

PSII Lab
Projectile Motion – Muzzle Velocity

Mr. Menin NAME _____ SEC _____ DATE _____

Goal: Use the equations of projectile motion to determine the muzzle speed of a foam “bullet/dart” by following a method to eliminate the effect of air resistance.

Materials: Foam dart, meter stick.

Procedure:

Part A:

1. Get a dart gun from me.
2. Mark the dart (*with a reference mark*) so that you can tell how to orient it consistently.
3. Shoot the gun ***horizontally***. Try it several times until you find an orientation that results in the dart flying horizontally from the gun, not curving up or down.
4. Shoot the gun horizontally from a height of **.25** meters. Measure how far away the bullet hits the floor. Repeat a couple of times & average the measurements.
5. Figure out the initial velocity of the bullet. (*Hint: treat this like a projectile word problem.*)
6. Show *all* measurements and calculations here:

7. The bullet’s muzzle velocity is _____.

OVER →→→→

Part B: \

8. The above velocity is not entirely accurate. Air resistance slows down the bullet, so the *actual* muzzle velocity is **larger** than your result. We now develop a way to find the actual muzzle velocity.

9. The slowing effect of air resistance is greater when the dart/bullet is in the air longer. So to see this effect we can shoot the bullet from greater and greater heights.

10. Repeat the above (1-5) for height = .5 m, .75 m, 1.0 m, 1.5 m, and 2.0 m. Try to shoot the bullet the same way each time. That is, make sure that the dart/bullet is always oriented the same.

11. Make a **table** of height and muzzle velocity.

INCLUDE THE VALUES FOR .25 m FROM THE OTHER SIDE.

12. Now plot velocity vs. height on 1/4" grid graph paper. Attach your completed graph to this lab packet.

13. The velocity should decrease as the height increases. This is because the effect of air resistance is larger for greater heights. To find out what the velocity *would* be if there were *no* air resistance, do the following:

a) Sketch a best-fit **curve** through your data points. It may be a straight line or a curve, depending on the points.

b) Extrapolate this curve back to the velocity axis.

c) The value where your curve intersects the velocity axis is the velocity you *would* measure if the gun's height were zero and the bullet spent *no time* in the air. You have just found a "limit", graphically. This is the true muzzle velocity of the gun.

14. Result: True Muzzle Velocity = _____ Convert this to mph using 1 m/s = 2.25 mph: _____

Attempt to measure the muzzle velocity with a photogate. How does it compare with the above calculation. If it didn't agree within + or - 10% do you have any thoughts as to why?
