduct investigations in which:

a) distinctions are made among observations, conclusions, inferences, and predictions;
b) hypotheses are formulated based on cause-and-effect relationships;
e) appropriate metric measures are used to collect, record, and report data.

4.2 The student will investigate and understand characteristics and interaction of moving objects. Key concepts include:

a) motion is described by an object's direction and speed;
b) forces cause changes in motion;
c) friction is a force that opposes motion; and
d) moving objects have kinetic energy.

Time (10 minutes) **Discussion**: What is the purpose of a rocket? How do you

think they work? What forces it into the air? Are rockets good for the environment? How do rockets safely come down?
(5 minutes) **Introduce lesson activity:** Describe the experiment that they will have an hour to complete.
(15 minutes) **Presentation:** Show Dr. Zoon Straw Rockets DVD. Dr. Zoon reviews basic information students need to know and understand. He will demonstrate how to properly use the launching device.
(60 minutes) **Lab:** Students will follow the directions in the Rockets Lab. They will work on a series of design experiments involving nose design, body length, number of fins, and design of fin. Students should work in groups of two – three(if individual is necessary that is okay, however it is important that all groups be able to use the launcher. The more groups the more challenging it will be for groups to test their rockets efficiently).

RocketLAB (see supplementary resource at the end of this lesson)

(30 minutes) **Closure:** Review what was learned. Clean Up.

Materials

For each student:
TravelTech_RocketLAB (1 copy per group)
3 Straws (different colors if possible)
Modeling Clay (3 pieces – approx. ½" x ½" x ½")
Scissors
Tape (Clear and masking)
Rulers

For the class:
Rocket Launcher
Tape Measure (Consider making a tape ruler on the floor for easier measuring of results)
Dr. Zoon Straw Rockets DVD

Instructional Strategies

1. **Discussion (about 10 minutes)**:
   Start off by asking the following questions:
   - What is the purpose of a rocket?
   - How do you think they work?
   - What forces it into the air?
   - Are rockets good for the environment?
   - How do rockets safely come down?
2. **Introduce lesson activity (5 minutes):**
   a. Challenge: Students must work in groups of two to three students to complete the Rocket LAB.
3. **Presentation (15 minutes):**
   Show Dr. Zoon Straw Rockets DVD. Dr. Zoon reviews basic information students need to know and understand. He demonstrates how to operate the rocket launcher safely.

   NEED: Dr. Zoon DVD: Straw Rockets

4. **Lab (60 minutes):**

Students will follow the directions in the Rockets Lab. They will work on a series of design experiments involving nose design, body length, number of fins, and design of fin. Students should work in groups of two – three (if individual is necessary that is okay, however it is important that all groups be able to use the launcher. The more groups the more challenging it will be for groups to test their rockets efficiently).

TravelTech_RocketLAB (see supplementary resource at the end of this lesson)

5. **Closure (30 minutes):**
    b. Review what was learned: Go over Lab Worksheet
    c. Clean Up

Closure

This lesson will be closed with a discussion based on what was completed during the lab. Discussion should include a comparison of successful and less rocket parts; nose shape, fin design, amount of fins, and body length. What worked, what did not work, and what had the greatest affect on distance traveled.

