

Balls and Ramp

Task Information

Grade: 4th Grade

Content: Physical Science
IIC2.2 - Energy can move from one object to another.
IID2 - Energy can be transferred from one object to another

Format: Manipulative

Purpose:

- To determine the student's ability to accurately measure distance.
- To determine the student's understanding of the greater the mass of an object the greater the force it exerts on another object when it strikes that object and causes it to move.
- To determine the students ability to make inferences based on data collected in an experiment.

Skills:

Primary: Measuring
Secondary: Interpreting Data

Time: 15 - 20 Minutes

Materials:

Teacher

- permanent black marker
- scissors or craft knife
- round plastic containers (at least 12 cm in diameter) cottage cheese containers work very well
- resealable plastic bags (sandwich or snack size)
- styrofoam balls (the size of golf balls)
- masking tape

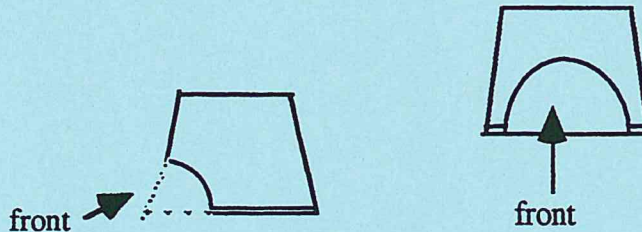
Per Student

- 3 -4 books or blocks of the same thickness
- round plastic container
- 30 cm ruler with grooved centers
- golf ball
- practice golf ball
- rubber ball
- metric tape measure
- Ball X sealed in a plastic bag

Preparation:

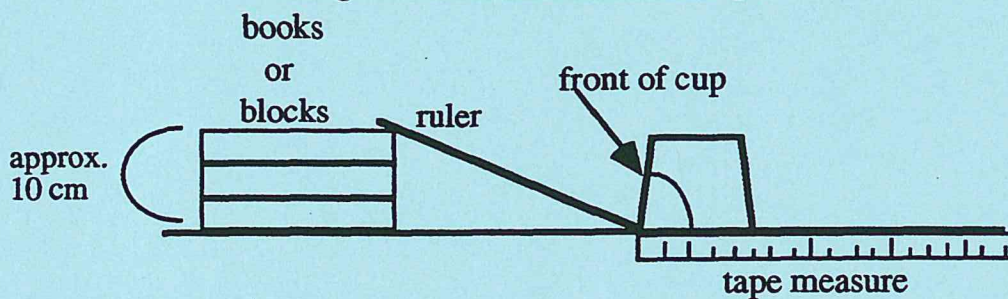
◇ Plastic container:

- cut a small hole in the rim of the plastic cup to allow enough room for the balls to roll inside. (see the diagrams below)



- All of the balls should be approximately the same size.
- The grooved ruler serves as the ramp for rolling the balls down (wood or plastic)
- The tape measure is taped to the table top at the foot of the ruler ramp out in a straight line. Metric tape measures can be purchased from any science supply company or fabric store.
- Label the resealable plastic bags "Ball X", place one styrofoam ball in each bag and seal the bags.

Diagram of student set up;



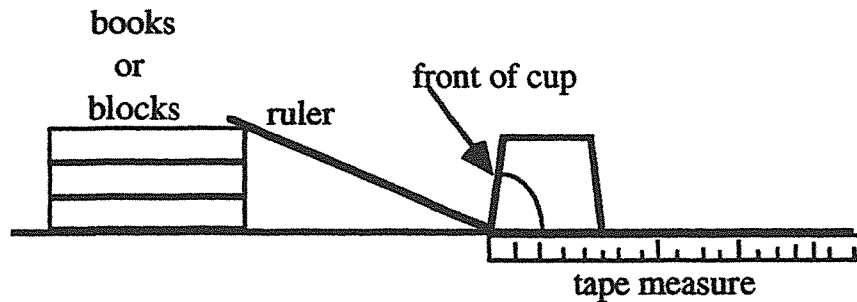
Safety: None

Balls and Ramp

Task: At this station, you will measure the distances different balls move a cup.

