

Activity #1 – Mass & Distance

Materials Needed:

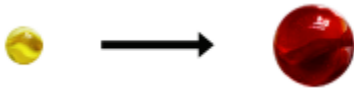
Varying size marbles
String or tape
Ruler
Mass scale

Procedure 1: Mass and Distance

a. Record the masses of each of the four marbles.

	Mass (g)
Marble #1	
Marble #2	
Marble #3	
Marble #4	

- b. On paper, measure a distance of 12 inches using your ruler, and draw a line
c. Place a small marble on one end of your line, a larger marble at the other.
d. Roll the small marble so that it collides with the larger marble



- f. Measure with your ruler the distance that the larger marble traveled, after the collision.
g. Record your measurement. Do this three times: trial 1, trial 2 and trial 3.

	Distance (cm/in)
Trial #1	
Trial #2	
Trial #3	

- h. Repeat experiment with the larger marble striking the smaller. Push larger marble into smaller one
i. Record your measurement. Repeat this three times.

	Distance (cm/in)
Trial #1	
Trial #2	
Trial #3	

Questions:

1. After the collision, which marble traveled farthest?

2. Why do you think this happened?

3. Does mass have anything to do with how far the marbles traveled?

4. Did the hardness of your throw have a possible effect?

5. Complete the sentence:

The smaller marble travels farthest when struck with the most massive marble because the most _____ marble has the greatest _____.



Activity #2 - Effects of Friction

* This is best done as a controlled teacher demonstration

What type of surface makes the bowling ball roll best?

Materials:

- Bowler's Ed carpeted lane
- Bowler's Ed ball
- Masking tape
- Tape Measure

Procedure:

- a. Place the Bowler's Ed carpeted lane down and tape off a similar lane distance alongside.
- b. Make a prediction of how far you think your bowling ball will travel on the gym floor versus the carpeted lane. Record your estimate in the table below and/or mark it on the lane with a piece of masking tape.

Do you think the ball will roll easier on the carpet or on the gym surface? _____

- c. Place a ball on the carpeted lane and push it gently down the laneway from a seated position.
- d. Record the distance traveled in the chart below.
- e. Place a ball on the gym floor. Push it gently across the marked area of the floor.
- * Have a student at the other end to stop the ball if it continues rolling.
- f. Record the distance traveled in the chart below.
- g. Repeat this procedure 3 times for each.

Record Data:

Distance	Estimate	Trial #1	Trial #2	Trial #3
Carpet Lane				
Bare Floor				

Questions:

1. On which surface did the ball seem to roll the farthest?

2. What difference did you notice between the floor and the carpet?

3. Which of the two, carpet or gym floor, provides the least friction?

4. Why are bowling lanes made of wood and not carpet?



5. How do you think it would differ if the bowling alley were made of sand? Grass? Ice?



Activity #3 - Force & Speed

Calculate the speed in which the ball traveled and the amount of force applied.

** Calculations of this nature are for students that have knowledge of how to divide numbers*

Materials:

Bowler's Ed Carpeted Lane

Timer or stopwatch

Bowler's Ed Ball

Metric tape measure

Procedure:

a. Measure the distance of the lane in meters with the tape measure and record the value.

Distance (m)	
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b. Have a partner ready with a stopwatch by the side of the lane.

Trial 1:

- c. From a seated position, use both hands to push the bowling ball gently.
- d. When the ball is released from your hands, start the timer.
- e. When the ball reaches the end of the lane, stop the timer.
- f. Record the time it took for the ball to travel down the laneway in the table below.

Trial 2:

- g. Increase your force and push the ball it slightly harder.
- h. Record the time it took for the ball to travel down the laneway.

