Training Header Sheet with Change Log Form

Kentucky
Science - Grade 7
2022 Spring Op

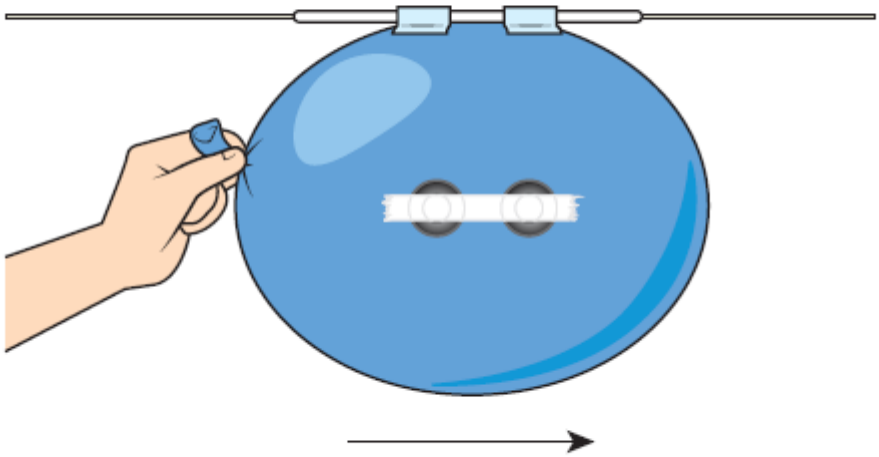
SC071616_08
Rockets and Forces

Anchor Set

Date	Comments	Version
10/2022	Operational Training Set	Set A

Stimulus

Kalil and Sophia were learning about space and space travel in school. They were designing models of transport systems to learn about motion and forces. Their first activity was to build a balloon rocket that would transport a load of washers from one end of a string to the other.



They recorded the results of their first attempts in the table below.

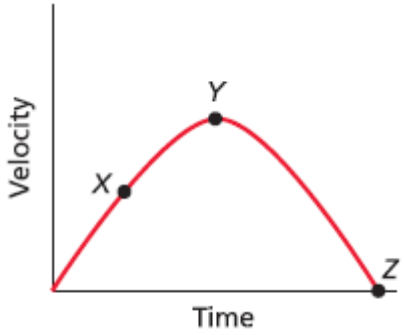
Diameter of Balloon (inches)	Number of Washers	Distance Traveled (meters)
6	2	1.5
8	2	1.8
10	2	2
12	2	2.4

Stimulus

After the initial investigation, the teacher asked the students to begin a new investigation. In this investigation, the students were asked to change the number of washers while controlling the other variables. The table contains their findings.

Diameter of Balloon (inches)	Number of Washers	Distance Traveled (meters)
10	1	2.4
10	2	2.0
10	3	1.7
10	4	1.4

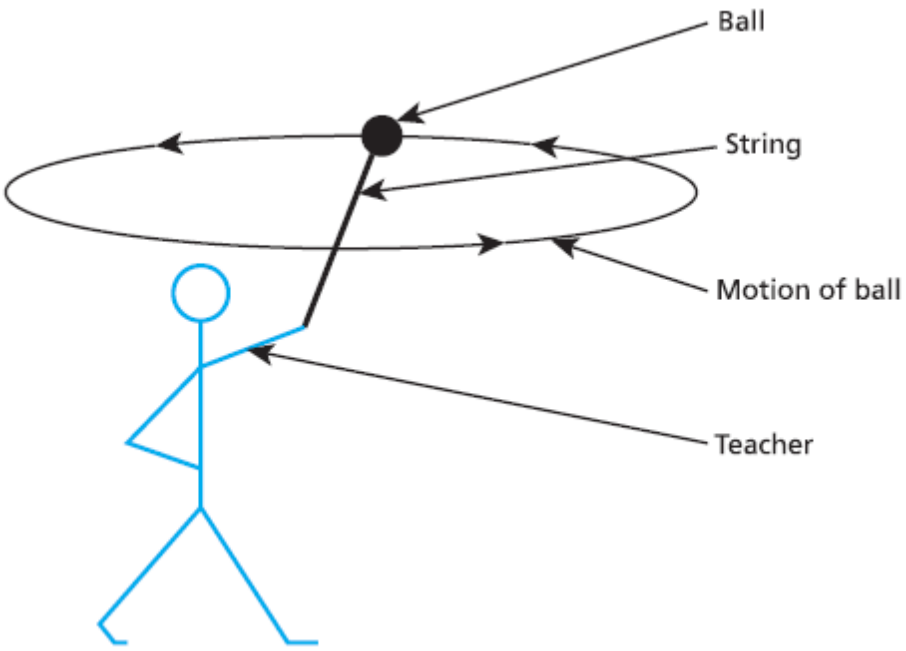
For the next investigation, the teacher had Kalil and Sophia use a motion detector to graph the balloon rocket from the beginning of the launch to the end. Following is a graph of the rocket's motion.