Materials

- books
- plastic cup
- ruler
- golf ball
- practice golf ball
- rubber ball
- tape measure
- Ball X in a sealed plastic bag



Directions

1. Make sure the equipment at your station is set up exactly as it looks in the diagram above. Make sure the cup is placed with the hole facing the ruler.
 - *** The balls must roll into the cup ***
 - *** Do not open bag with ball X ***
2. Gently roll the golf ball from the top of the ruler.
3. Measure, in centimeters, from the front of the cup, how far the golf ball moved the cup .
4. Record your measurement on the data table.
5. Repeat steps 2 - 4 for the practice golf ball and the rubber ball .
6. Answer questions 2 - 4 on the answer sheet.

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ANSWER SHEET

1. Record your measurements on the data table below.

Object	Distance Cup Moved (in Centimeters)
Golf Ball	
Practice Golf Ball	
Rubber Ball	

2. Write a statement about the balls and the distances the cup moved. Base your statement on the data from the chart above.

3. Write a sentence explaining why the 3 balls produced different results.

4. Examine ball X. Do not take the ball out of the plastic bag. You cannot test ball X, but if you could, predict how far the ball would move the cup.

Explain your prediction in the space below. _____ cm

Balls and Ramp - Scoring Rubric

Maximum Score - 5 points

1. Data Table

2 points total

Standard: The student will accurately record his/her measurements in the data table.

Criteria:

The distance measurements should show an accurate relationship among the balls.

- Golf Ball - longest distance
- Rubber Ball - middle distance
- practice golf ball - shortest distance

Distances should be recorded in reasonable measurements of centimeters or inches, not meters or yards.

- 2 points for three measurements with correct relationship
- 1 point for one correct measurement

2. Comparison of the Distances the Cup Moved

1 point total

Standard The student will make an observation comparing the distances that the balls pushed the cup.

Criteria:

- 1 point for a statement that includes a correct relationship between two or three balls.
 - The golf ball moved the cup the farthest distance and the practice golf ball moved the cup the shortest distance.
 - The golf ball moved the cup very far and the practice golf ball didn't move the cup hardly at all.
 - The golf ball went the furthest, then the rubber ball, and then the practice golf ball.
 - The golf ball moved the cup the farthest
 - The practice golf ball didn't move the cup very far or not at all
- 0 points for no observation or comparison.
 - The balls moved the cup.
 - The balls moved the cup different distances.

*** Evaluate the students observations based on the information they have recorded in their data table in question #1, even if their data is incorrect.

3. Explanation for the Difference in Distances**1 point total**

Standard The students will explain that mass of the balls affects the distance each moves the cup.

Criteria:

- Acceptable 1 point answers:
 - The balls move the cup different distances because some are heavy and some are light.
 - The golf ball is the heaviest so it moves the cup the farthest.
 - The practice golf ball isn't very heavy so it doesn't move the cup very far or at all.
- 0 point answers:
 - The balls are made of different materials
 - The balls moved the cup different distances

4A. Prediction**No credit**

Standard: The student will make a valid predication based on his/her data table and observations.

4B. Explanation for Prediction**1 point total**

Standard The student will logically explain his/her predication

Criteria:

- Acceptable 1 point answers:
 - The ball feels lighter than the others so it won't move the cup very far.
 - It's very light
 - It feels like the practice golf ball
- 0 point answers:
 - It's foam/styrofoam
 - It won't move the cup

Highest possible score - 5 points

Student ID _____ Scoring Form - Balls And Ramp

Male / 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.

1. Data Table	0	1	2
2. Comparisons	0	1	
3. Explanation	0	1	
4A. Prediction	No credit		
4B. Explanation of predication	0	1	

Total Score _____
Total possible score - 5

Student ID _____ Scoring Form - Balls And Ramp

Male / 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.

1. Data Table	0	1	2
2. Comparisons	0	1	
3. Explanation	0	1	
4A. Prediction	No credit		
4B. Explanation of predication	0	1	

Total Score _____
Total possible score - 5

Student ID IMSJA - 4 #1 Scoring Form - Balls And Ramp

Male / 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.

