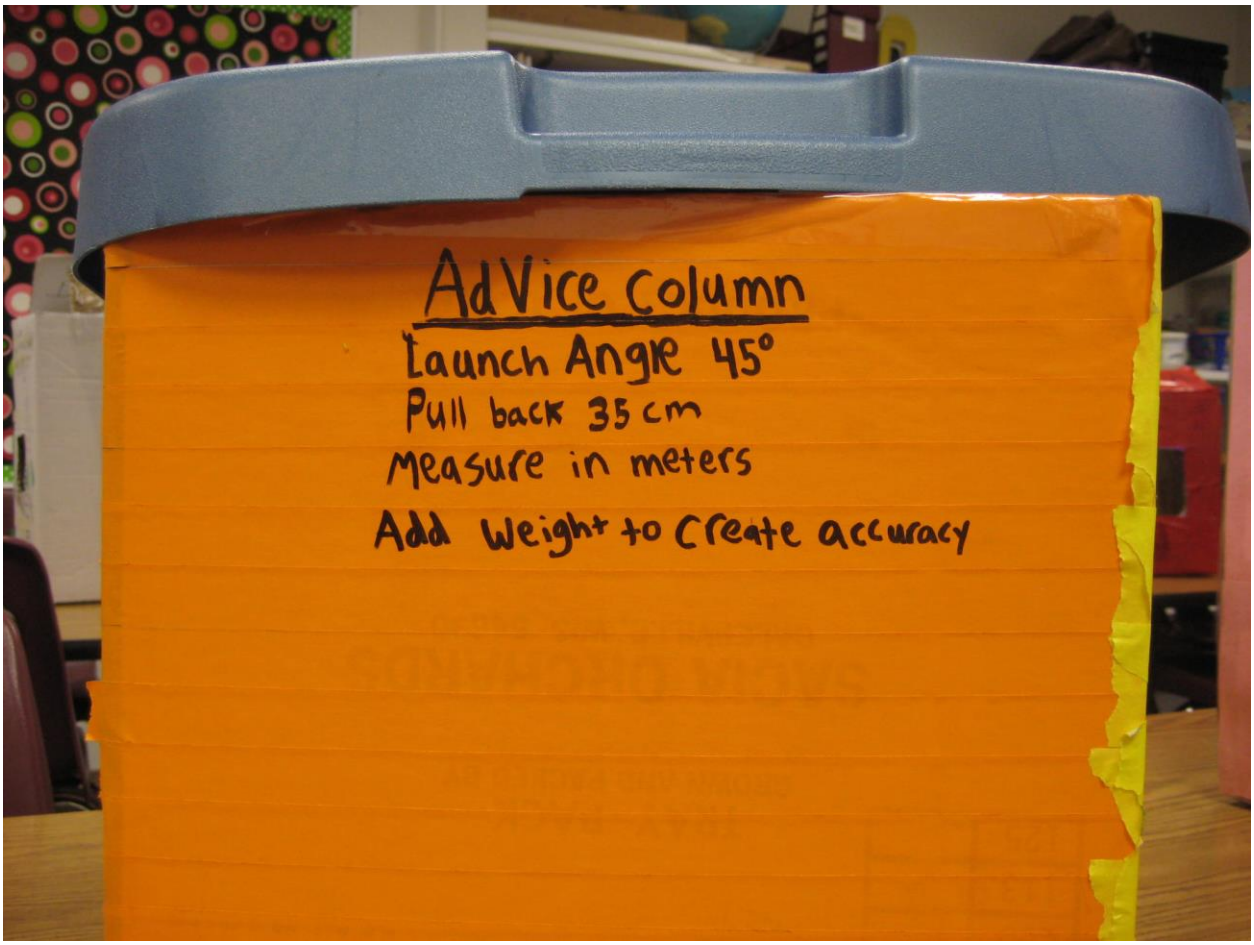
