

The BOTTLE FLIP

STEM CHALLENGE



Part 1 THE DATA continued...

BOTTLE	TOTAL SUCCESSFUL TOSSES	SUCCESS RATE <small>(Fraction of success/total tosses)</small>	SUCCESS PERCENTAGE
A			

THE DATA

Write the number of successful tosses for each of your bottles. Write the total number of tosses for each bottle. Write the success rate as a fraction of total successful tosses over total tosses. For example, if you tossed each bottle 25 times and you succeeded 5 times, the success rate would be 5/25.

TOTAL SUCCESSFUL TOSSES
TOTAL NUMBER OF TIMES YOU TOSSED

Use your calculator to figure out the success percentage. Divide the top number by the bottom number then multiplying by 100. In the above example, 5 divided by 25 is 0.20. Write the percent symbol after the 20 on the table.

Part 2 THE TECHNIQUE

First practice tossing the bottles. Once you have developed a technique you are comfortable with, fill out the checklist. You will need to use this same technique for the challenge so write it all down.

HAND USED

LEFT HAND

HAND MOVEMENT

- SLOW LOB
- QUICK FLICK

BODY DISTANCE

FEET

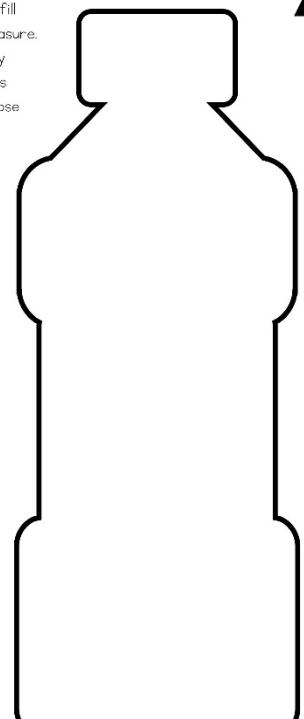
Part 3 THE VIDEO

You have now determined the best water bottle and the amount of water to use. Now it's time to create a video of your best chance of landing your bottle. Prep your bottle by filling with water to the amount you determined. Practice your highest success rate. You will now create a video of a successful toss. 1. Open the App Slow Motion. If it is your first time using the app, give it access to the camera and microphone.

Part 2 THE WATER LEVEL

Measuring with a ruler from the bottom of the water bottle, choose 4 different levels to fill and toss. Use inches or centimeters to measure. If you cannot think of your own levels, try using 1 inch, 2 inches, 3 inches, and 4 inches from the bottom. Mark the levels you choose and label on the blank water bottle.

B	
C	
D	



MEASURE FROM THE BOTTOM

1. Open the App Slow Motion. If it is your first time using the app, give it access to the camera and microphone.

2. Have a buddy hold the iPad vertically and do a few practice tosses. Make sure the entire toss is in the frame.

3. Tap the red circle to start filming.

4. Toss the bottle.

5. Tap the red circle button again to stop filming.

6. Tap the red circle button to land the bottle.

7. Tap the red circle button in the corner to open it. Touch it again.

8. Tap the red circle button to length if you want or just drag it to fill the space.

9. Tap the red circle button to 25%.

10. Tap the red circle button to 50%.

11. Tap the red circle button to 75%.

12. Tap the red circle button to x1.25.

13. Tap the red circle button to x1.5.

14. Tap the red circle button to x2.0.

15. Tap the red circle button to HIDE.

16. Tap the red circle button to CLEAR.

17. Tap the red circle button to Save Video.

Erin Flanagan 2016

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Thank you for your purchase!
♥ Erin

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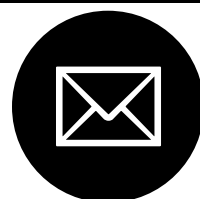
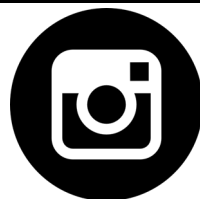
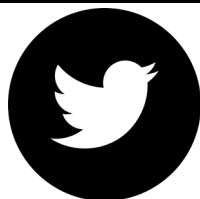


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CLICK THE BUTTON TO CONNECT WITH ME



NOTE TO TEACHERS

This STEM Challenge & iPad video project is based on Bottle Flipping or Bottle Tossing - a popular trick using a plastic water bottle. You can show students the original video that inspired the trend here:

<https://www.youtube.com/watch?v=GdUVtEeg9I4>

The Challenge:

Students will first test a variety of bottles by filling them with water and tossing / flipping them to determine which bottle of theirs has the highest success rate. Next students will use that bottle to determine the best amount of water to use. After students share which bottles and water levels yielded the highest success rate, students can then use what they learned to design the perfect Bottle-Tossing bottle. Optional: students will make a slow motion video on the iPad of themselves tossing the water bottle.

Materials Needed:

Students will need at least 4 different types of plastic water bottles, but there is recording space for up to 8 bottle types. Small groups of students may share. Students can collect plastic water bottles after lunch for a few weeks leading up to the challenge or bring in recycled plastic water bottles from home rather than purchasing new ones. Bottles can be any size, brand, style or height. If you plan to do the iPad video part, students will also need access to an iPad with the free app Slow Motion Camera Free. **[Click to download the app.](#)** Newer iPads and iPhones have the ability to slow down video right in the camera app.

