



Marble Launcher Lab

PSI Physics

Name _____

Objective:

- To apply the conservation of energy
- To observe the relationship among the following energies: Kinetic Energy (KE), Gravitational Potential Energy (GPE), and Elastic Potential Energy (EPE).

Description:

In this lab, you are going to use a marble launcher to launch an object into the air at a 90° angle. You must first pull the handle of the launcher down, which will give the system EPE, and when you release it, the EPE will be converted into KE, giving the object an initial velocity (v). When the marble reaches the top of its trajectory (h); all of the KE is converted completely into GPE.

Materials:

- Marble Launcher
- 10 or 20 g ball bearing or marble
- Meter Stick
- Table
- Scale to measure the mass of the marble

Procedure:

Note: all data collection and analysis tables are on the last page of this handout.

1. Measure the mass of the object and *record this in the 3rd column of the Data Analysis Table at the back of this handout.*
2. Hold the meter stick vertically level with the middle of the marble, ready to measure the maximum height of the marble (h).
3. Place the handle of the launcher into one of the first 3 notches. Practice launching the marble a few times (2 or 3) and practice measuring the maximum height using the meter stick.

For each of the 3 notches on the launcher, repeat the following 3 times:

4. Release the handle and measure the height (h) the object goes. Record which notch you used and h in the Data Collection Tables.

Data Analysis:

1. Record your average values of h for each value of x in the last row of the Data Collection Tables
2. Copy the each value of x with its associated average value of h in to the appropriate place in the Data Analysis Table.
3. Complete the Data Analysis Table by calculating the following values for each value of x :
 - Maximum Gravitational Potential Energy, using the average height, $GPE = mgh$
 - Maximum Kinetic Energy (from GPE)
 - Initial velocity of the object (from $KE = \frac{1}{2}mv^2$)
 - Elastic Potential Energy of spring in launcher (from KE)

Analysis:



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1. As the notches on the launcher get farther down, what happens to the maximum height of the released object (h)?

2. How does increasing the notch distance affect the EPE of the spring in the launcher?

3. If you placed the marble launcher from your experiment on the edge at the top of a building instead of a table, and launched the object straight up, which energies would the object have at the following times: (Only consider EPE, GPE, and KE)
 - a) Just before the object is released
 - b) At its maximum height
 - c) Half way to the ground
 - d) Just before the object hits the ground

Application:

4. If a 0.4 kg baseball at 25 m/s straight into the air, how high does the ball go? (Use energy to find the answer)

5. A spring is compressed so that it has 7.2 J of elastic potential energy. A 0.3 kg ball is placed on top of the spring. When the spring is released, how high will the ball go?



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Data Collection Tables:

Notch 1 cm	
Trial #	h (m)
1	
2	
3	
Average	

Notch 2 cm	
Trial #	h (m)
1	
2	
3	
Average	

Notch 3 cm	
Trial #	h (m)
1	
2	
3	
Average	

Data Analysis Tables:

	h (m)	m (kg) (mass of object)	GPE = mgh (J)	KE = $\frac{1}{2}mv^2$ (J)	$v = \sqrt{\frac{2(KE)}{m}}$ (m/s)	EPE (J)
x ₁ =						
x ₂ =						
x ₃ =						

*** **HINT:** The maximum EPE converts to the maximum KE and to the maximum GPE.