



Virtual Learning

Physics

Newton's Laws of Motion Sim Part I

April 21, 2020



Physics

Newton's Laws of Motion Sim Part I: April 21, 2020

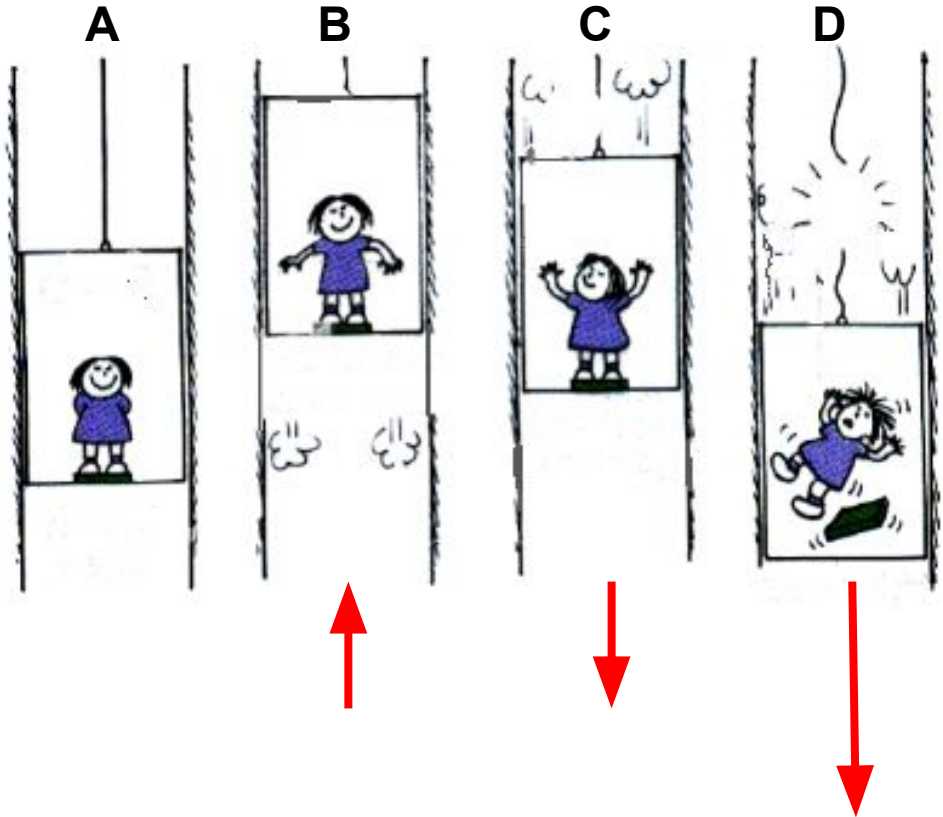
Objective/Learning Target:

Students will use a computer simulation to examine Newton's Laws of Motion.

Quick Review #1

The diagram to the right shows four different elevator scenarios. The student is standing on a bathroom scale in each case, and the arrows show the direction of acceleration.

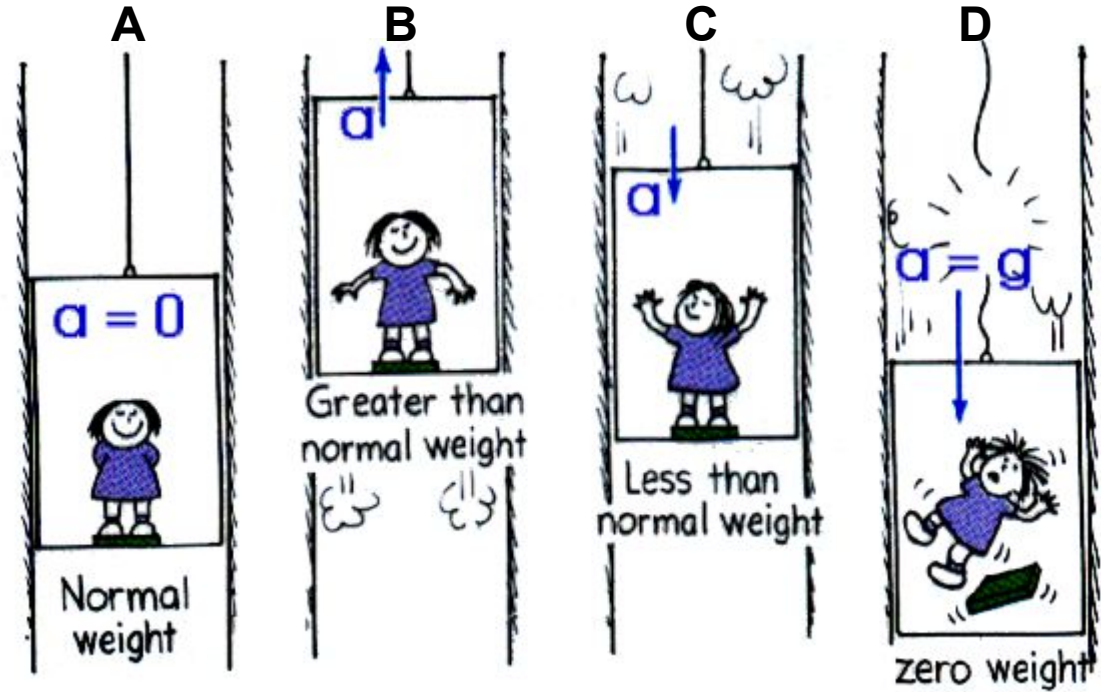
List from greatest to least the readings given by the bathroom scales.