Set Up:

Print pages 5-28 for each student. These can be printed front to back or have students work in pairs if you wish to conserve paper. Each page has directions for what students need to do. Students can work at their own pace to complete each page. Students will determine how to set up their bottle toss - whether on a desk, table, or the floor for example - so students will need to spread around the room. Determine what kind of graph you want students to make.

How to toss or flip the bottle:

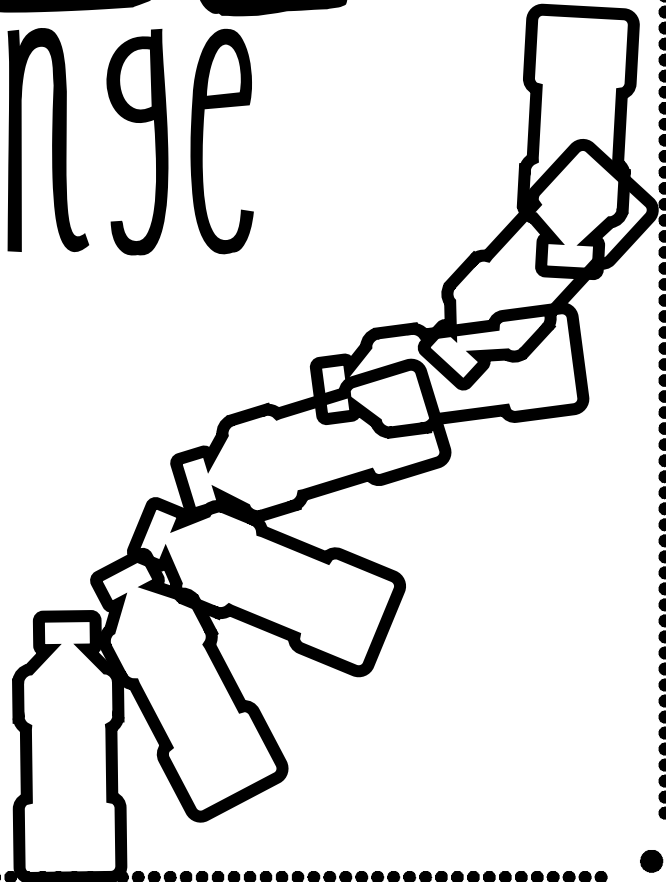
Many students are already familiar so ask them to demonstrate. If not, the best way to toss the bottle is to pick it up at the neck lightly and quickly snap your wrist - flipping or spinning it away from your body. Bottles should not travel more than a foot or so up in the air. You can show students this video if needed:

<https://www.youtube.com/watch?v=AxyFr7TSNg8>

The ultimate BOTTLE FLIP challenge

Find the ideal bottle type and water level for all your bottle toss & flipping trick-shot videos!

Name: _____



THE BOTTLES

For this challenge, you will need at least 4 different bottles to test. They may be different brands, shapes, sizes, and colors. Describe each bottle. Be sure to indicate the unit you used to measure the height - you will need to use a ruler. Also list the units you will use to compare the volume. The volume is typically on the bottle's label. Use the same units for each bottle. Illustrate your bottles. Be sure to show any specific features like curves, dents, ridges, etc.

BRAND

A

HEIGHT

VOLUME

ILLUSTRATION

BRAND

B

HEIGHT

VOLUME

ILLUSTRATION

THE BOTTLES *continued...*

For this challenge, you will need at least 4 different bottles to test. They may be different brands, shapes, sizes, and colors. Describe each bottle. Be sure to indicate the unit you used to measure the height - you will need to use a ruler. Also list the units you will use to compare the volume. The volume is typically on the bottle's label. Use the same units for each bottle. Illustrate your bottles. Be sure to show any specific features like curves, dents, ridges, etc.

BRAND

C

HEIGHT

VOLUME

ILLUSTRATION

BRAND

D

HEIGHT

VOLUME

ILLUSTRATION

THE BOTTLES *continued...*

For this challenge, you will need at least 4 different bottles to test. They may be different brands, shapes, sizes, and colors. Describe each bottle. Be sure to indicate the unit you used to measure the height - you will need to use a ruler. Also list the units you will use to compare the volume. The volume is typically on the bottle's label. Use the same units for each bottle. Illustrate your bottles. Be sure to show any specific features like curves, dents, ridges, etc.

BRAND

E

HEIGHT

VOLUME

ILLUSTRATION

BRAND

F

HEIGHT

VOLUME

ILLUSTRATION

THE BOTTLES *continued...*

For this challenge, you will need at least 4 different bottles to test. They may be different brands, shapes, sizes, and colors. Describe each bottle. Be sure to indicate the unit you used to measure the height - you will need to use a ruler. Also list the units you will use to compare the volume. The volume is typically on the bottle's label. Use the same units for each bottle. Illustrate your bottles. Be sure to show any specific features like curves, dents, ridges, etc.

