Wizards of Wright

Lesson: Straw Rockets – More Variables – Data Sheet

Design constraints need to be applied to every rocket constructed (unless this is the variable you are testing).
- Rockets should have a minimum of two fins and a maximum of five fins.
- The body of the rocket should be a minimum length of 10 centimeters and a maximum length of 20 centimeters.
- The amount of clay used for the nose cone should have a maximum diameter of two centimeters when rolled into a ball.

Name: ____

The directions below are for you and your partner. Build and test rockets together, work together and take turns, and record data on your own sheet.

Test #1: Test for *Varying Rocket Length*

1. **Hypothesis**: Write a hypothesis or prediction describing how you think length will affect the rocket's range.

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2. Construct your two straw rockets of different lengths. The difference in lengths should be a minimum of 5 centimeters and a maximum of 10 centimeters. The other main components should be the same for both rockets (same number of fins, same fin size and shape, same nose cone size and shape).

3. Label one rocket "Rocket A" and the other "Rocket B".

4. Place the rocket on the launch tube.

5. Adjust the direction angle to 45 degrees.

6. Raise the launch rod to the fifth calibration line.

7. To launch, release the launch rod so that it falls to the bottom of the cylinder.

8. Measure the rocket's range using the measuring tape.

9. Record the rocket's range on your data sheet.

10. Repeat steps 4-9 twice more for Rocket A, and three times for Rocket B.

11. Analyze the data, write a conclusion, and compare your hypothesis to your conclusion.

Data: Record your data.

	Body Length	*Launch 1*	*Launch 2*	*Launch 3*
Rocket A				

Rocket B				

11. **Conclusion**: How did the straw rocket's body length effect the rocket's range?

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Comparison: How does your conclusion compare to your hypothesis?

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Test #2: Test for *Varying Nose Cone Mass*

1. **Hypothesis**: Write a hypothesis or prediction describing how you think nose cone mass will affect the rocket's range.

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2. Construct one straw rocket, except for the nose cone. You will design three different nose cones for this rocket.

3. The first nose cone design should be made from a ball of clay with a mass of 3 grams. It may have whatever shape you choose. Use the digital scale to verify the mass.

4. Create two more nose cones, one from clay with a mass of 4 grams and another with a mass of 5 grams. These should be the same shape as your first nose cone. Use the digital scale to verify the mass.

5. Place the lightest nose cone onto the straw rocket body you created in Step 2.

6. Place the rocket on the launch tube.

7. Adjust the direction angle to 45 degrees.

8. Raise the launch rod to the fifth calibration line.

9. To launch, release the launch rod so that it falls to the bottom of the cylinder.

10. Measure the rocket's range using the measuring tape.

11. Record the rocket's range on your data sheet.

12. Repeat steps 6-11 twice more for the lightest nose cone, and three times for the other two nose cones.

12. Complete the data chart, including calculating the average range for each nose cone.

13. Analyze the data, write a conclusion and a comparison.

Data: Record your data.

	Launch 1 Range	*Launch 2 Range*	*Launch 3 Range*	*Average Range*
Rocket with 3g Nose Cone				
Rocket with 4g Nose Cone				
Rocket with 5g Nose Cone				

13. **Conclusion**: How did the nose cone mass effect the rocket's range?

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Comparison: Why did the nose cone with the greatest range do so well?

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Test #3: Test for *Varying Launch Angles*

1. Read over the data chart. There are multiple pieces of information that you will need to collect from each launch.

2. Place the rocket on the launch tube.

3. Adjust the direction angle to 15 degrees.

4. Raise the launch rod to the fifth calibration line.

5. To launch, release the launch rod so that it falls to the bottom of the cylinder.

6. As soon as one of you launches the rocket, the other starts the stopwatch to time the rocket's flight. Stop timing when the rocket hits the ground.

7. Measure the rocket's range using the measuring tape.

8. Record the rocket's range and flight time on your data sheet.

9. Launch the rocket one more time form the trajectory angle of 15 degrees.

10. Record the second launch's information on the data sheet.

11. Repeat steps 2-10 using trajectory angles of 30 degrees, 45 degrees, 60 degrees, 75 degrees, and 90 degrees.

12. Complete the data sheet.

13. Analyze your data and write a conclusion.

Data: Record your data.

Launch Angle	*Launch 1* *Range/Flight Time*	*Launch 2* *Range/Flight Time*
15 degrees		
30 degrees		
45 degrees		
60 degrees		
75 degrees		
90 degrees		

13. **Conclusion**: How did the launch angle affect the rocket's range?

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Test #4: Test for *Mass vs. Range*

1. **Hypothesis**: Write a hypothesis or prediction describing how you think changes in the rocket mass will affect the rocket's range.

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2. Construct one 15 centimeter long straw rocket with a minimum of two fins and a maximum of five fins.

3. Add a one gram clay nose cone to the rocket.

4. Place the rocket on the launch tube.

5. Adjust the direction angle to 45 degrees.

6. Raise the launch rod to the fifth calibration line.

7. To launch, release the launch rod so that it falls to the bottom of the cylinder.

8. Measure the rocket's range using the measuring tape.

9. Record the rocket's range on your data sheet.

10. Perform three launches at a 45 degree launch angle and a calibration mark of five. Record the ranges on your data sheet.

11. Add mass to your rocket. Add clay to your body tube or paperclips to your fins. Record the variable you are using. Perform three launches with the same launch angle and calibration mark. Record the results.

12. Change the mass to your rocket. Record the variable you are using. Perform three launches with the same launch angle and calibration mark. Record the results.

13. Analyze the data, write a conclusion, and compare your hypothesis to your conclusion.

Design Description: Describe the variables used in your design.

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Data: Record your data.

	Rocket Mass	*Launch 1 - Range*	*Launch 2 - Range*	*Launch 3 - Range*
Rocket 1				
Rocket 2				
Rocket 3				

13. **Conclusion**: How did the rocket's mass affect the range you achieved?

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Comparison: How does your conclusion compare to your hypothesis?

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Test #5: Test for *Varying Fin Numbers or Shapes*

1. **Hypothesis**: Write a hypothesis or prediction describing how you think changes in fins will affect the rocket's range.

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2. **Design Description**: Describe the variables used in your design. Will you change the number of fins, or the shape of the fins? Remember you can only change one variable at a time.

3. Construct three rockets using the fin variable you decided on. The other main components should be the same for both rockets.

4. Place the rocket on the launch tube.

5. Adjust the direction angle to 45 degrees.

6. Raise the launch rod to the fifth calibration line.

7. To launch, release the launch rod so that it falls to the bottom of the cylinder.

8. Measure the rocket's range using the measuring tape.

9. Record the rocket's range on your data sheet.

10. Repeat steps 4-9 twice more for the first rocket, and three times for the other 2 rockets.

11. Analyze the data, write a conclusion, and compare your hypothesis to your conclusion.

Data: Record your data.

	Fin Variable	*Launch 1 - Range*	*Launch 2 - Range*	*Launch 3 - Range*
Rocket 1				
Rocket 2				
Rocket 3				

12. **Conclusion**: How did the changes to the fins affect the range you achieved?

Comparison: How does your conclusion compare to your hypothesis?

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