Stimulus

After Kalil and Sophia completed their investigations for the class, the teacher asks the class to think about how real rockets are different from the balloon rockets they made in class. He asked the question, "If we launched one of these rockets toward space, what would happen?" The students said it would just fall back to Earth because the rocket would not have enough stored energy to overcome the force of gravity. The teacher agreed and explained that gravity is a very important force everywhere in the universe, not just on Earth.

The teacher demonstrated a model of gravity in the Sun-Earth system by swinging a small ball above his head on a string. After discussing the parts of the system and how they interacted, the teacher gave the students a drawing of the activity on paper.



Stimulus

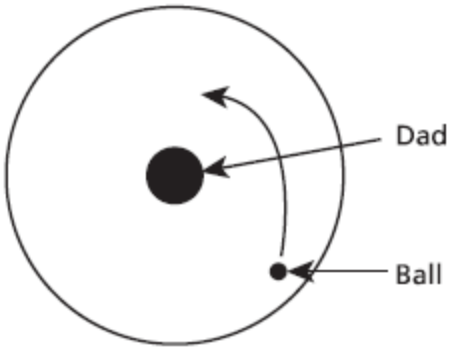
To help the students better understand how gravity works, the teacher gave the students a different model to explore. The teacher shared this diagram with the class.

The force of gravity varies with distance from Earth

Distance in miles from Earth's surface.	Acceleration due to gravity in feet per second	Amount that a 100-pound person would weigh at each location in pounds
0	32	100
4,000	8	25
8,000	3.6	11
12,000	2	6.25
16,000	1.3	4
20,000	0.9	2.77
24,000	0.6	2

One student looked at this diagram and said, "Wow, I'll bet you don't have to travel very far until the force of Earth's gravity drops to zero."

"Why doesn't Pluto orbit one of the planets instead of orbiting the sun?" Kalil asked the teacher. To help Kalil understand, the teacher gave the class another model to think about. "Imagine that your dad is sitting in the middle of a trampoline. You roll a ball across the trampoline. What happens to the ball?"



Stimulus

The teacher asked the students to think about all they had explored about forces, motion, and gravity in order to design an investigation to solve a new problem that involved using forces to work against gravity.

The class was asked to launch a balloon rocket vertically. The rocket needed to carry a load of five washers to a height of three meters. To conduct the investigation they had the following materials available:

Materials

Fishing line
Yarn
Cotton string
Small-diameter straws
Medium-diameter straws
Large-diameter straws
7-inch round balloons
8-inch round balloons
9-inch round balloons

Prompt

Part A

Explain which variable you will change and which you will keep constant.

Part B

Describe how you will measure your variables.

Part C

Describe how your choice(s) of materials affected the forces acting on the rocket.

	Kentucky Academic Standards Science Rubric
Score	Description
4	There is evidence in this response that the student has a complete and thorough understanding of the multi-dimensional question as evidenced by their explanation of the phenomenon and/or solution to the problem. The response is complete, thorough and correct and based on appropriate knowledge and skills The response does not contain errors or flaws in logical thinking or those flaws are irrelevant to the accuracy of the answer The response reflects complete synthesis and understanding of complex ideas The response is completely coherent and based on effective application of relevant dimensions (SEP and/or DCI and/or CC) The response integrates a solution that is completely correct and based on the principles of engineering design (if applicable)
3	There is evidence in this response that the student has a general understanding of the multi-dimensional question as evidenced by their explanation of the phenomenon and/or solution to the problem. The response is generally complete and the question is answered using appropriate knowledge and skills The response may contain minor errors or flaws in logical thinking and those flaws may or may not be irrelevant to the accuracy of the answer The response reflects a general synthesis and understanding of complex ideas The response is generally coherent and based on application of relevant dimensions (SEP and/or DCI and/or CC) The response integrates a solution that is generally correct and mostly based on the principles of engineering design (if applicable).
2	There is evidence in this response that the student has a limited understanding of the multi-dimensional question as evidenced by their explanation of the phenomenon and/or solution to the problem. The response is partially complete and/or the question is answered using limited understanding of knowledge and skills The response may contain significant errors or flaws in logical thinking The response reflects a limited synthesis and understanding of complex ideas The response may or may not be coherent and based on some application of relevant dimensions (SEP and/or DCI and/or CC) The response integrates a solution that is partly correct and may or may not be based on the principles of engineering design (if applicable).
1	There is evidence in this response that the student has a minimal understanding of the multi-dimensional question as evidenced by their explanation of the phenomenon and/or solution to the problem. The response is minimal and/or the question is answered using minimal understanding of knowledge and skills The response may contain major significant errors or flaws in logical thinking The response reflects a minimal synthesis and understanding of complex ideas The response is not coherent or is not based on application of relevant dimensions (SEP and/or DCI and/or CC) The response integrates a solution that is minimally correct and may or may not be based on the principles of engineering design (if applicable).
0	There is no evidence that the student has an understanding of the material related to the question being asked in terms of science content and logical thinking skills. The response is blank, entirely incorrect and/or irrelevant.