BRAND

G

HEIGHT

VOLUME

ILLUSTRATION

BRAND

H

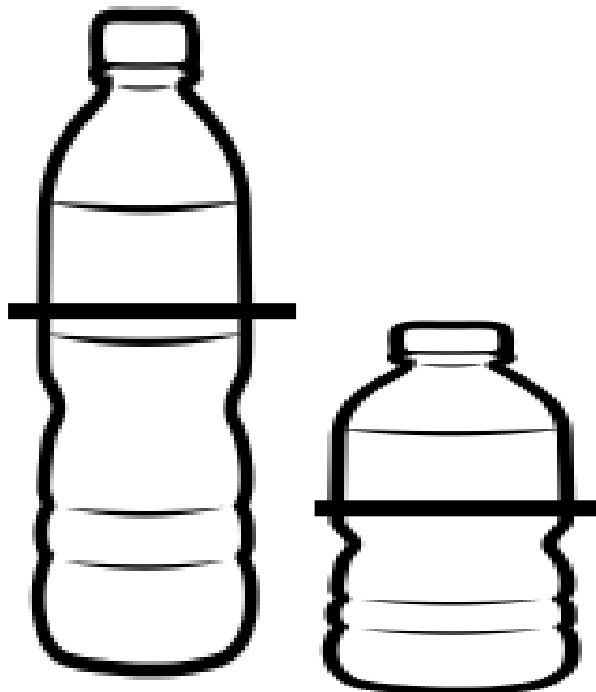
HEIGHT

VOLUME

ILLUSTRATION

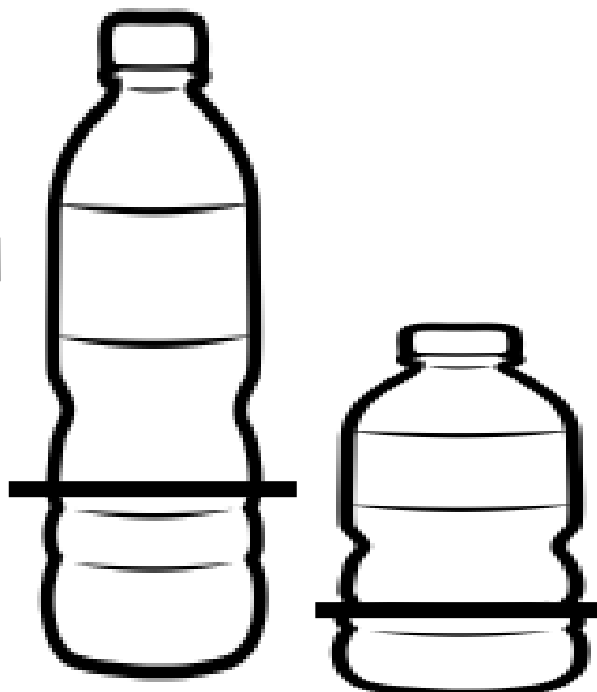
THE WATER

Each bottle will need to have the same relative water level. Bottle tossing typically works best when the bottle is a third to half full. Each bottle might have a different amount of water.



These bottles
are both marked
at the half point.

These bottles
are both marked
at one third full.



Decide which level you will use for all of your bottles:

HALF or **THIRD**

THE TECHNIQUE

First practice tossing the bottles. Once you have developed a technique that you are comfortable with, fill out the checklist. You will need to use this same technique each time you toss for the challenge so write it all down.

HAND USED

- LEFT HAND
- RIGHT HAND

BODY POSITION

- STANDING
- SITTING
- SQUATTING
- ON KNEES
- OTHER: _____

BOTTLE LOCATION

- TABLE TOP
- DESK
- FLOOR
- CARPET
- OTHER: _____

START POSITION

- BOTTOM SIDE DOWN
- BALANCING ON CAP

HAND MOVEMENT

- SLOW LOB
- QUICK FLICK

BODY DISTANCE

- 1 FOOT
- 2 FEET
- 6 INCHES
- OTHER: _____

*Anything
ELSE?*

THE FLIP

Toss each bottle the same predetermined amount of times.. If you are working with a small group or partner, you may split the tosses - just be consistent and do the same for each bottle. Use tally marks to record if the toss was successful or not. A successful toss is one where the bottle lands the same way as it started. Be sure to use the same technique for each toss as marked on the techniques page.

Number of tosses for each bottle:
Circle one or choose your own (realistic) number.

15
 25
 50

Successful?

BOTTLE	YES	NO
A		
B		
C		
D		

THE FLIP *continued...*

Successful?

BOTTLE

YES

NO

E

F

G

H

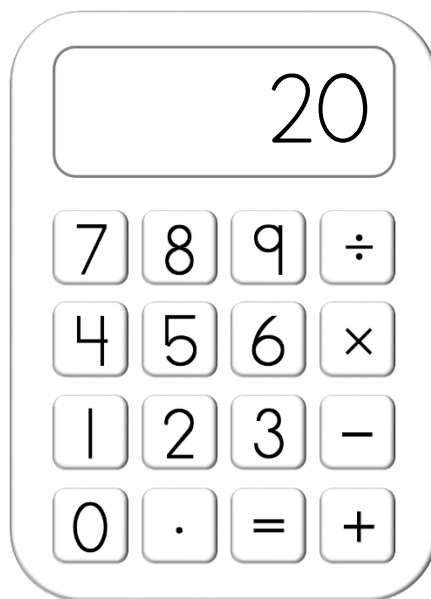
THE DATA

Total up the number of successful tosses for each of your bottles. Write the total number. Next write the success rate as a fraction of total successful tosses over total tosses. For example, if you tossed each bottle 25 times and you successfully landed Bottle A 5 times, the success rate would be $5/25$.

TOTAL SUCCESSFUL TOSSES

TOTAL NUMBER OF TIMES YOU TOSSED THE BOTTLE

Use your calculator to figure out the success percentage by dividing the top number by the bottom number then multiplying by 100. In the above example $5/25$ would become $0.20 \times 100 = 20$. Write the percent symbol after the 20 on the table.



That means that in our example, Bottle A has a 20% chance of landing successfully if tossed by you with your technique.

