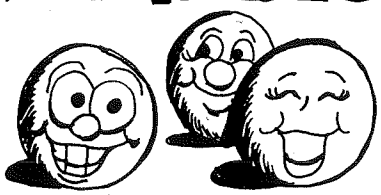
"It's Simply Marbleous"



I. **Topic Area**

Interpreting Data and Controlling Variables

II. **Introductory Statement**

A marble will be rolled down an inclined plane several times from different heights. Upon the completion of this activity, students will be able to describe the relationship between the slope of an incline plane and the distance an object will roll.

III. **Math Skills**

a. Averaging
b. Graphing
c. Measuring
d. Adding

Science Processes

a. Collecting Data
b. Predicting/Estimating
c. Observing
d. Measuring
e. Recording Data
f. Interpreting Data
g. Controlling Variables

IV. **Materials (per group)**

16 books (each with a spine about 2cm in width)
2 meter sticks
1 marble
1 metric tape measure
masking tape
Student Worksheets, pages 30-31

V. **Key Question**

"How does the slope of an incline plane affect the distance a marble will roll?"

VI. **Background Information**

Generally, the steeper the slope, the farther the marble will roll. Eventually, the height of the slope will become so steep that the marble will not continue to roll as far as it did previously. This is due to the fact that the forward motion of the marble is absorbed into the floor.

VII. **Management Suggestions**

1. Estimated time: One 45 minute period.
2. Demonstrate this activity to the students by setting up the inclined plane.
3. Find a fairly open area which has smooth carpeting or use a sheet spread on the floor. The texture of the surface on which a marble rolls will be a factor in how far it rolls.
4. Attach about 5 cm of masking tape to the metric rulers at the top and bottom so there is a separation wide enough for a marble to roll down.
5. Place one book with a 2 cm spine on the floor. From the edge of the book spine mark a baseline 88 cm with a piece of tape.
6. Place the meter sticks on top of the book so that the ends of the meter sticks meet the 88 cm tape mark on the floor.
7. Practice gently placing the marble in the groove and releasing it from the edge of the book spine, so the marble can roll freely from the ramp. Measure the distance the marble rolls.
8. Explain to the students that this is the process they are to use in the experiment. Discuss the importance of controlling all variables (keeping everything the same except for the height of the ramp).

VIII. **Procedure**

1. Distribute the necessary materials.
2. Have the students work in small groups and set up the experiment.
3. Each group should have the student worksheets.
4. Each group should have one person to roll the marble, one or two to mark where the marble stops. Each student records the measurement on his individual worksheet.
5. Students are to roll the marble five times each at heights of 2 cm, 4 cm, 8 cm, 16 cm, 32 cm. They must always maintain a base of 88 cm. The marble must be released each time at the edge of the book spine.
6. The students measure the distance the marble rolls each time it is released.
7. Students record the measurement in cm on the data table.
8. They then find the average for each height and record it on the data table.
9. Students then complete the graph.

IX. **What the Students Will Do**

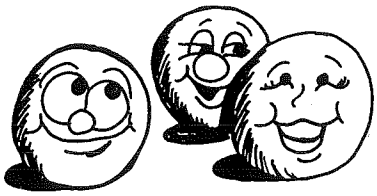
1. Measure the distance the marbles roll.
2. Record measurements in Data Table.
3. Total and average the trials for each height.
4. Graph the average distances.

X. **Discussion**

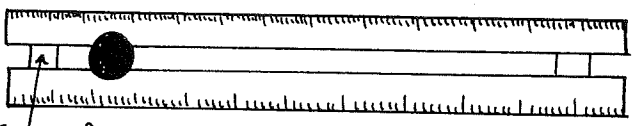
1. Did the height of the slope increase the distance the marble rolled? Why? Why not? (Yes, the marble has more potential (stored) energy with greater height.)
2. If the slope keeps getting steeper, will the marble roll farther each time? Why? Why not? (Up to a point, yes. When the slope is completely vertical, the marble will not roll far because its energy is absorbed by the ground.

XI. **Extension**

1. Use different sized marbles.
2. Use different spheres—golfballs, ball bearing, etc.
3. Use different surfaces—rug, cement, dirt, table top, etc.