- | | | | |
|--------------------------------|-----------|----------|----------|
| 1. Data Table | 0 | 1 | <u>2</u> |
| 2. Comparisons | <u>0</u> | 1 | |
| 3. Explanation | 0 | <u>1</u> | |
| 4A. Prediction | No credit | | |
| 4B. Explanation of predication | <u>0</u> | 1 | |

Total Score 3
Total possible score - 5

Student ID IMSJA - 14 #2 Scoring Form - Balls And Ramp

Male / 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.

- | | | | |
|--------------------------------|-----------|----------|----------|
| 1. Data Table | 0 | 1 | <u>2</u> |
| 2. Comparisons | <u>0</u> | 1 | |
| 3. Explanation | 0 | <u>1</u> | |
| 4A. Prediction | No credit | | |
| 4B. Explanation of predication | 0 | <u>1</u> | |

Total Score 4
Total possible score - 5

Student ID 1MSJA-6 #3 Scoring Form - Balls And Ramp

Male / 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.

- | | | | |
|--------------------------------|-----------|----------|----------|
| 1. Data Table | 0 | 1 | <u>2</u> |
| 2. Comparisons | 0 | <u>1</u> | |
| 3. Explanation | 0 | <u>1</u> | |
| 4A. Prediction | No credit | | |
| 4B. Explanation of predication | 0 | <u>1</u> | |

Total Score 5
Total possible score - 5

Student ID _____ Scoring Form - Balls And Ramp

Male / 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.

- | | | | |
|--------------------------------|-----------|---|---|
| 1. Data Table | 0 | 1 | 2 |
| 2. Comparisons | 0 | 1 | |
| 3. Explanation | 0 | 1 | |
| 4A. Prediction | No credit | | |
| 4B. Explanation of predication | 0 | 1 | |

Total Score _____
Total possible score - 5

ANSWER SHEET

MARCH 13, 1990

1MSJA-4 #1
female

1. Record your measurements on the data table below.

Object	Distance Cup Moved (in Centimeters)
Golf Ball	39 C.M.
Practice Golf Ball	2 C.M.
Rubber Ball	8 C.M.

2. Write a statement about the balls and the distances the cup moved. Base your statement on the data from the chart above.

The Distance they moved
is all different.

3. Write a sentence explaining why the 3 balls produced different results.

They all have different
way to wear, so the heavier
the farther

4. Examine ball X. You cannot test ball X, but if you could, predict how far the ball would move the cup.

5 ¹/₂ cm

Explain your prediction in the space below.

The weigh

1. Record your measurements on the data table below.

Object	Distance Cup Moved (in Centimeters)
Golf Ball	44 cm
Practice Golf Ball	$\frac{1}{2}$ cm
Rubber Ball	7 cm

2. Write a statement about the balls and the distances the cup moved. Base your statement on the data from the chart above.

The heavier the ball was the more it would move the cup.

3. Write a sentence explaining why the 3 balls produced different results.

The golf ball was heavier so it moved farther, and practice golf ball moved the least and the rubber was

Examine ball X. You cannot test ball X, but if you could, predict how far the ball would move the cup.

$\frac{1}{2}$ cm cm

Explain your prediction in the space below.

The ball is light and made of styrofoam.

ANSWER SHEET

1. Record your measurements on the data table below.

1MSJA-6
female
#3

Object	Distance Cup Moved (in Centimeters)
Golf Ball	24 cm
Practice Golf Ball	0 cm
Rubber Ball	7 cm

2. Write a statement about the balls and the distances the cup moved. Base your statement on the data from the chart above.

The golf ball went the farthest, the practice golf ball went the lowest and the rubber ball was in the middle.

3. Write a sentence explaining why the 3 balls produced different results.

because the golf ball was the heaviest the rubber ball was in the middle, and the Practice golf ball was the lightest.

4. Examine ball X. You cannot test ball X, but if you could, predict how far the ball would move the cup.

1 cm

Explain your prediction in the space below.

because it is so light and little.