

Student Name: _____

Experiment Worksheet

Part I. Measurement procedure on the flat bank.

1. Measure the vertical height and length of the flat bank (see Fig. 1) using the two-meter stick and calculate the slope of the ramp.

The flat bank measures _____ m high.

The slope of the ramp equals _____.



Fig. 1. Flat bank.

2. Mount the motion detector on the tripod and place it on the deck of the flat bank. Pivot the motion detector head so that it is perpendicular to the surface of the ramp.
3. Record the position and velocity of the box over time as it skates down from the top to the bottom of the flat bank using LabQuest[®]2 which is connected to the motion detector. The final speed at the bottom measures _____ m/s.
4. Repeat the experiment nine more times. Fill in the final speeds (m/s) in the following nine blanks: _____, _____, _____, _____, _____, _____, _____, _____, _____.

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_____, _____, _____, _____. Calculate the average of the ten speeds at the bottom: $\bar{v} =$ _____ m/s.

5. Calculate the theoretical value of the final speed at the bottom.

$$\text{Theoretical value} = \sqrt{2gh} = \sqrt{2 * 9.81 * \underline{\hspace{2cm}}} = \underline{\hspace{2cm}} \text{ m/s.}$$

6. Calculate the percentage error of the measured final speed.

$$\text{Percentage error} = \frac{|\text{theoretical value} - \text{experimental value}|}{\text{theoretical value}} * 100\% =$$

$$\frac{|\underline{\hspace{2cm}} - \underline{\hspace{2cm}}|}{\underline{\hspace{2cm}}} * 100\% = \underline{\hspace{2cm}} \%$$

Part II. Measure impact force without padding.

1. Weigh the produce carton and book using a force plate and LabQuest[®]2.

$W =$ _____ N. Calculate the mass of the produce carton and book:

$$m = \underline{\hspace{2cm}} \text{ N} / (9.81 \text{ m/s}^2) = \underline{\hspace{2cm}} \text{ kg.}$$

2. Use LabQuest[®]2 and a force plate to measure the peak impact force on the produce carton and book when they are dropped on the force plate on the ground from the top of the flat bank. One may also drop the produce carton and book on the force plate from a height equal to that of the flat bank.

Peak impact force = _____ N. Impact time = _____ s.

3. Repeat the experiment nine more times. Fill in the impact time and peak impact force data in the following table:

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Trials	Impact Time (s)	Peak Impact Force (N)
1		
2		
3		
4		
5		
6		
7		
8		
9		
10		

4. Calculate the average peak impact force of the ten trials: $\bar{F} =$ _____ N.

Average impact time = _____ s.

Part III. Measure impact force with padding.

1. Use Duct tape to attach the Styrofoam padding (17" x 11" x 2") to the bottom of the box.
2. Use LabQuest[®]2 and a force plate to measure the peak impact force on the produce carton and book when they are dropped on the force plate on the ground from the top of the flat bank. One may also drop the produce carton and book on the force plate from a height equal to that of the flat bank.

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Peak impact force = _____ N. Impact time = _____ s.

3. Repeat the experiment nine more times. Fill in the impact time and peak impact force data in the following table:

Trials	Impact Time (s)	Peak Impact Force (N)
1		
2		
3		
4		
5		
6		
7		
8		
9		
10		

4. Calculate the average peak impact force of the ten trials: \bar{F} = _____ N.
Average impact time = _____ s.