Anchor 01
Score Point 0

Part A

Explain which variable you will change and which you will keep constant.

I would change having to have cotton string and just have the one kind.

Part B

Describe how you will measure your variables.

I will measure the variables with the mearsuing tool

Part C

Describe how your choice(s) of materials affected the forces acting on the rocket.

My chocies affect the materials because it would make it easier to have all of this stuff

Anchor 02
Score Point 0

Part A

Explain which variable you will change and which you will keep constant.

I would chose to use the fishing line, small diameter straw and the 8-inch round ballon.

Part B

Describe how you will measure your variables.

I would chose to use the fishing line, small diameter straw and the 8-inch round ballon becauce they seem to be the best choice of materials

Part C

Describe how your choice(s) of materials affected the forces acting on the rocket.

I feel that my choices of materials would hep the student acheive their goal of reaching a vertical height of three meters. I feel like it is the best possibale way to affect the forces on the ballon rocket.

Anchor 03
Score Point 0

Part A

Explain which variable you will change and which you will keep constant.

9-inch round balloons, large-diameter straws, and a fishing line

Part B

Describe how you will measure your variables.

first ballons, then large straws, and last fishing line

Part C

Describe how your choice(s) of materials affected the forces acting on the rocket.

the 9-inch round balloons can have a lot of heleam, the large-diameter straws so they can carry the washers, and the fishing line so it can carry more washers

Anchor 04
Score Point 1

Part A

Explain which variable you will change and which you will keep constant.

i would take out the cotten string and the small diameter straws and i would take out the 7 inch ballons

Part B

Describe how you will measure your variables.

1. i would hook the fishing line to the 9 inch balloons.
2. i would tie them all together and then test it.

Part C

Describe how your choice(s) of materials affected the forces acting on the rocket.

the fishing line is less mass so that means that it would go faster and more smoothly and then the 9 inch ballon is a big one so it would have more helem (the stuff you put in balloons) to float better and go up faster because it is big so it can hold the washers.

Anchor 05
Score Point 1

Part A

Explain which variable you will change and which you will keep constant.

The variable I will change is straws I would use a 2 large-diameter straw and a 9-inch round ballon.

Part B

Describe how you will measure your variables.

Part C

Describe how your choice(s) of materials affected the forces acting on the rocket.

The bigger the diameter of the ballons the more it travels.

Anchor 06
Score Point 1

Part A

Explain which variable you will change and which you will keep constant.

cotton string i would get rid of because it is not strong. i would keep the 9-inch round balloons baecause it would make you go farther

Part B

Describe how you will measure your variables.

small,medium,large diameter straws 7,8,9 inch round balloons fishing line,yarn, cotton string.

Part C

Describe how your choice(s) of materials affected the forces acting on the rocket.

my choices are fishing line medium-diameter straws 9inch round balloons

Anchor 07
Score Point 2

Part A

Explain which variable you will change and which you will keep constant.

You change The balloon size yet keep the amount of washers a constant.

Part B

Describe how you will measure your variables.

The inch size of a balloon, and the hight the ballon travels.

Part C

Describe how your choice(s) of materials affected the forces acting on the rocket.

The balloon has more whiet so it has to fight agenst gravity evan harder.

Anchor 08
Score Point 2

Part A

Explain which variable you will change and which you will keep constant.

The variable i would change is large-diameter straws, the variable i would keep constant is 9-inch round ballons.

Part B

Describe how you will measure your variables.

I will measure the variables by seeing how far the ballon travled in meters, and measure the ballons diameter in inches..

Part C

Describe how your choice(s) of materials affected the forces acting on the rocket.

How my materials affected the forces is, the larger the diameter the farther it will go(shown by the ballon rocket model), also the yarn and cotton string would create more fricton.

Anchor 09
Score Point 2

Part A

Explain which variable you will change and which you will keep constant.

You will change the size of the ballons and keep everything else the same.

Part B

Describe how you will measure your variables.

You will measure how far they travel to see which one works the best.