Quick Review #1 Review

From Greatest To Least:

B, A, C, D



Quick Review #2

A high-speed truck and an innocent bug have a head-on collision. The force of impact splatters the poor bug over the windshield.

- a. Is the corresponding force that the bug exerts against the windshield greater, less, or the same?
- b. Is the resulting deceleration of the truck greater than, less than, or the same as that of the bug?



Quick Review #2 Answer

- a. The magnitudes of both forces are the same because they constitute an action–reaction force pair that makes up the interaction between the truck and the bug.
- b. The accelerations, however, are very different because the masses are different. The bug undergoes an enormous and lethal deceleration, while the truck undergoes a very tiny deceleration—so tiny that the very slight slowing of the truck is unnoticed by its passengers. But, if the bug were more massive—as massive as another truck, for example—the slowing down would unfortunately be very apparent. (Can you see the wonder of physics here? Although so much is different for the bug and the truck, the amount of force each encounters is the same. Amazing!)

Newton's Laws of Motion



Introduction

You will use a computer simulation today to reinforce your ideas of Newton's Laws of Motion. Since this is "inquiry based", you're not supposed to know everything going in, but learn as we walk through the lesson. **You must read the following slides carefully.** Let's get started!

Newton's 1st Law of Motion

Website: [Force and Motion Computer Simulation](#)

Make sure to use the HTML5 version.

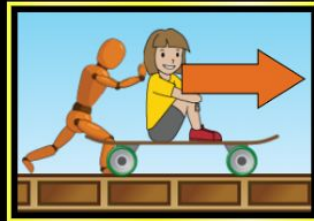
Select the motion icon and double click to start.



