

Sand In Bottles

Task Information

Grade: 8th Grade

Content:

Physical Science

- G.1.B. - The acceleration of objects depends upon many factors.

Format: Manipulative

Purpose:

To determine the effect that material inside a bottle has on the rolling characteristics.

Skills:

Primary: Predicting

Secondary: Generalizing / Inferring

Time: 10 -15 minutes

Materials:

Teacher:

- white or construction sand
- plastic bottles with caps at both ends. - size 148 ml
- hot glue

Per Student or Station:

- 5 bottles labeled A, B, C, D & X
- 2 books approximately 1 inch thick
- clipboard

Preparation:

- Fill enough bottles for each student or station accordingly
 - ≈ Bottle A - full of sand
 - ≈ Bottle B - 1/2 full of sand
 - ≈ Bottle C - 1/4 full of sand
 - ≈ Bottle D - empty
 - ≈ Bottle X - full of sand
- Bottles must be smooth so that they will roll down the clipboard easily.
- Slide a dark piece of paper inside bottle X so that the students cannot see inside.
 - Seal the tops with glue to avoid spills.
 - To make the bottles roll evenly glue a cap on the bottom of the bottles as well.
 - Film containers will work if they have tops that push inside to seal.
 - Place only bottles labeled A, B, C, and X at the student stations. Distribute bottle D after the student has completed question #10.

Safety:

- Caution the students if glass bottles are used

Extensions & Modifications:

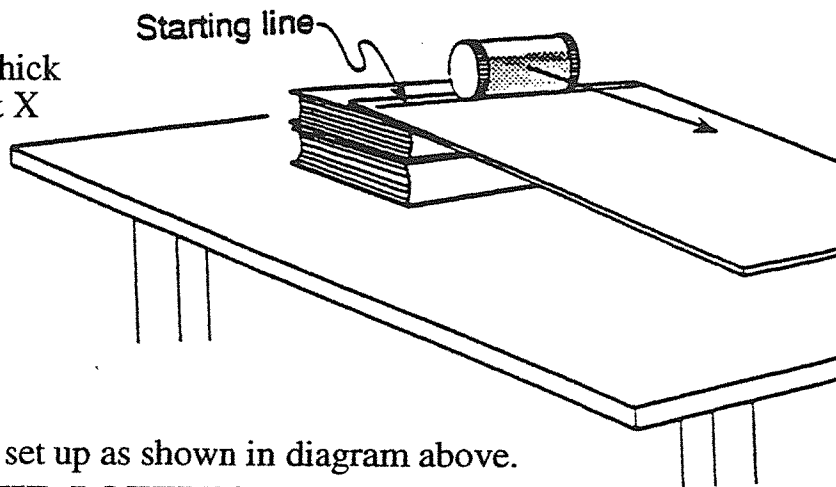
- Medicine vials or film containers can also be used.
- Any hard flat surface such as, fiberboard, smooth wood, or cardboard may be used to create the incline.

Sand in Bottles

Task: At this station, you will be determining the different speeds that bottles will roll with different amounts of sand inside.

Materials:

- clipboard
- 2 books, approx. 2 - 5 cm thick
- 5 bottles labeled A, B, C, & X



Directions:

1. Make sure that your equipment is set up as shown in diagram above.
2. **DO NOT OPEN ANY OF THE BOTTLES IN THIS ACTIVITY.**
3. Examine bottles A, B, and C.
4. Starting at the line on the ramp, allow each bottle to roll down the ramp once or twice and observe how fast each bottle rolls down the ramp. Do not push the bottle.
5. Record the relative speeds of the bottles in the data table below. Use the following terms: slow, medium, and fast.

Data Table: Speed of Bottles

Letter	Amount of Sand	Speed of Bottle
A	Full Bottle	
B	1/2 Full Bottle	
C	1/4 Full Bottle	

6. Based on your observations, write a general statement describing the relationship between the amount of sand in the bottles and the speed of the bottles.

Please Continue on the Next Page

7. Roll bottle X down the ramp and observe how fast it rolls.
8. Use this observation and the information from the data table to determine how much of bottle X is filled with sand.