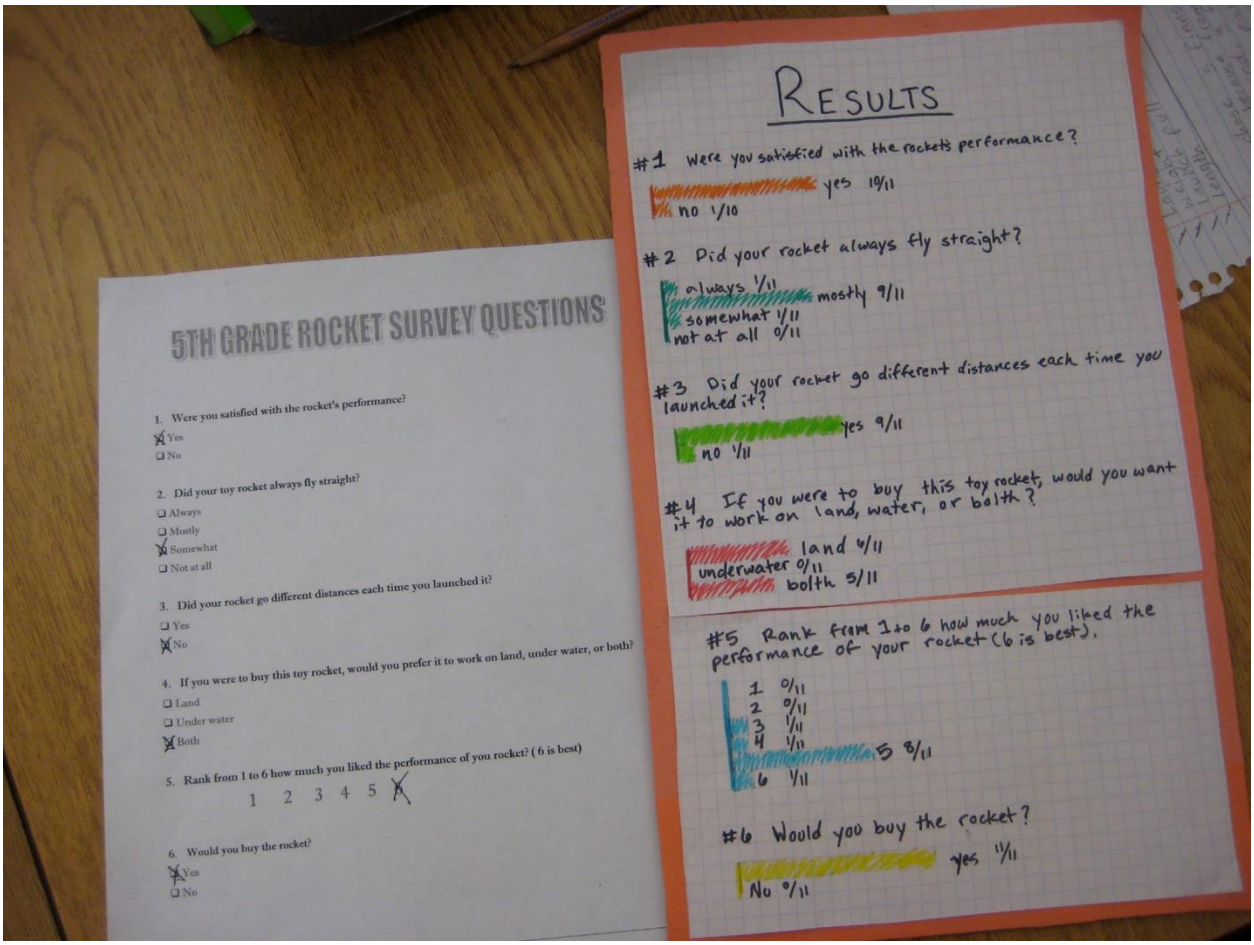
Student Work Samples


