

Impulse and Momentum Lab



Watch:

<https://www.pbs.org/video/segment-4a-momentum-and-impulse-nryodl/>

Watch: <https://www.youtube.com/watch?v=LvsXxd3DM9w>

Watch: <https://www.youtube.com/watch?v=hHXx8AmBwXg>

Do all work on a separate piece of paper

Purpose of the lab:

To determine the relationship between Impulse and change in momentum.

Answer everything in red on a blank sheet of paper

Prelab:

1. In your own words define Impulse.
2. Describe how one surface breaks the egg, is harder, than the surface that doesn't break the egg (is softer).

Go to Physics Aviary Impulse Lab: [The Physics Aviary Impulse Lab](#)

This is Wally, he is an astronaut floating around in space using a fire extinguisher as a jet pack. When you activate the "jetpack" it provides a force and he begins to move. When you shut it off, he continues to move but he is no longer speeding up.

On the left side of the screen are 2 red lines. These represent the laser beams from the photogates. Photogates are devices used to measure the speed of an object. The time starts when the first laser is broken, and ends when the second laser is broken, this gives you data that you can use to calculate Wally's speed after the "jetpack" has been turned off. (Speed = Distance / time) You must turn off the "jetpack" before you get to the first beam.

Guidelines:

1. Force, mass and force-time are easy to find on the screen.
 - a. Force = the thruster on his "jetpack" giving him a push to get him moving
 - b. Mass = how much matter he is made of
 - c. Force-Time = the amount of time the force of the thruster is being applied for
2. Photogate, Distance, and Photogate-Time are also found on the screen.
 - a. Photogates = devices that have a laser beam, Wally will break the beam of light as he passes through, then 10 m later he will break the second one
 - b. Distance = the photogates are 10 m apart, so he will travel a distance of 10 meters from when he breaks the first beam to the second beam
 - c. Photogate-Time = is the time it takes for Wally to travel between the two red lines of the photogate.
3. Equations:
 - a. Impulse = Force x time
 - b. Momentum = mass x velocity
 - c. Velocity = change in position/time (displacement between photogates divided by time)
 - d. Change in momentum = $mv_2 - mv_1$ (in this lab $mv_1 = 0$)

Lab:

1. What is happening to Wally's Speed when the thruster is on?
2. If you shut off the thruster is Wally's speed still changing?
3. Which of Newton's laws apply? Explain.
4. How will you figure out Wally's speed between the 2 laser beams? (you must shut off the thruster before Wally hits the first laser beam)
5. You will need to change milliseconds (ms) to just seconds. How will you change ms to seconds?
6. Try changing Wally's mass and explain what changes.
7. Try changing the extinguishers force and explain what changes

Variables

Independent variables: Impulse

Dependent Variable: Change in Momentum

Constants: Wally's mass

Copy table and fill in using the data from the screen and calculate unknown values.

Force (N)	Force Time (s)	Product of force and time (F x t) (N x s)	Mass (kg)	Change in Velocity (d/t) <i>=10 ÷ photogate time</i>	Change in Momentum (Mass x Δv) (kg m/s)

Claim: (How does the Impulse compare to the change in momentum? Write an equation to show the relationship between Impulse and Change in Momentum.)

Evidence: (Use Evidence from the data table to prove this.)

Reasoning: (Explain how this can be true)

Use your equation to make a scenario to and duplicate it in the simulation