Trial 3:

- i. You may stand up. Using one hand, you may roll the ball quickly.
- j. Record the time it took for the ball to travel down the laneway.

k. Switch with your partner and repeat the experiment.

l. Calculate speed by dividing the distance in meters by the time in seconds.

$$Speed = \frac{Distance (m)}{Time (s)}$$

m. Calculate the average speed for both you and your partner.

$$Average Speed = \frac{Speed1 + Speed2 + Speed3}{3}$$

Record Data:

	Partner #1		Partner #2	
	Time Ball Rolled	Calculated Speed	Time Ball Rolled	Calculated Speed
Trial #1		----- =		----- =
Trial #2		----- =		----- =
Trial #3		----- =		----- =
Average		----- =		



Questions:

1. On which throw did the ball travel the fastest?

2. On which throw did you apply the most force?

3. What can you conclude about how hard you throw the ball, and how fast it travels?



Activity #4 - Angles and Collisions

Materials:

Bowler's Ed In-School Bowling Equipment
Gymnastic mats or similar mats for 'bumpers' alongside lane

Procedures:

Method 1:

- a. Roll the ball as straight as you can down the laneway.
 - b. Record how many pins you knock down.
 - c. Reset all the pins standing up on the dots.
- Repeat this 2 more times.

Method 2:

- d. Roll the ball slightly to the left of the front pin.
 - e. Record how many pins are knocked down
 - f. Reset all the pins standing up on the dots.
- Repeat this 2 more times.

Method 3:

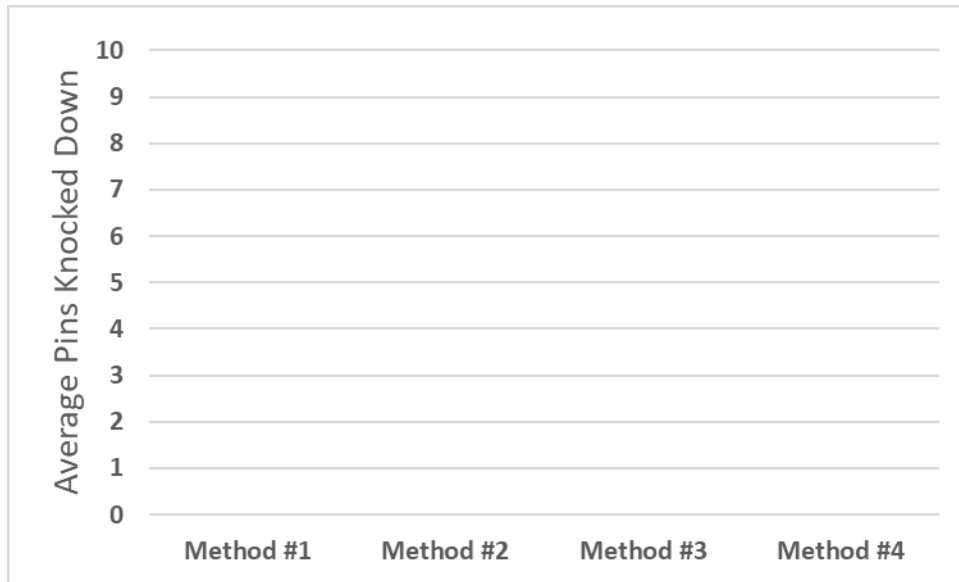
- g. Roll the ball slightly to the right of the front pin.
 - h. Record how many pins are knocked down
 - i. Reset all the pins standing up on the dots.
- Repeat this 2 more times.

Method 4:

- j. Roll the ball down the alley so that it bounces off the sides. Observe ball speed after it bounces.
 - k. Record how many pins are knocked down.
 - l. Reset all the pins standing up on the dots.
 - m. Repeat this 2 more times.
- n. Find the average number of pins knocked down using each method.
o. Construct a bar graph of your data. (averages)

Record Data:

Number of Pins Knocked Down				
	Method #1	Method #2	Method #3	Method #4
Trial #1				
Trial #2				
Trial #3				
Average				

Graph: Bar Chart**Questions:**

1. Which method knocked down the most pins?

2. Which method knocked down the least?

3. What happened to the ball's speed after it bounced each time?

4. What happened to the ball's energy after it bounced off of the sides?