AdVice Column
Launch Angle 45°
Pull back 35 cm
Measure in meters
Add Weight to Create accuracy



5TH GRADE ROCKET SURVEY QUESTIONS

1. Were you satisfied with the rocket's performance?
☒ Yes
☐ No

2. Did your toy rocket always fly straight?
☐ Always
☐ Mostly
☒ Somewhat
☐ Not at all

3. Did your rocket go different distances each time you launched it?
☐ Yes
☒ No

4. If you were to buy this toy rocket, would you prefer it to work on land, under water, or both?
☐ Land
☐ Under water
☒ Both

5. Rank from 1 to 6 how much you liked the performance of you rocket? (6 is best)
1 2 3 4 5 ☒

6. Would you buy the rocket?
☒ Yes
☐ No

RESULTS

#1 Were you satisfied with the rocket's performance?
yes 10/11
no 1/10

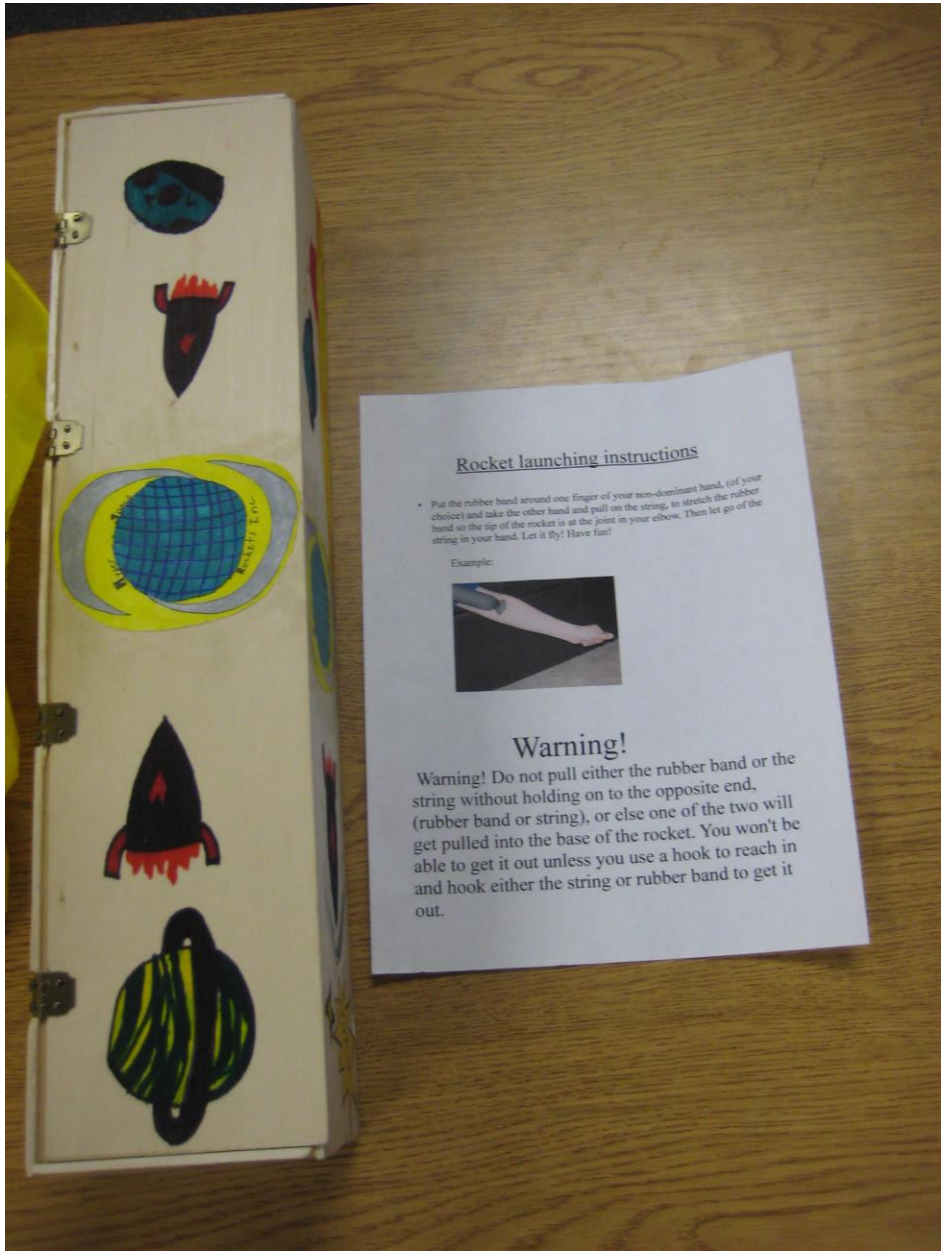
#2 Did your rocket always fly straight?
always 1/11
mostly 9/11
somewhat 1/11
not at all 0/11

