Stomp Rocket Lab – Guided

PSI Physics – Kinematics

Name_____ Date_____ Period_____

Description

The goal of this experiment is to calculate the initial velocity and peak height of a rocket launched vertically, using the kinematics equations learned in class.

Materials (per team)

- One Stomp Rocket Set
- Stopwatch

Procedure

1. Go outside and set up the rocket launcher and rocket. Try to have the rocket aiming perfectly straight up.
2. Do a couple of practice launches.
3. When you are ready, you should time the entire flight of the rocket for each person in your group, up to three people.
4. As one student launches the rocket, another student will time the flight with the stopwatch. Remember you need the time from when the rocket is launched to when the rocket returns to the ground.
5. Write down each person's name and their total flight time in the data table on the next page.

Data Collection

Record your group's values for t_{total} in the table on the last page of this handout.

Calculations:

Using the kinematics equations, calculate the initial velocity (v_o) and the maximum height (x) of the rocket launch. Then repeat the calculations for each of the launches. Remember to enter your results in the data table following each launch.

Equations:

$$g = \text{-}9.8\ m/s^2$$
$$v = v_o + at$$
$$x = x_o + v_o t + \tfrac{1}{2}\, at^2$$
$$v^2 = v_o^2 + 2a(x - x_o)$$

1. **The apex is the peak of the rocket's flight.** Calculate the time it takes the rocket to reach its apex, which is equal to ½ the total flight time. Enter this information in the data table.

2. Make a mini-sketch of the path of the rocket launch and landing.
   - Label the ground level "x_o" and the highest point "x."
   - Next to the x's, write the corresponding symbols for initial and final velocity.
   - What section(s) of your sketch do you think would be represented by t and ½ t? Label t and ½ t.

3. What is the velocity of the rocket at the instant it reaches the apex? _____

4. For **each launch**, fill in known values in the data table.

5. Taking into account the variables for which you have data, select the kinematics equation that could be used to determine the initial launch velocity (v_o) of the rocket and manipulate it as necessary below. Write the equation in the table, under the column "Equation Used."

6. Use the equation you chose in #5 to calculate the initial velocity for each of the launches. Show ALL work for your launch here. Enter the results in the table.

7. Now, again taking into account the variables which you now do have data for, which kinematics equation could be used to determine the maximum height (x) achieved by the rocket? Manipulate the equation as necessary below. Write the equation under the column "Equation Used" in the table.

8. Use either of the equation you chose in #7 to calculate the maximum height of all the launches. Show ALL work for your launch here. Enter all results in the data table.

Analysis

1. What was the rocket's velocity at the apex of its flight?

2. What is the rocket's speed just before it hits the ground? Why? Use the appropriate kinematics equation to calculate your answer.

Application

3. How could you use this method to calculate the height of a building? Explain.

4. If you drop a silver dollar off a building and it hits the ground in 10 seconds, how fast was the coin going just before it hit?

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	Equation Used	Name:	Name:	Name:	Name:	Name:
t_{total}						
t_{apex}						
v_{apex}						
a						
v_{o}						
x						