

1. Epistemological Table - Courtesy of Group D

| Claim | Type of Knowledge |
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| The height of the table was 89 centimeters. | Measurement using a meter stick. ✓ |
| After it is released from the gun, the bullet experiences a constant, downward acceleration, due to gravity. | Discovered in lab 2; gravity exerts a constant acceleration on all objects in free-fall, regardless of their initial velocity. Yes! |
| This constant acceleration due to gravity is approximately 9.8 m/s/s. | Canonical. Yes! |
| The initial vertical velocity of the bullet is zero. | Inference, since the bullet was fired horizontally, the initial vertical velocity of the bullet is zero. Yes! |
| The amount of time it should take for the ball to fall from its initial height to the ground is 0.425 seconds. | True by calculation using the derived displacement equation for constant acceleration motion $x = \frac{1}{2}at^2 + V_0t$. ✓ |
| The bullet took 0.013 seconds to pass through the light gate(s). | Measurement using the photogate and digital timer. ✓ |
| The distance between the light gates was 8 centimeters. | Measurement using a meter stick. ✓ |
| $v = \frac{x - x_0}{t - t_0}$ | Definition of average velocity. ✓ |
| The average velocity of bullet through the light gate(s) was 577.32 cm/s. | Calculation using the definition of average velocity and measurements obtained using the photogate, digital timer and the meter stick. ✓ |

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| <p>Velocity in the x-direction will be (approximately) constant throughout the experiment.</p> | <p>Inference, the acceleration affects things in free-fall which involves the y-direction. Since there is no acceleration in the x-direction, the velocity is constant throughout the experiment. ✓</p> |
| <p>The initial horizontal velocity of the bullet was 577.32 cm/s.</p> | <p>[Calculation using the definition of velocity and measurements obtained using the photogate, digital timer and the meter stick.]</p> <p>This is the only answer that was <u>not</u> correct in this ET. This value 577.32 cm/s <i>was</i> calculated from the data obtained using the photogate, digital timer, & meter stick, <i>but</i> that calculation only gives you <i>average velocity through the photogates</i>. The question is, how do we know that the initial velocity is also equal to 577.32 cm/s. A correct answer would be:</p> <p>“Because velocity is constant in the horizontal direction, average velocity through the photogates = initial velocity.”</p> |
| <p>$x = \frac{1}{2}at^2 + V_0t$</p> | <p>Derived displacement equation for constant acceleration motion. ✓</p> |
| <p>The gun should be placed 245.361 cm away from the target.</p> | <p>True by calculation using the derived displacement equation for constant acceleration motion $x = \frac{1}{2} at^2 + V_0 t$. ✓</p> |

Research Design Chart – Courtesy of Group B

The vertical displacement of the bullet from the ground was approximately 88.6 cm.



Using this information and a downward acceleration from gravity, a time was calculated using the derived equation for constant acceleration.



The time calculated was used to find the horizontal displacement, also using the same derived equation for constant acceleration, but with variables pertaining to the horizontal axis.