#3 Did your rocket go different distances each time you launched it?
yes 9/11
no 1/11

#4 If you were to buy this toy rocket, would you want it to work on land, water, or bolth?
land 6/11
underwater 0/11
bolth 5/11

#5 Rank from 1 to 6 how much you liked the performance of your rocket (6 is best).
1 0/11
2 0/11
3 1/11
4 1/11
5 8/11
6 1/11

#6 Would you buy the rocket?
yes 11/11
No 0/11



Rocket launching instructions

- Put the rubber band around one finger of your non-dominant hand, (of your choice) and take the other hand and pull on the string, to stretch the rubber band so the tip of the rocket is at the joint in your elbow. Then let go of the string in your hand. Let it fly! Have fun!

Example:

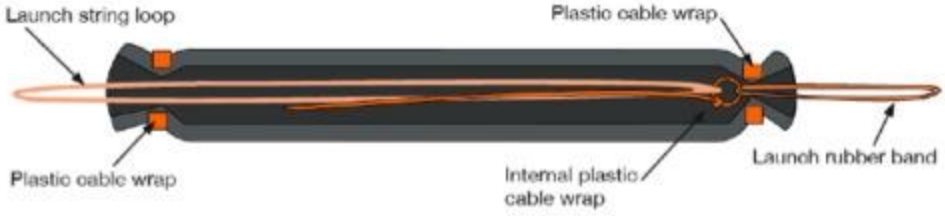
Warning!

Warning! Do not pull either the rubber band or the string without holding on to the opposite end, (rubber band or string), or else one of the two will get pulled into the base of the rocket. You won't be able to get it out unless you use a hook to reach in and hook either the string or rubber band to get it out.

ACME Toy Company Memorandum

To: Engineers
From: the CEO
RE: Redesign this Flying Toy Product

This flying toy prototype has been brought to our company, and I think it has the potential for becoming a big seller for the educational division of our company and possibly our general toy sales.



Current Materials and Costs: $0.36

1. 30 cm Foam Tubing ($0.24)
2. 75 cm mason line ($0.01)
3. 3, 8" cable ties ($0.09)
4. 1 rubber band ($0.01)

Design Requirements:

1. The flying toy's behavior must be predictable and/or easily adjustable.
2. The materials must be common and inexpensive.
3. The toy must be safe for elementary school use.

Scientific and Engineering Practices (NRC, 2012)	Toy Rocket Unit
Asking questions (for science) and defining problems (for engineering)	Create a rocket that meets certain requirements (predictable/adjustable rocket behavior, cheap to make, and safe)
Developing and using models	Students designed their own rockets
Planning and carrying out investigations	Mini-investigations of rocket variables were conducted by students
Analyzing and interpreting data	Students discussed findings from mini-investigations
Using mathematics and computational thinking	Average distances were calculated from multiple launching trials
Constructing explanations (for science) and designing solutions (for engineering)	Students created final rockets based on knowledge from mini-investigations
Engaging in argument from evidence	Students discussed findings from mini-investigations in large group
Obtaining, evaluation, and communicating information	Students presented their products in a mini-conference environment