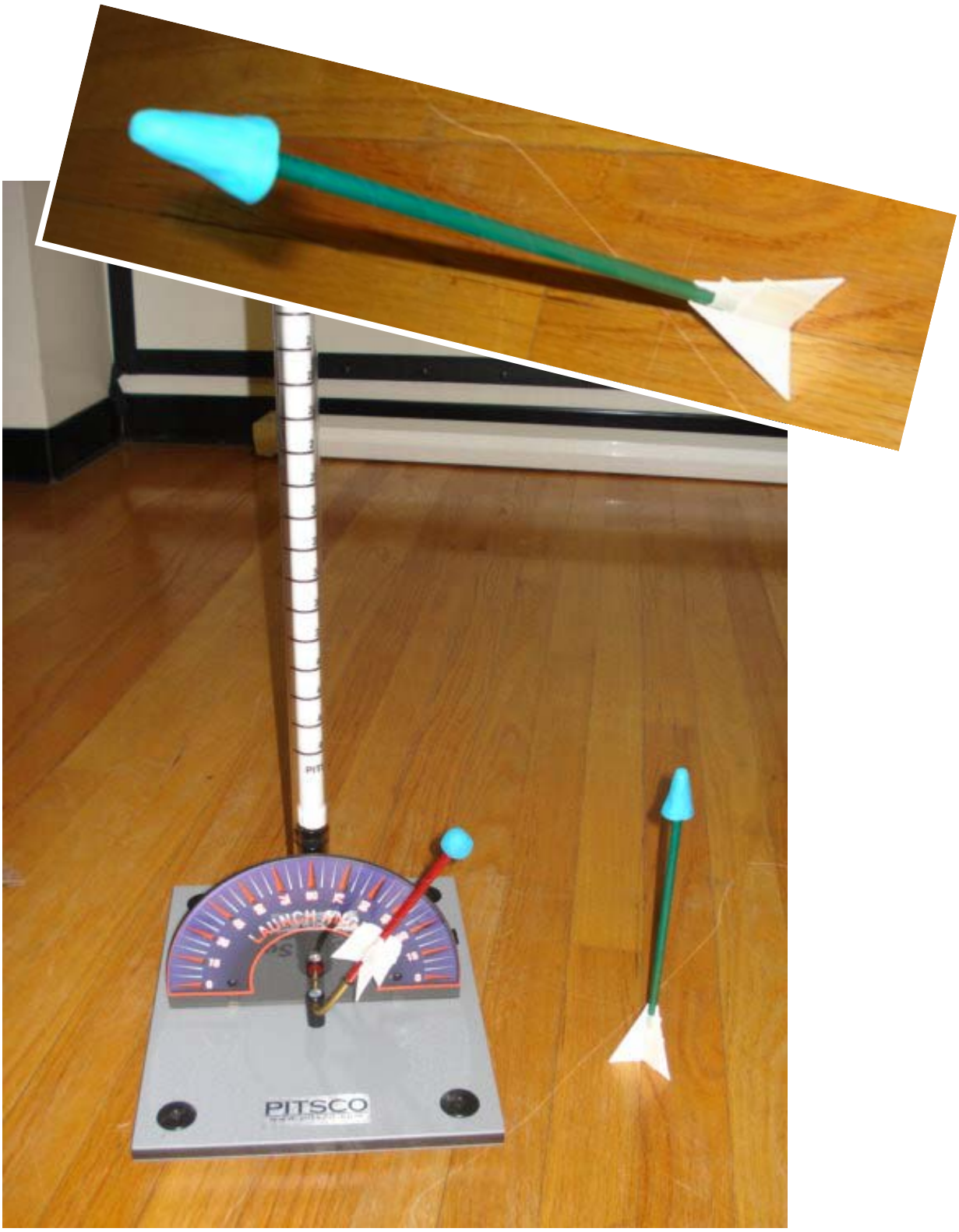
Assessment

At the conclusion of this lesson and activity students will have completed approximately 10 rockets. Each rocket will be tested for success in distance traveled. Students will have to average the distance traveled and analyze how the rockets did in comparison to each other. Students will be completing the lab with a series of thought provoking questions that requires the student to observe, analyze, and build on their current knowledge and understanding.

References and Teaching Tips

Rocket LAB designed by Emily Leake
Dr. Zoon DVD: Straw Rockets by Pitsco

Examples of straw rockets; notice the different nose shapes and body length.



Rockets...

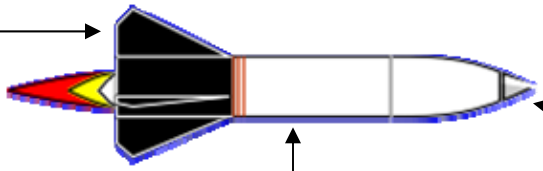
Engineers: _____

_____

Introduction: Rocket Parts

Fin	Nose
Body	

1. Label the parts of the rocket below.



_____ _____

_____

2. Someone that designs rockets is known as a:
   - **a.** Rocket Designer
   - **b.** Rocket Scientist
   - **c.** Rocket Engineer
   - **d.** Rocket Launcher

3. What do you think is most important when designing a rocket?

Length of body	Nose Shape
Fin Design	Launching Device
Outside Wind	Other: _____

Directions:

First, you will make *three* rockets. Using the templates at the end of this lab, **cut out all 9 fins** using the card stock provided. Once all 9 are cut, tape them to the straws (body of your rocket). Each rocket needs 3 fins.

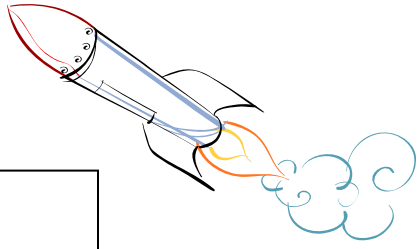
How long are your rockets?

Rocket #1 _____

Rocket #2 _____

Rocket #3 _____

Part One: Nose Design



1. Using the space below. Draw three different designs for the shape of your nose cone.

Nose #1	Nose #2	Nose #3

2. Select the shape you think will help your rocket travel the furthest. Which one did you pick? _____

3. Using the modeling clay, shape your clay to match the design you picked. Place it at the top of your rocket.

4. Using the rocket launcher. Set your rocket to 80 degrees. Launch your rocket and measure the distance it traveled. Record the results in the box below.

