

19.4: Procedures

You will analyze the motion of objects that travel down ramps from different heights.

Ramp to Carpet

1. Find a flat location that will allow you to utilize the full length of carpet. Assemble ring stand with the clamp at a height of your choice. Place the metal ramp such that the low end of the ramp is sitting on one edge of the carpet and the high end of the ramp is balanced on the clamp.



Figure 19.4.1

2. Discuss as a team where you predict the ball will stop when released from the high end of the ramp. Stand next to the carpet at the predicted stopping point while another team member releases the ball from the top of the ramp. If the ball continues past the end of the carpet your ramp is too high. Lower the ramp and repeat this process until the ball stops on its own before reaching the end of the carpet, when released from the high end of the ramp.
3. Use the weight boat and measure the mass of your steel ball. Also measure the mass of the Styrofoam cup. Record these values.
4. Draw a table for the steel ball, and a table for the Styrofoam cup. **Do not fill in data until you have read the instructions for obtaining that data.**

Table 19.4.1: Steel Ball Data

	Height 1	Height 2	Height 3	Height 4
Initial Height (meters)				
GPE (Joules)				

Table 19.4.2: Styrofoam Cup Data

	Distance 1	Distance 2	Distance 3	Distance 4
Distance Moved (meters)				
Mechanical Work (Joules)				

5. Choose 4 locations on the ramp from which to release the ball, and mark each location with a piece of tape. Place the Styrofoam cup 1 meter from the low end of the ramp.

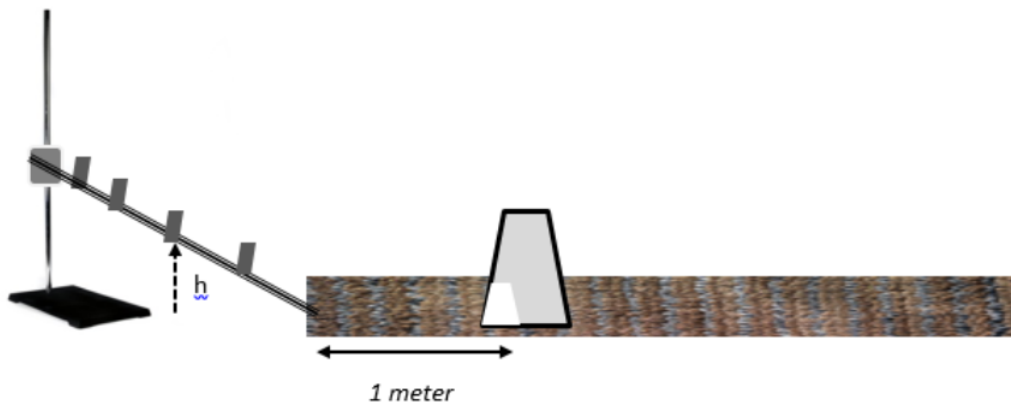


Figure 19.4.2

6. Measure and record the height (h), in meters, from the floor to each piece of tape on the ramp; these are the initial heights for your steel ball. Use these heights and the mass of the steel ball to calculate the GPE in Joules for each height, and record these values in your *Steel Ball* data table.
7. Release the ball from each of the heights. Measure and record the distance the Styrofoam cup moves as the ball is released from each of the heights. Use the distance the cup moves and the weight force of your Styrofoam cup to calculate the Mechanical Work done to move the cup, in Joules. Record these values in your *Styrofoam cup* data table.
8. Remove the Styrofoam cup from the system.
9. Draw another table in which to record stopping distance data and copy the initial heights for the steel ball to this table. Read the instructions for obtaining the data.

Table 19.4.3: Stopping Distance Data

	Initial Height (meters)	Trial 1 (meters)	Trial 2 (meters)	Trial 3 (meters)	Average Stopping Distance (meters)
Height 1					
Height 2					
Height 3					
Height 4					

10. Release the ball and observe where the ball stops. Measure and record the distance in meters from the low end of the ramp to the ball, for each height, completing three trials for each height. If the ball leaves the carpet, the trial does not count and must be redone. Calculate the average stopping distance for each height and record these values in your table.

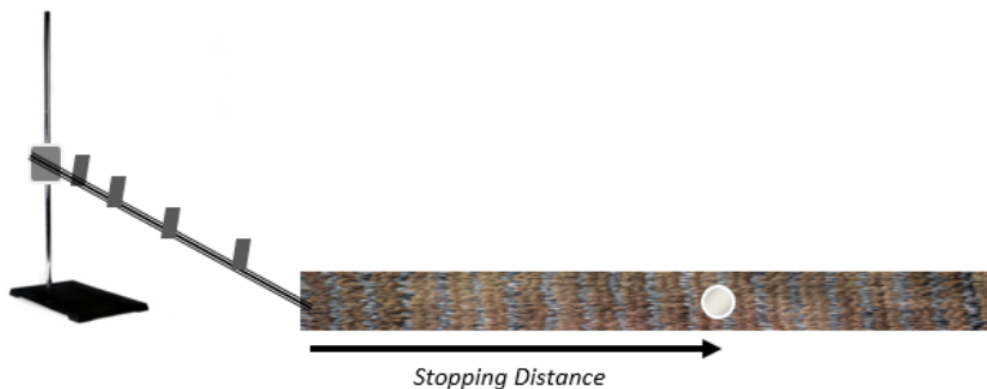


Figure 19.4.3

Clean-up

- Remove and dispose of all tape

Different Slopes

- Set up the adjustable ramp on the floor, and position the photogate timer at the bottom of the ramp as shown in the image. Send the car down the ramp a few times and familiarize yourself with the photogate; it should be set to measure velocity.

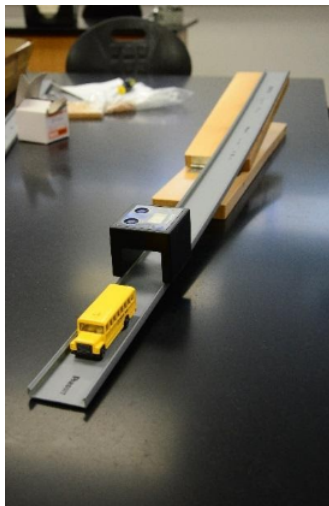


Figure 19.4.4: Car on track by Norihiro licensed under CC0

- Draw a table in which to record the initial height and velocity for the three different angles (10° , 20° , and 30°) of ramp incline. Read the instructions for obtaining the data.

Table 19.4.4: Different Slopes Data

Angle	Initial Height (meters)	Velocity (m/s)
10°		
20°		
30°		

- Set the ramp at the first angle. Position the car for release from the top, and hold it there. Measure and record the initial height of the car. Then release the car from the top of the ramp and observe the velocity shown by the photogate. Record the velocity your car had at the bottom of the ramp. Repeat the process for the other two angles.

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