**Thread NSTA Bullet and Momentum Question**

**From:** physics-request@list.nsta.org [mailto:physics-request@list.nsta.org] **On Behalf Of** Lee Jones  
**Sent:** Wednesday, February 03, 2010 11:26 AM  
**To:** physics@list.nsta.org  
**Subject:** Bullet and Momentum

On Wed, Feb 3, 2010 at 10:26 AM, Lee Jones <[leejones15@gmail.com](mailto:leejones15@gmail.com)> wrote:

In the movies, a person shot with a gun always flies backwards (usually through a conveniently placed wafer glass window) and I know this is not in line with conservation of momentum.  Not being a physics pro, I am having a hard time coming up with a mathematical explanation for this.  I am looking for a problem where students can use the mass and velocity of a bullet, the mass of a man, and figure out how far he shouldn't fly.

Any websites or example problems would be awesome.  Also, a tip on a video clip from youtube to show and analyze...

Thanks!  
  
-- Lee  
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Lee Jones  
Dallas High School  
Dallas, OR  
Chem, AP Chem, Physics

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Mythbusters did a segment in one of their shows on this.  Also showed how the movie SFX people do it.  Might be an interesting way to get the discussion rolling.

Paul Montbriand

Penn High School

Mishawaka, IN

Good example of bad physics:  Lethal Weapon.  
  
Mel Gipson gets shot by a shotgun (while wearing a kevlar vest) and goes flying backward through a storefront window.  Sounds like the type of physics faux pas you're looking for.  Another example of these types of scenes is the video game "Max Payne".  I'm sure there are plenty of youtube clips for this, but as I recall it's a pretty bloody game ...  
  
  
  
Andrew Bennett  
Physics and Physical Science Teacher  
North High School, Davenport, IA  
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Lee Jones wrote:

In the movies, a person shot with a gun always flies backwards (usually through a conviently placed wafer glass window) and I know this is not in line with conservation of momentum.  Not being a physics pro, I am having a hard time coming up with a mathmatical explanation for this.  I am looking for a problem where students can use the mass and velocity of a bullet, the mass of a man, and figure out how far he shouldn't fly.

The distance he flies isn't really the issue.  The question is, what would be the victim's initial velocity, and is that velocity high enough to produce the effect you see in the movie.   
  
Is momentum conserved?  Well, if the define the system as the bullet + man, then yes as long as you ignore friction (which disappears when the man's feet leave the ground).   
  
mv\_i = (m+M)v\_f   
  
Note that m << M, so for all practical purposes we can ignore the m on the RHS. Therefore, v\_f = (m/M)v\_i = [roughly] (0.01/100 )(1000) = 0.1 m/s = 10 cm/s.   
  
Nope.  (And this assumed a 10-gram bullet, which is very massive.)   
  
More correctly, this is a conservation of angular momentum problem.  The easiest way to perform the calculation is to define the vertical-0 axis through the victim's center of mass, then conserve angular momentum to find the initial angular speed about the victim's center of mass.

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Thanks!   
  
-- Lee   
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Lee Jones   
Dallas High School   
Dallas, OR   
Chem, AP Chem, Physics

I’ve also done it similarly by blowing a cork out of 2 liter bottle, it makes for a nice discussion of conservation of momentum in comparing the 2 masses and their velocities before and after the “explosion.”  I make an aluminum foil “boat” and float baking soda into the bottle with vinegar so I can get it sealed before they mix.

Jessica Greenfield

Pine Island HS, MN

Physical Science, Physics

**From:** physics-request@list.nsta.org [mailto:physics-request@list.nsta.org] **On Behalf Of** RICHARD HECKATHORN  
**Sent:** Wednesday, February 03, 2010 2:03 PM  
**To:** Joseph Mello  
**Cc:** Lee Jones; physics@list.nsta.org  
**Subject:** Re: Bullet and Momentum

Greetings,  
  
If you have two carts and twomotion sensors that will measure the velosity of the two mass after the carts explode apart, you can calculate the velocity of the larger mass given the two masses and the velocity of the smaller mass and then compare it to the velocity determined by the sensor.  
  
I use the vernier motion sensors.  You can also use any variation of masses.  
  
Dick

There were two Mythbusters episodes that busted this myth – they did it once and got so many letters that they had not done the experiments “correctly” that they revisited it again J  You can probably find the clip on the Discovery channel’s page or on youtube.  They do talk about the physics behind the problem as well and show how the stunt people in Hollywood pull it off.

FYI, they also did a fantastic job demonstrating that a bullet dropped and a bullet fired really do hit the ground at the same time.  It was in a different episode, but I know that’s an idea that students really have a difficult time believing, even after all of the demos we do in class.

Siobhan Sackey

Physics/Physical Science Teacher

Maryvale High School

Phoenix, AZ

I talk about the amazing bullet when I discuss Newton's 3rd Law. I break it down to "bullet pushes gun-gun pushes shooter, which always appears to be much less force than "Gun pushes bullet-bullet pushes victim".  
We had a goofy schedule recently and I had to do some physics filler. I showed "kinetic Karnival"   
 <http://vids.myspace.com/index.cfm?fuseaction=vids.individual&VideoID=32782133>  
  
Plus clips of a belly flopper: <http://www.fandome.com/video/101976/Professor-Splash-High-Dives-into-Kiddie-Pool-Breaks-World-Record/>  
  
-air bag diver: <http://community.guinnessworldrecords.com/_Highest-Dive-Into-An-Airbag/video/162329/7691.html>  
 and much better slo-mo brick break:   <http://www.5min.com/Video/How-The-Hand-Reacts-In-A-Karate-Chop-10074213>  
 and then followed it up with a documentary on Bruce Lee's 1-inch punch. (Youtube)  
  
~Joe Mello