BOTTLE	TOTAL SUCCESSFUL TOSSES	SUCCESS RATE (Fraction of success/total tosses)	SUCCESS PERCENTAGE
A	5	$\frac{5}{25}$	20%

THE DATA *continued...*

BOTTLE	TOTAL SUCCESSFUL TOSSES	SUCCESS RATE <small>(Fraction of success/total tosses)</small>	SUCCESS PERCENTAGE
A			
B			
C			
D			
E			
F			
G			
H			

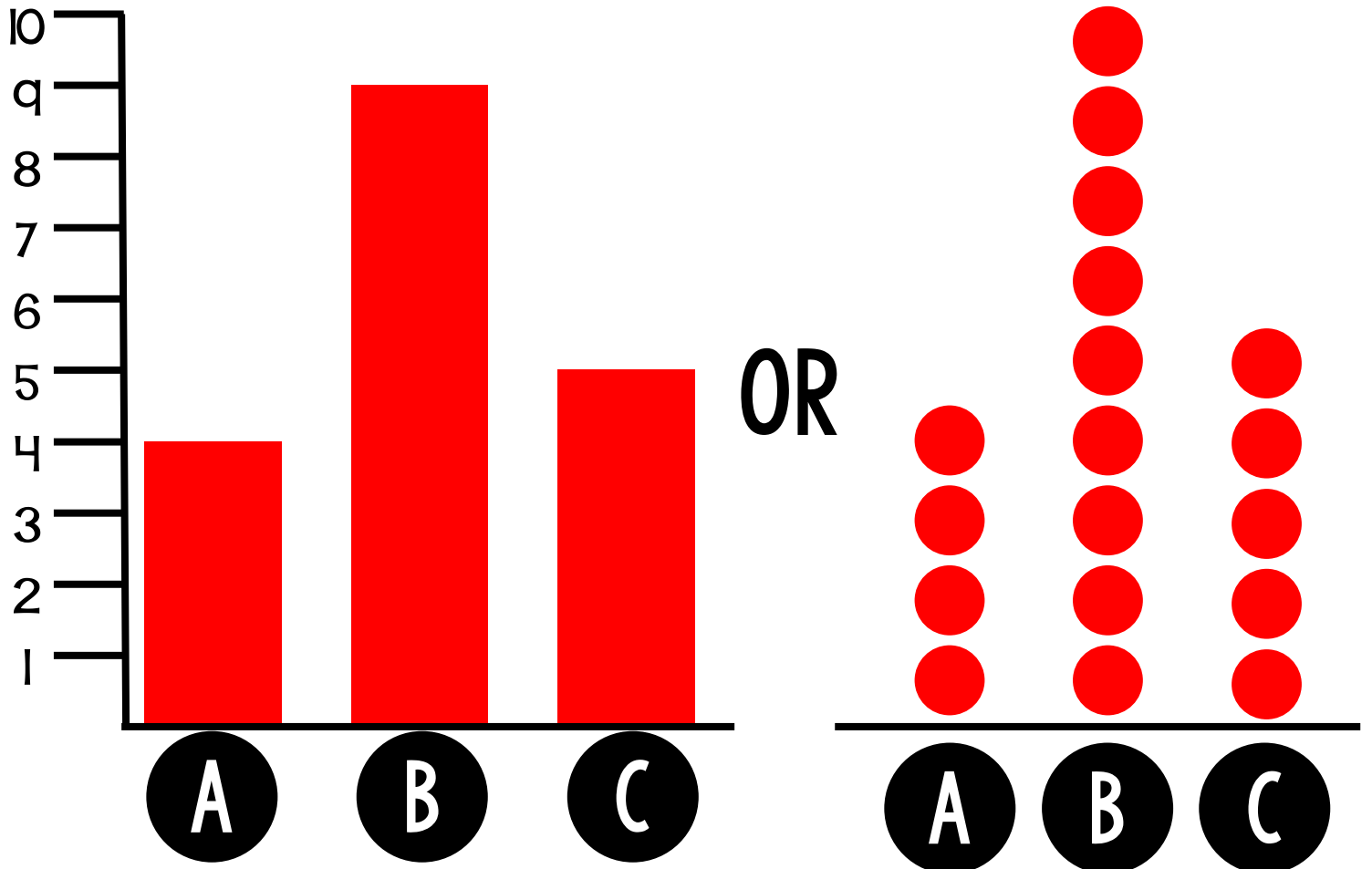
THE FREQUENCY

BOTTLE	TOTAL SUCCESSFUL TOSSES - TALLY MARKS	FREQUENCY
A		
B		
C		
D		
E		
F		
G		
H		

THE FREQUENCY

Sample Frequency Chart & Plot/Graph

BOTTLE	TOTAL SUCCESSFUL TOSSES - TALLY MARKS	FREQUENCY
A		4
B	 	9
C	 	5

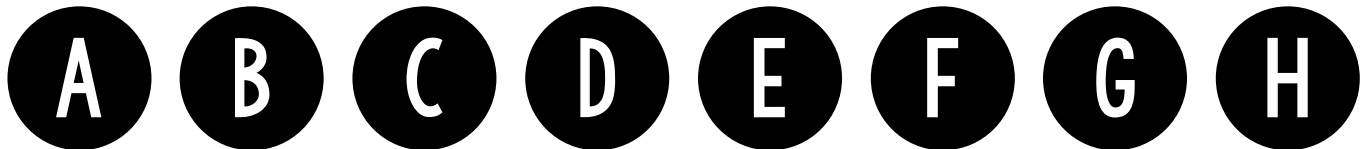


THE GRAPH

Use the data from the frequency chart to make a line plot, dot plot or graph. You will need to label the Y-axis, write in your total number of tosses and title your graph.