Day of Unit	Lesson Objective/Goals
1	Scenario, Baseline launch
2	Data Analysis, What is a prototype?, What affects the rocket's flight?
3	Controlled Variable Testing
4	Variable Data Analysis, Plan, and Design
5	Design, Build, and Test
6	Design, Build, and Test
7	Final Product Work
8	Final Product Work
9	Final Product Work
10	Student Mini-Conference

Variables Tested	Controlled Parameters	Parameters Tested	Furthest Distance
Number of Fins	0	0, 2, 3, 4	3
Weight at Front	0g	0g, 10g, 20g, 30g	0g
Length	20cm	10cm, 20cm, 30cm, 40cm	40cm
Rubber Band Pull	20cm	10cm, 20cm, 30cm, 40cm	40cm
Launch Angle	30°	15°, 30°, 45°, 60°, 75°	45°

Rubric

	1	2	3	4
Creativity	Student product and design remains conventional, showing no original thinking. The product does not use a variety of ideas, concepts, or materials.	Student product and design may be conventional, but shows some evidence of original thinking. The product exhibits a variety of ideas, concepts, or materials.	The student's product design demonstrates creativity and shows original or unique thought processes. The product uses a variety of ideas, concepts, and/or materials.	The student's product design demonstrates imaginative thinking and shows original and unique thought processes. The product uses unconventional ideas and concepts and uses a variety of materials. Product shows a sense of humor and adventurous thinking.
Design Process	The student did not complete the task. No evidence of the design process being used.	The student used some appropriate resources to complete the task. The student used some elements of the design process.	The student determined appropriate resources to complete the task. The product design shows awareness of resource limitations, time, or space. The student used the design process to complete the task.	The student effectively determined the appropriate resources to complete the task. The product design shows awareness of resource limitations, time, and space. The student used alternative design strategies to accomplish the task in an effective sequence.
Rocket Change & Modifications	The final product exhibits no modification of ideas, adaptations, or improvement of the original toy design. No change from the original design is evident.	The final product shows limited modification of ideas, adaptation, or improvement of the original toy design. A change from the original product may be present and is based on limited scientific understanding.	The final product shows modification or ides, adaptation, and improvement of the original toy design. Some change from the original product is evident and is based on grade level scientific understanding.	The final product shows several modifications of ideas, adaptation, and improvement on the original toy and a willingness to take risks. Change from the original product is evident and based on scientific understanding.
Explanation of scientific process & Use of data	Scientific explanation of toy performance is not based on scientific evidence.	Scientific explanation of toy performance is based on some claims supported by scientific evidence. Limited data is expressed and may not be legible.	Scientific explanation of toy performance is based on claims supported by evidence. Data is expressed clearly and is legible.	Scientific explanation utilizes descriptive vocabulary of toy performance and is based on claims supported by evidence. Data is expressed in multiple formats and is legible.
Presentation & Performance	Presentation/ performance delivery does not reflect understanding of the content. Presentation/ performance is not appropriate length or suitable for the audience.	Presentation/ performance delivery reflects some understanding of content. Presentation/ performance may not be appropriate in length or suitable for the audience.	Presentation/ performance delivery reflects appropriate understanding of content. Presentation/ performance is the appropriate length and is suitable for the audience.	Presentation/ performance and content represents a high level of understanding. Presentation/ performance engages and/or captivates the audience. Presentation/ performance is the appropriate lengths and is suitable for the audience.

	1	2	3	4
I enjoyed the Flying Toy Project.	---	8%	50%	42%
I learned new science information from the Flying Toy Project.	8%	25%	42%	25%
I learned about the engineering design process from the Flying Toy Project.	---	17%	54%	29%
I liked the product choices in the Flying Toy Project.	---	---	46%	54%
I was able to apply creative thinking skills in my final product.	---	4%	29%	67%