Part C

Describe how your choice(s) of materials affected the forces acting on the rocket.

If you change the size of the baloon, it will hold more air so it will travel farther.

Anchor 10
Score Point 3

Part A

Explain which variable you will change and which you will keep constant.

I will use the fishing line and medium straw as a constant. The variables will be different size ballons.

Part B

Describe how you will measure your variables.

When doing the trials I will measure the distance the ballons travel.

Part C

Describe how your choice(s) of materials affected the forces acting on the rocket.

Fishing line is the stronger option and is smoother allowing the less resistance. The medium straw has more weight than a small straw, but not too much weight. The 7 inch balloon has less mass which allows it to travel farther.

Anchor 11
Score Point 3

Part A

Explain which variable you will change and which you will keep constant.

We would have to keep the mass of the 5 washers the same, so that would be the constant variable, and we would change the size of the balloons and the size of the straws.

Part B

Describe how you will measure your variables.

I would organize the data to show how far the rocket went for each change, such as changing the balloon size or the straw size. I would not change two things at once; only test one variable at a time.

Part C

Describe how your choice(s) of materials affected the forces acting on the rocket.

My choices of materials affected the forces acting on the rocket with the launch-speed. However fast the rocket takes off, the more force the rocket has on the string. The bigger the balloon, the faster it takes off and the farther it goes. The bigger the straw diameter, the faster and farther the rocket goes.

Anchor 12
Score Point 3

Part A

Explain which variable you will change and which you will keep constant.

The variable I would change is the size of the balloon becuase the mass could affect how fast it goes. I will also use the straws as a varible becuase they are different enghts and could effect the propulsion. would keep the amount of air in the balloon constant becuase if it was off it could have a wild effect on the lauching which is not what we are testing.

Part B

Describe how you will measure your variables.

How I will measure my variables is I will get a 7 inch ballon and try it on each type of straw and see if it hits three meters. Then I will use the 8 inch and do the same thing along with the 9 inch. I can measure how the effect the speed with this.

Part C

Describe how your choice(s) of materials affected the forces acting on the rocket.

How my choices of materials affected the forces acting on the rocket is with the different sizes of balloons I could affect the mass acting the rocket and see if it lauches it the rocket farther. With the straws I could test how short or how long the lauching area is and if that makes the rocket go higher and lower and if it gives it friction and force.

Anchor 13
Score Point 4

Part A

Explain which variable you will change and which you will keep constant.

To create a rocket using five washers to three meters I would change the size of the balloons and I would keep the type of line the same and the type of straw the same. Keeping these variables constant would mean that I could explore the resistance of the air and the amount of force I need to complete my task.

Part B

Describe how you will measure your variables.

I will measure my variables by making a note of which balloon size traveled the farthest. My constant variables do not change and I will inflate each balloon to the same size and start the tests at the same point to ensure that my results are accurate.

Part C

Describe how your choice(s) of materials affected the forces acting on the rocket.

I chose fishing line, medium-diameter straws, and I changed the type of balloon with each test. The fishing line and medium-diameter straws made less friction with each test and made the balloons and washers travel faster. Each balloon added more force to each experiment which changed the conclusions to each test.

Anchor 14
Score Point 4

Part A

Explain which variable you will change and which you will keep constant.

My constant would be the five washers, the line, and the size of the balloons. I will use 9 inch round balloons and a fishing line. The changing variable will be the straws that connect it to the line. I predict the looser the straw is on the fishing line, the farther it will go.

Part B

Describe how you will measure your variables.

I will measure the changing variable- which is the straw- by the difference in how far the balloons go. I know this the straw will be the reason for change because it is my only varible that changes. In other words, all of my other materails I will use every time-they are my constants- and the straw I will change

Part C

Describe how your choice(s) of materials affected the forces acting on the rocket.

Each different aspect of the experiment changes the outcome. For example if I used a 7 inch balloon rather than an 9 inch and kept the five washers, the 9 inch would go farther because the 7 inch is smaller than the 9 inch. As we saw in the "Balloon Rocket Experiment" chart, the larger the balloon goes faster compared to the smaller balloons if you do not change the number of washers. So, I am using a fishing line, a 9 inch balloon, five washers, and my straw will change. The fishing line will not cause much tension on the straw I use because it is smoother than the yard. Then my 9 inch balloon will go the longest distance compared to the other balloons if we do not change any other variables. Then, the choice of straw will either increase or decrease the length of distance compared to the others. I predict that the smaller straws will cause more tension and a lesser distance because the balloon is fighting to get across whereas the medium straw won't be slowed down as much from the force of the fishing line stopping it. However, the large straw may be too big and sag on the fishing line and slow it down. So, I think that the medium straw will go the longest distance.