Times Bottle Landed Successfully Out of _____ Tosses.

(Title)

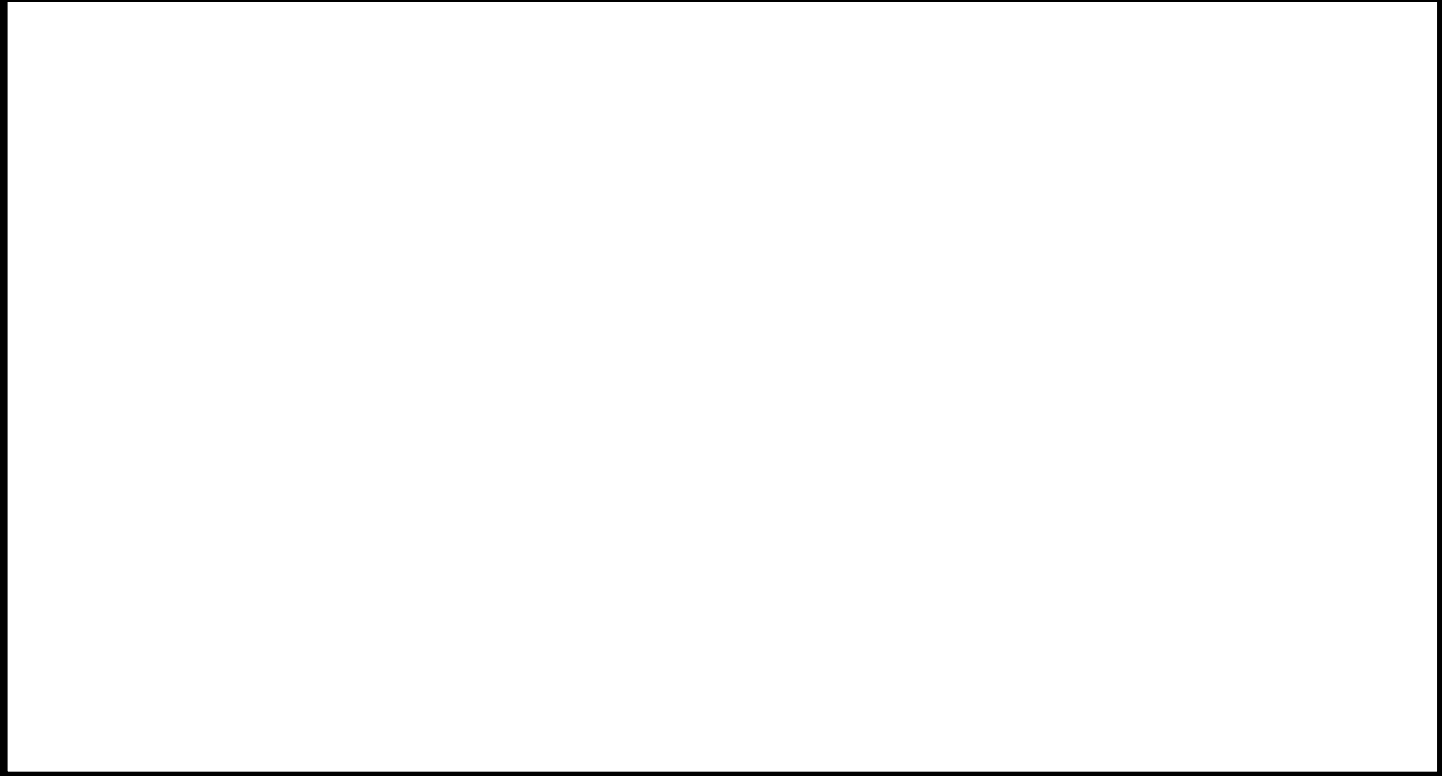


Bottle Tossed _____ Amount of Times

THE LANDMARKS

Look at your data to determine the following. Use the space to show your work.

MEAN / AVERAGE NUMBER OF SUCCESSFUL TOSSES



Which bottles were less successful at landing than the average?

Which bottles were more successful at landing than the average?

THE RESULTS

Which water bottle or bottles had the highest success rate? Why do you think that might be?

Which water bottle had the lowest success rate? Why do you think that might be?

What is something you did well in this part of the challenge?

What is something you had difficulty with in this part of the challenge?

THE BOTTLE

Use the bottle from Part I that had the highest success rate and fill out the information below. Be sure to indicate the unit you used to measure the height - you will need to use a ruler. Also list the unit for volume. The volume is typically on the bottle's label. Make a detailed illustration of your bottle. Be sure to show any specific features like curves, dents, ridges, etc.