In the space below, explain the reason for your answer.

9. Use the information from the data table to predict the speed of a bottle 1/8 full of sand compared to bottles A, B, and C.

Explain the reason for your prediction.

10. Use the information from the data table to predict the speed of an empty bottle as compared to the other bottles rolling down the ramp.

11. Now raise your hand and quietly ask your teacher for bottle D, and empty bottle. Roll Bottle D down the ramp. Did it match your prediction?

What is a possible explanation for why this happened?

Sand in Bottles - Scoring Rubric

Maximum Score - 13 points

5. Relative speed data table

Total 2 points

Letter	Amount of Sand	Speed of Bottle
A	Full Bottle	<i>fast</i>
B	1/2 Full Bottle	<i>medium</i>
C	1/4 Full Bottle	<i>slow</i>

Point Criteria:

- Allow 2 points if at least two (2) out of the three (3) entries in the data table are correct.
- Allow 1 point if only (1) out of the three (3) entries in the data table is correct.

6. Statement relating amount of sand to speed of bottles

2 points total

Point Criteria:

- Allow 2 points if the student makes a general statement about a directly proportional relationship between speed and the amount of sand in a bottle.
 - The more sand in the bottle, the faster it rolls.
 - The less sand in a bottle, the slower its speed.
 - A bottle will roll faster with more sand inside than a bottle with less sand.
- Allow 1 point if the student restates a specific observation.
 - A bottle half full of sand rolls slower than a full bottle of sand.

8. Prediction of speed of bottle X and explanation

3 points total

Point Criteria:

- Prediction
 - Allow 1 point for predicting that bottle X is $> 1/2$ to full.
 - Allow 0 points if student implies that he/she looked into bottle X.
- Explanation
 - Allow 2 points for an answer comparing bottle X to bottle A or B.

Sample of acceptable answers:

- Bottle X rolls at a similar speed as bottle A or B and bottle A is full and Bottle B is 1/2 full.
- It feels like the same weight as bottle A or B.
- It rolls a similar distance from the ramp as bottle A or B..
- Allow 1 point (partial credit) for an incomplete explanation with no comparison to their data.
 - Bottle X rolled fast.

9. Prediction of speed of a bottle $\frac{1}{8}$ full and explanation 3 points total

Point Criteria:

- Prediction
 - Allow 1 point for predicting that the bottle will roll the slowest of all the bottles.
- Explanation
 - Allow 2 points for an answer applying the data from bottles A, B, and C to the bottle $\frac{1}{8}$ full.

Sample of acceptable answers:

- When there is less sand in a bottle, it rolls slower down an incline.
 - The trend in the data show that bottles with more sand roll faster than bottles with less sand, so a bottle $\frac{1}{8}$ full will roll slowest.
- Allow 1 point (partial credit) for an incomplete explanation with no comparison to their data.

10. & 11. Prediction of the speed of bottle D and explanation 3 points total

Point Criteria:

- Prediction
 - Allow 1 point for an answer that is consistent with their data.
- Explanation
 - Allow 2 points for an answer applying the data from bottles A, B to & C to the empty bottle.

Sample of acceptable answers:

- The data shows that bottles with more sand roll faster than bottles with less sand. So a bottle with no sand will roll slower than the rest.
- Allow 1 point (partial credit) for an incomplete explanation with no comparison to their data.
 - The bottle rolled very slowly.
- 0 points for an answer that states that the bottle will **not** roll.
- 0 points for an answer that only verifies the prediction.

Highest possible score - 13 points

Student ID _____

Scoring Form - Sand in Bottles

Male or Female (circle one)

Circle the student's score for each question. Add the points for each question and write the total score at the bottom of the scoring form.

Question	Circle Point Breakdown	Points Earned
5. Speed data table	0 1 2	_____
6. Speed/Amount of sand relationship	0 1 2	_____
8. Bottle X Predicted amount Explanation	0 1 0 1 2	_____
9. Bottle 1/8 full of sand Predicted amount Explanation	0 1 0 1 2	_____
10. Bottle D Predicted speed 11. Explanation	0 1 0 1 2	_____

Total Score _____
Highest possible score - 13 points