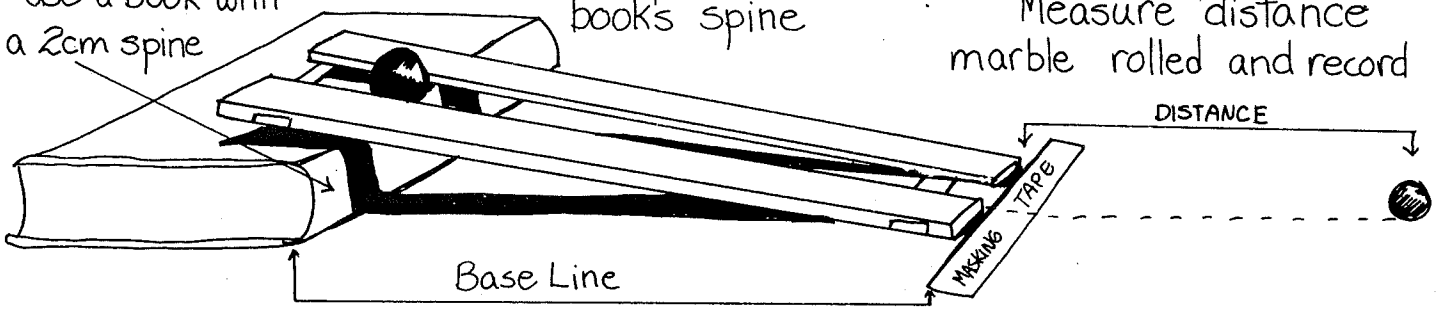
Construct a ramp for the marble



Use a book with a 2cm spine

Start the marble from the book's spine

Measure distance marble rolled and record



Mark and Keep Base Line at 88cm

How does the slope of the ramp affect the distance a marble will roll?

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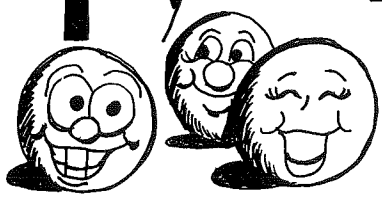
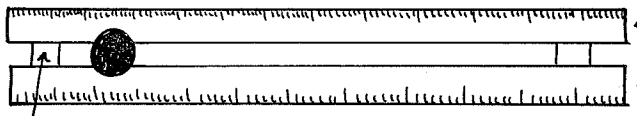
name _____

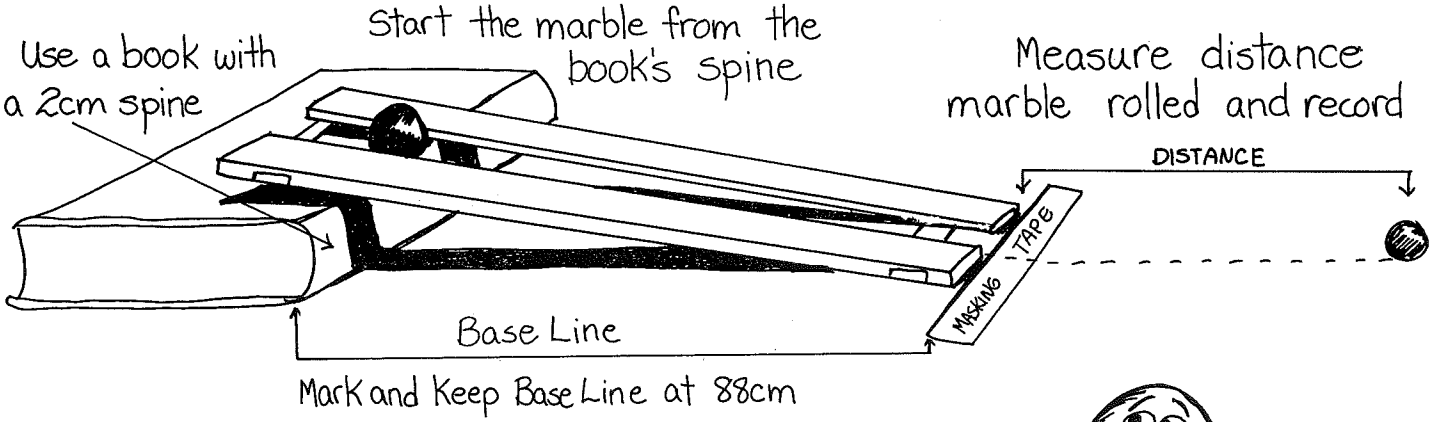


Height	2 cm	4 cm	8 cm	16 cm	32 cm
Trial #1					
Trial #2					
Trial# 3					
Trial# 4					
Trial# 5					
Total					
Average					

DISTANCE MARBLE ROLLED IN CM

Construct a ramp for the marble





How does the slope of the ramp affect the distance a marble will roll?

name _____

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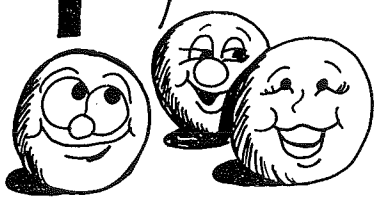

Distance the marble rolls (cm)

300
290
280
270
260
250
240
230
220
210
200
190
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0

2cm 4cm 8cm 16cm 32 cm