BRAND

HEIGHT

VOLUME

SUCCESS RATE %

ADDITIONAL INFO

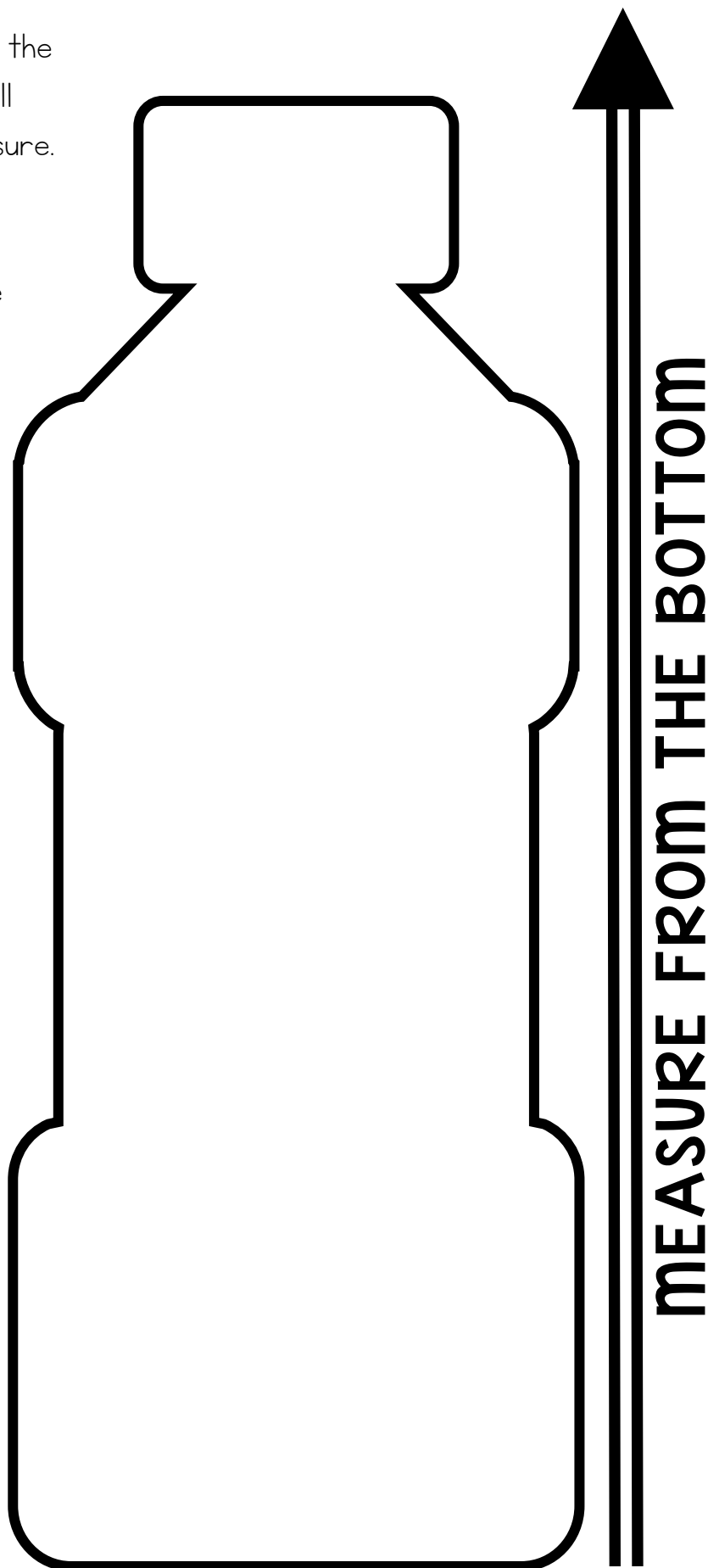
ILLUSTRATION

Part
2

THE WATER LEVEL

Measuring with a ruler from the bottom of the water bottle, choose 4 different levels to fill and toss. Use inches or centimeters to measure.

If you cannot think of your own levels, try using 1 inch, 2 inches, 3 inches, and 4 inches from the bottom. Mark the levels you chose and label on the blank water bottle.



**Part
2**

THE FLIP

Fill the bottle one of the measurements you chose then toss it the same amount of times as you did in Part 1. If you are working with a small group or partner, you may split the tosses - just be consistent and do the same for each water level. Use tally marks to record if the toss was successful or not. Be sure to use the same technique for each toss as marked on the techniques page for Part 1

Number of tosses for each bottle:
Circle the same number you used in Part 1.

15 25 50

Successful?

WATER LEVEL from the bottom	YES	NO

THE DATA

Crunch the numbers the SAME way you did for Part 1.

WATER LEVEL from the bottom	TOTAL SUCCESSFUL TOSSES	SUCCESS RATE (Fraction of success/total tosses)	SUCCESS PERCENTAGE

THE RESULTS

Which water bottle water level had the best results? Why do you think that might be?

DESIGN YOUR OWN

Use what you have learned from your own project and from seeing your classmates' work to design what you think would make the perfect bottle-tossing water bottle. Be sure to label the parts and any features your bottle has.