Nose Design	**Launch Angle**	**Distance Traveled**
Nose #1	80 ˚	
Nose #2	80 ˚	
Nose #3	80 ˚	
Average		

5. Using your next favorite nose design. Create a different style nose. This will be nose #2. Test this nose, measure the distance traveled and record the results in the table above.

6. Using your final nose design, create this nose for your third rocket. Test nose #3, measure the distance traveled and record the results in the table above.

7. Which Nose design produced the **best** results? _____

8. Determine the average launch angle and distance traveled for this experiment. Record your results in the row for *Averages*.

   Hint: Nose #1 + Nose #2 + Nose #3 = Total
   Total ÷ 3 = Average

Question: Did the *shape of the nose* affect the success of the rocket? How or how not? _____

Part Two: Body Length

1. At the beginning of this lab you were asked to measure the rocket length. This time we are going to experiment with length to see if that has an effect on the distance traveled. First, you will need to make all the noses identical. Select the nose design that did the best from Part One. Remove all the noses and shape them to be the same size and shape.

2. Next, you will measure your rocket body and make 2 of them NEW sizes. One of them will stay the original size. Measure and cut the remaining 2 rockets to be: **10 cm and 15 cm**

3. Now add the noses you made to each of your 3 rocket bodies. Remember each rocket should be a different height!

4. Using the rocket launcher. Set your rocket to 60 degrees. Launch your rocket and measure the distance it traveled. Record the results in the box below.

Rockets	Launch Angle	Distance Traveled
Rocket #1	60 ˚	
Rocket #2	60 ˚	
Rocket #3	60 ˚	
Average		

5. Select a different rocket for test #2. Test this rocket, measure the distance traveled and record the results in the table above.

6. Test the final rocket (#3), measure the distance traveled and record the results in the table above.

7. Which Rocket length produced the **best** results? _____

8. Determine the average launch angle and distance traveled for this experiment. Record your results in the row for *Averages*.

   Hint: Rocket #1 + Rocket #2 + Rocket #3 = Total
   Total ÷ 3 = Average

Question: Did the *length of the rocket* affect the success of the rocket? How or how not?

_____

_____

Part Three: Number of Fins

1. Using your longest rocket you will conduct three more tests. Remove the fins from your other rockets.

2. First, you will add one more fin to your existing 3 fin rocket. You should have a total of 4 fins.

3. Using the rocket launcher. Set your rocket to 75 degrees. Launch your rocket and measure the distance it traveled. Record the results in the box below.

Rocket	Launch Angle	Distance Traveled
4 fins	75 ˚	
5 fins	75 ˚	
2 fins	75 ˚	
Average		

4. Now add a 5th fin to the existing rocket and test again. Record your results in the table above.

5. Finally, remove 3 fins from your existing rocket. This should leave you with 2 fins on the rocket. Launch this rocket and record your results in the table above.

6. Which Rocket produced the **best** results? _____

7. Determine the average launch angle and distance traveled for this experiment. Record your results in the row for *Averages*.

   Hint: Rocket #1 + Rocket #2 + Rocket #3 = Total
   Total ÷ 3 = Average

Question: Did the *amount of fins on the rocket* affect the success of the rocket? How or how not?

_____

Part Four: Fin Design

1. Using the space last page called "FIN DESIGN," design three NEW fin designs.

2. Cut out your three ideas and trace them three times on your cardstock.

3. Select your first set of fins to test. Tape the 3 fins onto the long rocket you used for the last experiment.

4. Using the rocket launcher. Set your rocket to 80 degrees. Launch your rocket and measure the distance it traveled. Record the results in the box below.

Rocket	Launch Angle	Distance Traveled
Fin Design #1	80 ˚	
Fin Design #2	80 ˚	
Fin Design #3	80 ˚	
Average		

5. Remove the fins from the last test and replace it with your next set of fins. This will be fin design #2. Launch this rocket and measure the distance traveled, record the results in the table above.

6. Using the final set of fins. Replace the ones used in test #2. This rocket will be fin design #3, measure the distance traveled and record the results in the table above.

7. Which fin design produced the **best** results? _____

8. Determine the average launch angle and distance traveled for this experiment. Record your results in the row for *Averages*.

   Hint: Nose #1 + Nose #2 + Nose #3 = Total
   Total ÷ 3 = Average

Question: Did the *fin design* affect the success of the rocket? How or how not?

_____

Use your rockets and experiment with the launch angle. What happens when you change the angle of the launch?

_____

Test Your Knowledge:

1. In the rocket launcher we are going to use, what is used to force the rocket up? (Circle the correct answer)

   Water Air Sand Plastic

2. What force causes the rocket to come down to the ground?

   _____

3. What are rockets used for?

   _____

Fin Design #1	Fin Design #2	Fin Design #3

Fin Templates