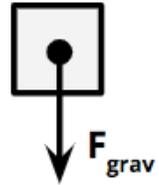


Motion Characteristics of Projectiles

Lesson Notes

What is a Projectile?

- An object upon which the only force of influence is gravity.
- A free-falling object.
- Maintain two simultaneous motions - horizontally and vertically.



Perpendicular Components of Motion

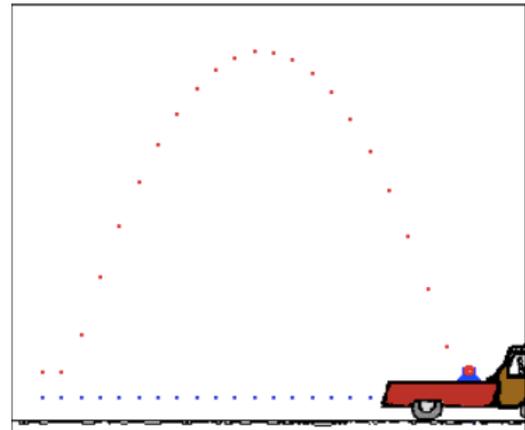
- Projectiles move both horizontally and vertically ...
- ... the horizontal motion does not affect the vertical motion; these two components of motion are independent!!
- The time to fall vertically is not affected by the initial horizontal velocity

Independence of x- and y-Motion

If a ball is projected vertically from the bed of a horizontally-moving (constant speed) truck, the ball will rise and fall vertically and land back in the bed of the truck. Proving that ...

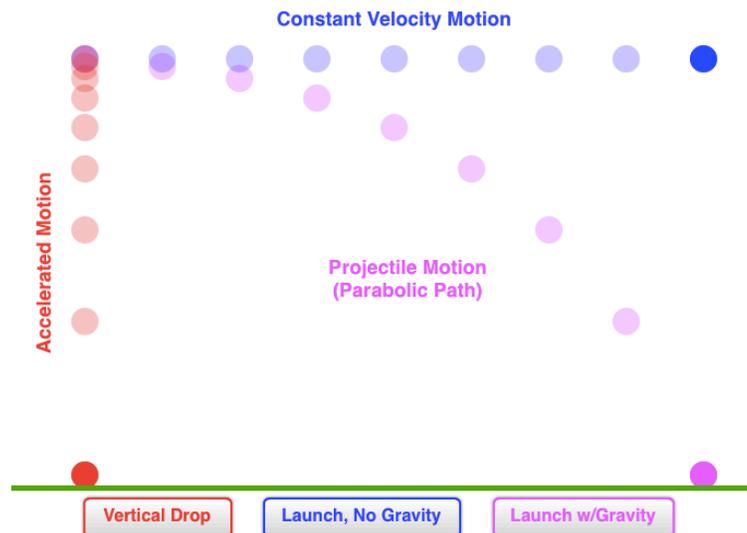
The ball's **horizontal motion is not affected by its vertical motion** ... and vice versa.

The ball maintains a constant vertical velocity.



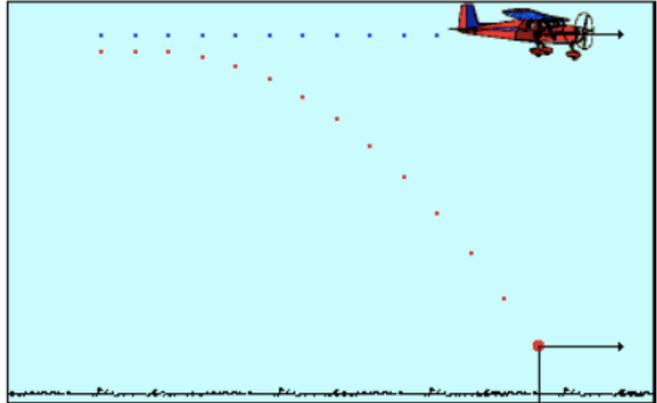
Gravity is a Vertical Thing!

- A projectile's motion is **only** influenced by gravity.
- Since the force of gravity is a vertical force, it will not affect the horizontal motion.
- The vertical velocity changes; the horizontal velocity remains constant.
- Projectile motion is a blend of these two simultaneous and independent motions.



Horizontal Motion is a Constant Velocity

- In the absence of horizontal forces, once *projected*, a projectile will continue with a constant horizontal velocity ... as predicted by Newton's First Law.
- **Law of Inertia:** Objects in motion stay in motion with the same speed and direction (when forces are balanced).
- If a plane moving with a constant horizontal velocity drops a package. The package will maintain its constant horizontal velocity as it accelerates to the ground.



Summary:

Motion Characteristics of a Projectile

	Horizontal Motion	Vertical Motion
Force?	No	Yes. Gravity. Down
Acceleration?	No	Yes. Down, -9.8 m/s/s
Velocity?	Constant	Changing by -9.8 m/s each s
Displacement?	Constant Δx each second ● ● ● ● ● ● ● ●	Changing Δy each second

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