Slingshot

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Physical Science _________ Hour

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The kinetic energy of a rock shot with a slingshot is obtained from the potential energy of the stretched sling, which in turn is obtained from the work done in stretching the sling. This work is equal to the average force acting on the sling multiplied by the distance it is drawn.

In this experiment, you will measure the force required to hold the center of a rubber band used to simulate a slingshot at various distances from its position of rest, and plot these data on a force vs. distance graph. The force is relatively small for small deflections, and becomes progressively larger as the rubber band is stretched further. The area under the force vs. distance curve out to some final deflection is equal to the average force multiplied by the total distance. This equals the work done in drawing the rubber band to that distance. Therefore, your graph will show not only the relationship of the force to the distance stretched, but also the potential energy possessed by the fully drawn bow.

The effect of a constant force of 10 N acting over a distance of 2m is represented in the graph in figure A The work done equals the area of the rectangle.

Work = Fxd = (20N) x (2m) = 40 Nm = 40J

Procedure:

Tie two rubber bands together. Stretch them to a length of 30 cm on the floor and tape the two ends to the floor to hold them in place. Stretch the bands and use it to launch a plastic bottle cap.

Answer the following on the back of your graph paper (blank side)

1. How did the takeoff speed of the bottle cap seem to change relative to the distance that you stretched the rubber band?
2. What type of energy transformation takes place here?

Use a spring scale to measure the distance the rubber bands are stretched from their original position and the force required to hold the rubber bands that far out. Prepare a table in which to record your data. Show the stretch distances in centimeters in the first column, and their equivalent values in meters in the second column. Show the force readings in Newtons in the third column.

Divide your graph paper into four sections. Each section will be used for a separate force-displacement graph.

Answer the questions below using complete sentences. Answers with written responses should be written on the back (blank side) of the graph paper. On your graphs, make sure that the x axis is labeled meters (m).

3. How much force is required to pull the rubber bands back to a distance of .01 m?
4. Create a force displacement graph to show the amount of work done.
5. What is the area of the shaded portion of the graph?

6. How much force is required to pull the rubber bands back to a distance of .03 m?
7. Create a force displacement graph to show the amount of work done.
8. What is the area of the shaded portion of the graph?

9. How much force is required to pull the rubber bands back to a distance of .07 m?
10. Create a force displacement graph to show the amount of work done.
11. What is the area of the shaded portion of the graph?

12. How much force is required to pull the rubber bands back to a distance of .10 m?
13. Create a force displacement graph to show the amount of work done.
14. What is the area of the shaded portion of the graph?