Mythbusters – Bullet Fired vs. Bullet Dropped Name: Key Score:

On Mythbusters "Knock your Socks off episode

Part 1

1. What is the "classic physics thought experiment" or myth that they are testing in this episode?

2. What theory states/suggests that this must be true? Why has no one ever tested this?

3. **Calculation** If the drop from the table height is 0.402 seconds, then how high was the table

$V_0 = 0$, $t = 0.402\,s$, $a = 9.8\,m/s^2$ $\quad d = \frac{1}{2}at^2 = \boxed{0.79m = d = H}$

4. What was the percent difference between the dropped ball bearing and the spring launched ball bearing?

$\left(\frac{8}{10}\right)1\% \approx .008$

Part 2

5. Before using real bullets, what do they decide to use? Why is this setup less than ideal? Why is this test invalid?

Paint Balls (difference is 59ms) The irregularities in the surfaces of the paintballs cause them to curve (in irregular ways)

6. **Calculation** If the shot ball takes 555 milliseconds, then how high was the gun?

$V_0 = 0$, $t = 0.555\,s$, $a = 9.8\,m/s^2$ $\quad d = \frac{1}{2}at^2 = \boxed{1.51m = H}$

Part 3

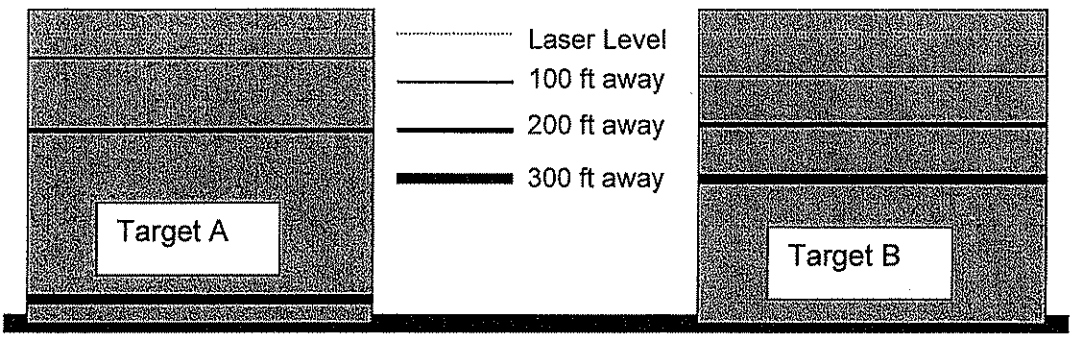
7. Why do they decide to use a 0.45 caliber gun?

Has large, slow moving bullets.

8. **Calculation** How high was the 0.45 off of the ground? 36in If 1" equals 2.54cm, then how long would it take a bullet to reach the ground?

$\frac{36in}{1} \mid \frac{2.54cm}{1in} = 91.44cm$ $\quad d_y = 91.44cm \Rightarrow .9144m$, $a = 9.8\,m/s$ $\quad t = \sqrt{\frac{2d_y}{a}} = \boxed{0.432\,s}$

9. Adam fires bullets into a target for some tests from 100, 200 and 300 feet. He shows these as orange, green, and blue lines. Why are the spaces increasing farther apart as the distance increases like target A, instead of equally spaced like target B? ↳ The vertical speed increases as it falls so... it will cover more distance each second.



Pattern of odds!

$d_y = \frac{1}{2}at^2$

$d_y = -4.9t^2$

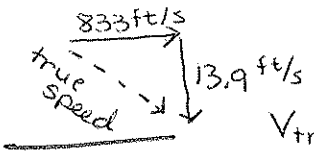
↑ for $t=1$, $t=2$, $t=3$ ↓

10. What are some of the problems with performing this test at a shooting range?

- uneven ground
- wind

11. **Calculation** If the 0.45 bullet flew 360-feet then how fast was the bullet moving?

Actual Speed



$d_x = 360ft = 109.728m$

$t = .432s$

$V = \frac{d}{t} = \frac{109.728m}{.432s}$

$= 254 m/s = 833 \frac{ft}{s}$

$V_{true} = 833.2 ft/s$ - almost all of velocity is horizontal.

Part 4

12. When they are inside Fort Mason Center Festival Pavilion, the Mythbusters test that the 0.45 is perfectly level firing from 36-inches off of the floor. Adam says "I will fire a bullet at that target 20 feet away. Now within that 20-feet the bullet is not going to drop at all....." Why isn't this a conceptually true statement even though it appears as though it is "practically" according to his test? It IS falling!! In the $d_x = 20$ feet the bullet has only been in flight for a very short period of time so the vertical drop is minimal.

*How does Target A in question 10 verify that Adam is wrong

13. What are they going to use to drop the bullet at the same time the fired bullet is shot? What is the problem with this system?

Electromagnet

- Residual Magnetism (")

Solenoid

- Pulls back too slowly

Part 5

14. At the end of the test, how much sooner does the fired bullet hit before the dropped bullet?

$39.6ms = \Delta t$

15. Did these tests convince you that the "myth" or "classic physics thought experiment" is valid? Why?

16. Can you think of away for them to improve on this test? *(don't say lasers...they ALREADY are using lasers)*

17. Using this video/experiment as a basis, is it always possible to exactly test an idea scientifically? Support your answer.