Projectile motion lab: using a toy gun

Science, Physics

Projectile Motion Lab: Using a Toy Gun Purpose: The purpose of this investigation is to measure the vertical displacement, or height of the launch, and the horizontal displacement, or range, travelled by a projectile (bullet from toy gun). Questions: What is the shape of the actual path travelled by a projectile? How closely does an actual projectile's results follow the theoretical predicted results? Hypothesis: The shape of the path travelled by the projectile, in this case the bullet of the gun, is a parabolic.

This means that is a curvy shape due to the bullet being launched in the air (making curve go up) and the earth's gravity pulling it down (making curve go down). As the height of the bullet's release increases the the time to reach the ground will increase, and therefore the range of the bullet will increase. This is because the bullet's vertical velocity will decrease later as the height is higher up, having a larger time, and therefore a larger range. Materials: Toy Gun Fake Bullets Metre Sick Stop Watch General Observations: A metre stick was used to measure the height and the range of the bullet.

A stop was used to determine the time it took for the bullet to reach the ground. As the bullet was released, its path was parabolic. This means that its was curvy because it was first int air, but the gravity pulled it back down to the surface. The toy gun was steadily held in my hand. The initial height was the distance from the gun to the surface used. The gun shot out the bullets at a fairly fast speed. As the height was increased, the more time the bullet took to reach the ground. As the height was increased, the range was also higher.

Analysis: Picture of the launcher: Height vs. Range graph- Refer to attached data in the back. Position vs. Time graph- Refer to attached data in the back. The graph results definitely support the hypothesis. This is because as the height of the toy gun was increased, the horizontal distance increased.

Also, as the horizontal distance of the bullet increased, so did the time (vice-versa). The graphs were very similar due to the horizontal distance (cm) being constant on the y- axis of the graph. In the Horizontal Distance vs. Time graph, the time represented the corresponding heights of the Horizontal Distance vs Height graph. Making the graphs very similar. Determining the Vi of the Bullet: Vi = aav x ? t aav = -9. 81 m/s? ? t = 3. 19 seconds Vi = -9. 81 x 3. 19 Vi = 31. 3 m/s [v] *Therefore the initial velocity of the bullet is 31. 3 m/s [v]. Theoretical Ranges of the Bullet:

Sources of error: The first source of error was the toy gun's bullet were not perfectly a cylinder. Since the bullets we made out of plastic foam there some ripped edges. This would definitely give a slightly inaccurate result sine the bullet would not consistently travel in the same way as it is going in a parabolic path. This would cause some twisting and turning of the bullet since the rips would collect air and make the bullet therefore move around (sort of like air pockets). The main problem with this is that the bullet is not consistently travelling in the exact same way.

Another source of error was that since the gun was shot from ahuman being's hand it is really tough to keep the gun at the same angle (zero degrees) as it is shot. If the angle of the gun is not consistently shot at the same angle it will definitely impact the results because the horizontal distance (range) of the bullet will be different each time. If the gun has an angle pointing downward, the range will decrease. The bullet will be in the air for a smaller amount of time, covering less ground. If the gun is pointing upward the range will increase.

The bullet will be in the air for a longer period of time, covering more ground. There can be ways though to fix these sources of errors. For the first one where there were rips in the bullet, what one can do to fix the bullets is use tape to cover up the holes. Or, a better solution would to buy new, fresh bullets where there are no bend, rips or chance of disfunction. To make sure that the bullets angle is constant after each shot, what one can do is use a stand to place the gun in. This would make sure that the gun is not pointing down or upward, giving very accurate data of the range. Conclusion:

All projectiles travel in a parabolic path. Projectile motion is the motion of an object who's path is affected by the force of gravity. Everything is affected by gravity, but it profoundly alters the motion of objects that are thrown or shot upward. The arching of the bullet in this experiment is caused by gravity, as well as its falling motion in general. Gravity causes change in the vertical velocity of the projectile. Objects experiencing projectile motion have a constant velocity in the horizontal direction, and a constantly changing velocity in the vertical direction. Thus, this is causing the parabolic shape.

The actual projectile's results were really close to the theoretical results in this case. There were no outliers in the range. If the theoretical range and the actual range were not close it would be due to the tools used to measure the time and the distance. A metre stick was used to determine the horizontal range for the experiment. This is very inaccurate because the bullet dropped way to fast to see the actual landing spot. The landing spot was based on the eye. Also since a timer was used to determine the time of the bullet's range this is again very inaccurate since the bullet dropped way to fast to use a stop watch.

Overall, the results in this case were luckily extremely close and accurate having a maximum percent error of 0. 00 8%. The reasons for the experimental error was mainly due to the tools used to measure data and, the inconsistency of the angle of the gun. As stated earlier a metre stick was used to determine the horizontal range for the experiment. This is very inaccurate because the bullet dropped way to fast to see the actual landing spot. The landing spot was based on the eye. Since a timer was used to determine the time of the bullet's range this is again very inaccurate since the bullet dropped way to fast to use a stop watch.

Again as stated earlier, if the angle of the gun is not consistently shot at the same angle it will definitely impact the results because the horizontal distance (range) of the bullet will be different each time. If the gun has an angle pointing downward, the range will decrease. The bullet will be in the air for a smaller amount of time, covering less ground. If the gun is pointing upward the range will increase. The bullet will be in the air for a longer period of time, covering more ground.