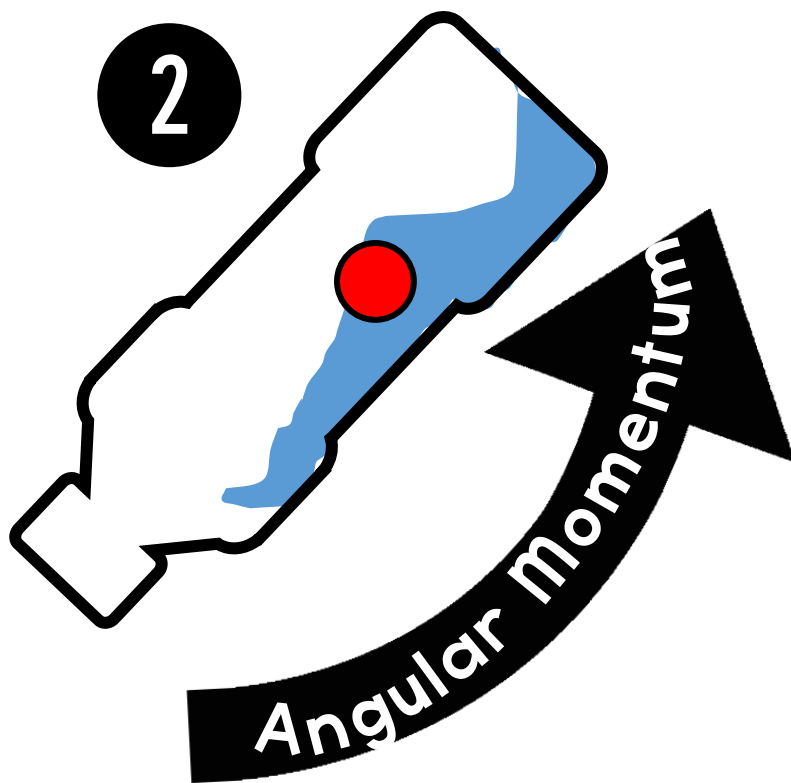
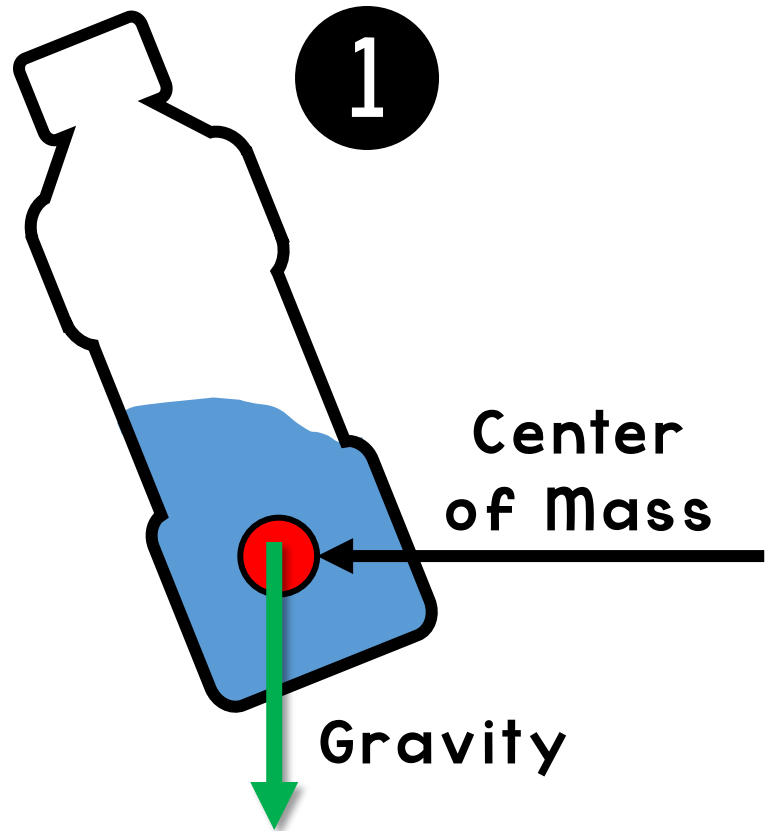
THE RUBRIC

How did you do? Use the scale to rate your performance in the Bottle Toss Challenge.

	NEEDS IMPROVEMENT	GOOD	EXCELLENT
I completed all parts of the project.	1	2	3
I followed the directions .	1	2	3
I determined the best bottle to use.	1	2	3
I determined the best water level to use in my bottle.	1	2	3
My calculations were accurate.	1	2	3
		TOTAL	/15

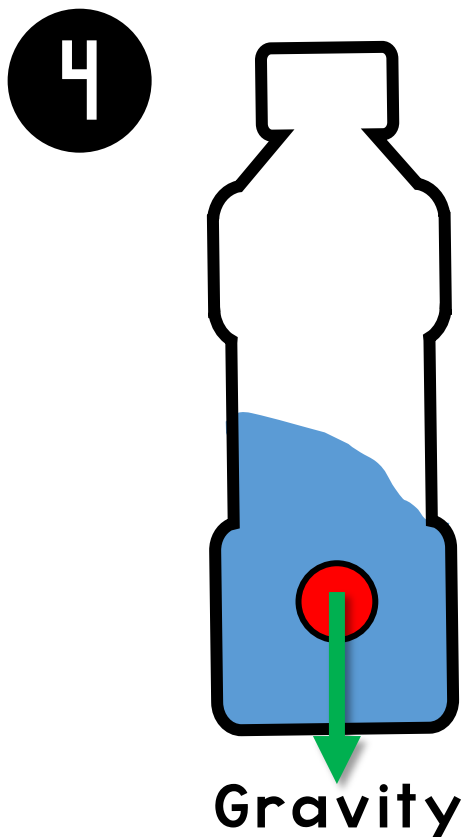
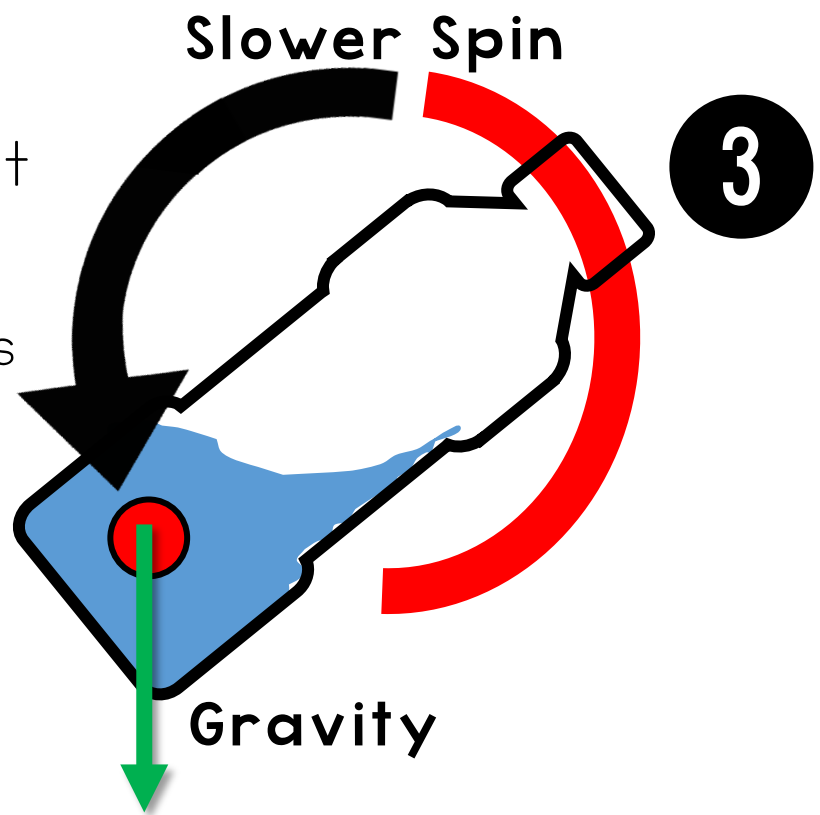
THE EXPLANATION

