

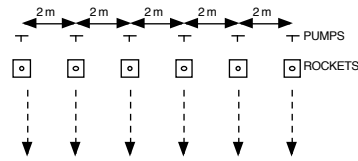
# ROCKET PROJECTILE LAB

## Background

In this lab you will launch an air-powered rocket. The rocket will be launched and land at the same height. You will launch the rocket twice. The first time you will launch it straight up. You will then predict the range of the rocket at a pre-assigned angle. You will measure the actual range.

## Non-negotiable rule

You are not to launch the rocket without the teacher's permission. If you launch without permission, you will receive a zero for the lab. If the individual responsible cannot be determined, then the whole group will receive the zero.



## Procedure/Calculations

### STEP 1

Follow the launch sheet's instructions and launch the rocket straight up. Using 2 stopwatches, measure the time the rocket is in the air. When you are completely ready to launch, stand behind the "line" to the right. Record your data on the math sheet.

### STEP 2

Using this data, calculate the initial velocity of the rocket. Show all your steps on the math sheet.

### STEP 3

Record your assigned angle on the math sheet.

### STEP 4

Calculate the rocket's range using the calculated initial velocity and the your pre-assigned angle. Show your work on the math sheet.

### STEP 5

Setup your rocket to launch according to the second sheet of launch instructions.

### STEP 6

When you are completely ready to launch, stand behind the "line" to the right.

### STEP 7

When you have the teacher's permission. You may launch and measure your rocket's range. Write the measured range on your math sheet.

### STEP 8

Work backwards from the measured range and calculate the needed time in the air measured in step 1 to give this range's result. Show your work on the math sheet.

### STEP 9

Calculate the percent error in the measured time in step one. Show your work and answer on the math sheet.

$$\text{Percent Error} = \frac{|\text{Calculated Time from range measurement} - \text{Measured Time from Step 1}|}{\text{Calculated Time from range measurement}} \times 100$$

### STEP 10

You may work together on the math calculations but everyone is to turn in their own paper. You may work with 1 partner on the bonus formula derivation.

# ROCKET PROJECTILE LAB

Show all your work for all the credit.

Be neat and label what you are solving for in each step or your work.

**Names:** \_\_\_\_\_

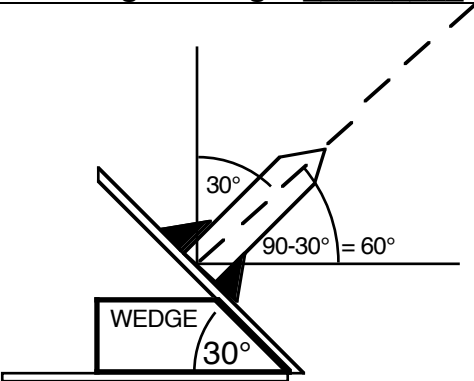
**STEP 1** Time #1 \_\_\_\_\_ Time #2 \_\_\_\_\_ Average Time \_\_\_\_\_

**STEP 2** (From the vertical launch)

$v_o =$  \_\_\_\_\_

**STEP 3** Assigned Angle \_\_\_\_\_

**STEP 4** (Calculated for the angled launch.)



Range: \_\_\_\_\_

**STEP 7** (Convert from the feet to meters if needed.)

Measured Range from the launch: \_\_\_\_\_

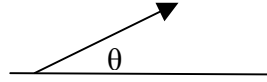
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**STEP 8**

For a rocket launched at an angle.

$$v_o = \sqrt{\frac{Rg}{2 \tan \theta (\cos \theta)^2}}$$
 where R = range,  $\theta$  is the angle with the ground and "g" is positive.



**[ Bonus points if you can derive the formula above. You may work with one partner. Turn it in on a separate sheet of paper. ]**

Calculated Air time for Step 1: \_\_\_\_\_

**STEP 9**

Percent Error: \_\_\_\_\_