When holding the bottle from the top, the water is at the bottom of the bottle and so is the center of gravity.



When you toss the bottle, it rotates, but the water does not rotate with it. This is because water flows freely and has space to slosh around.

As it spins, the bottle pushes against the water and the angular momentum is transferred to the water. But the water is much heavier than the bottle and the rate of rotation starts to slow down.



The bottle will fall with gravity and land straight up on the table if it stops spinning at about the same time as the water collects in the bottom of the bottle.

THE VIDEO on iPads

You have now determined the best water bottle and the amount of water to add for the best chance of landing your bottle. Prep your bottle by filling with water to the level that had the highest success rate. You will now create a video of a successful toss.

1. Open the App Slow Motion. If it is your first time using the app, give it access to the camera and microphone.



2. Set up an area to film. Have a buddy hold the iPad vertically and do a few practice tosses to make sure he/she can fit the entire toss into the frame.

3. Press the red circle button to start filming.



4. If the toss is successful, press the circle button again to stop filming. If not repeat steps #3-4 until you land the bottle.

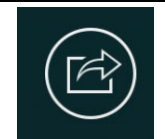


5. Press the video in the bottom left corner to open it. Touch it again.

6. Touch the yellow bar and adjust the length if you want or just drag it to fill the space. Then touch the stop watch. Set the speed to 25%.



7. Press the share button to save.

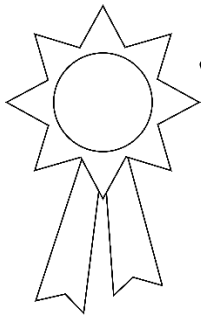


8. Select to save the video to the camera roll.

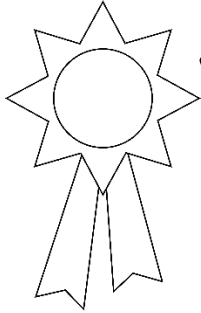


Save Video

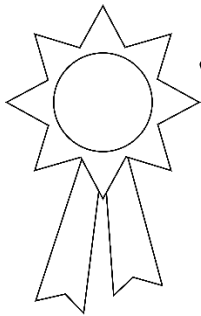
Print, cut, and distribute. Have students color and tape around their "winning" water bottle.



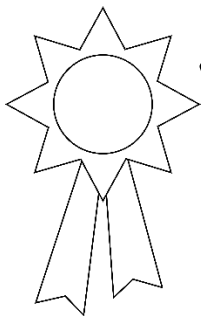
WINNER
of the BOTTLE FLIP CHALLENGE



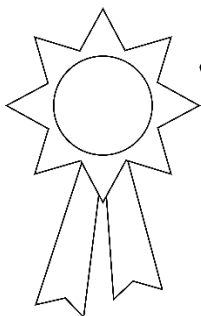
WINNER
of the BOTTLE FLIP CHALLENGE



WINNER
of the BOTTLE FLIP CHALLENGE



WINNER
of the BOTTLE FLIP CHALLENGE



WINNER
of the BOTTLE FLIP CHALLENGE

Digital Version

Optional

- ✓ A digital version of the **student pages only** has been included for distance learning or remote classroom usage.
- ✓ The Google Slideshow version is meant to be used as recording sheets for students to use when completing the experiments at home using real water bottles and water. This is not a digital simulation.

[CLICK HERE TO DOWNLOAD A COPY OF THE STUDENT PAGES ON GOOGLE SLIDES](#)

- ✓ Please DO NOT share the link online in an unsecured location such as on a personal webpage or social media account as that is against my TOU.
- ✓ After downloading the slideshow, create an assignment in Google Classroom and assign the slides to students so every student "gets a copy" to work on at home.
- ✓ I recommend using the teacher pages in the PDF to introduce the experiment and model each part prior to assigning to students in a virtual classroom.