Forces and Motion: Basics



Net Force



Motion



Friction



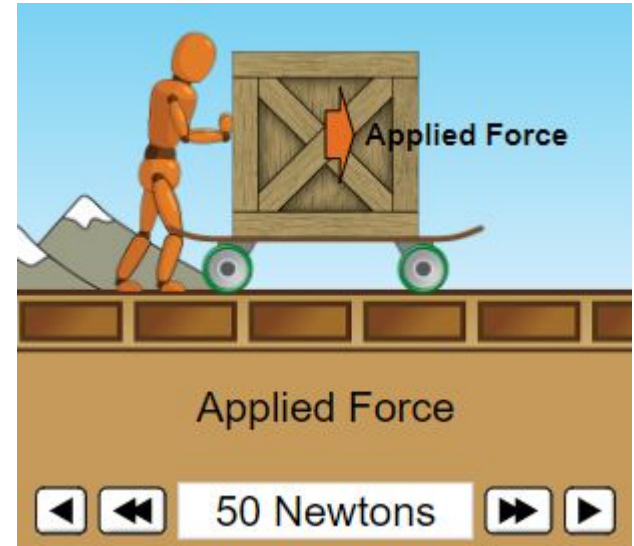
Acceleration

Newton's 1st Law of Motion

**Make sure the boxes that say “Force”,
“Values” and “Speed” are checked!**

**Press the pause button before setting your
parameters. Once set push play.**

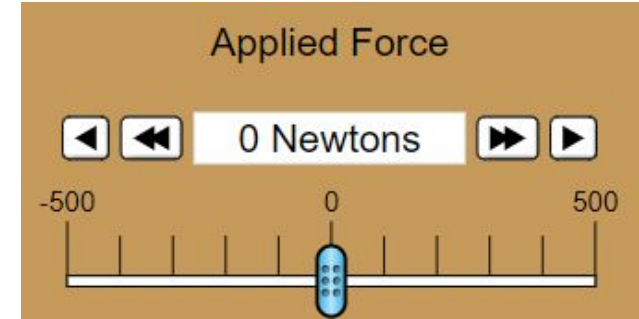
1. Apply a force of 50 N right to the box.
Describe the motion of the box using
physics terms (i.e. velocity, acceleration,
displacement). Refer to the speedometer
in your answer.



Newton's 1st Law of Motion

Reset the scenario, check the values, force and speed boxes as before. Again check the pause button before setting the parameters.

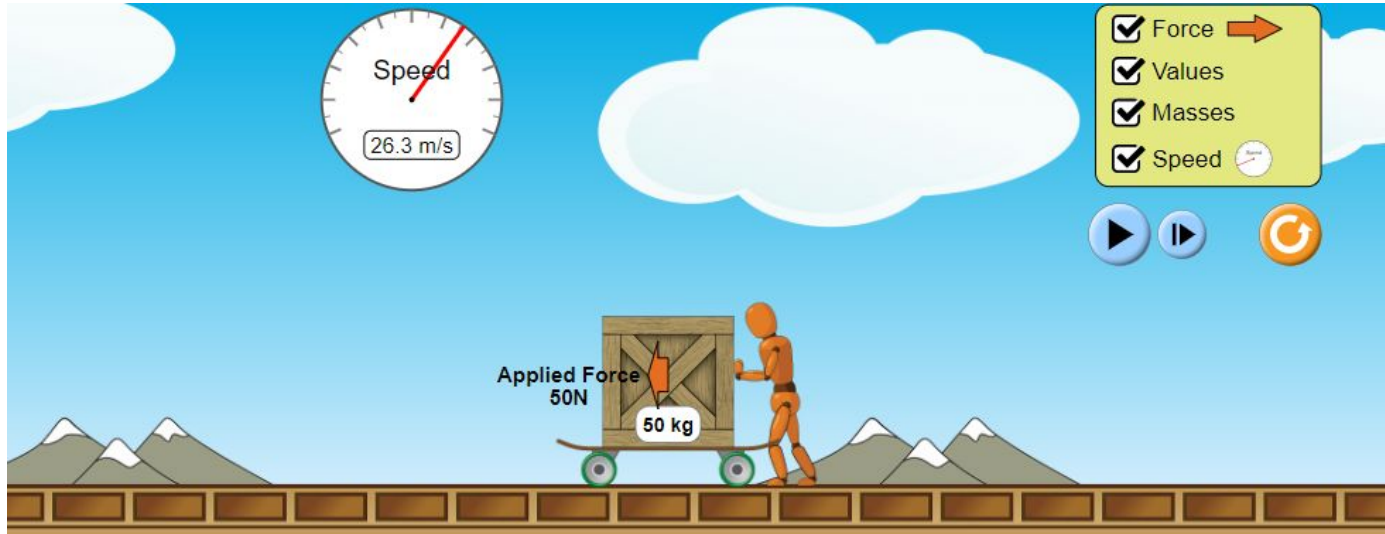
2. Apply a force of 50 N to the right for about 5 seconds then reduce the applied force to zero by clicking the blue slider. (the man should stop pushing). Don't reset the scenario. Describe the motion of the box. Refer to the speedometer in your answer.



Newton's 1st Law of Motion

Reset the simulation.

3. Apply a force of 50N to the left. Describe the motion of the box.
4. Explain the exact steps needed to make the box come to a stop.



Newton's 1st Law of Motion

5. Newton's First Law of Motion States "An object at rest stays at rest and an object in motion stays in motion with the same speed and in the same direction unless acted upon by an unbalanced force." Explain how your observations in 1 - 4 support this Law.



Simulation Answers 1-4

1. The crate started stationary and was slowly accelerated at a nice steady rate. So the displacement was very small per unit of time to begin with but gradually increased over time. At 40 m/s the man collapsed and the crate continued rolling along at a constant velocity 40m/s.
2. After 5 seconds the crate had reached a velocity of 5 m/s. Once the man stopped pushing the crate continued rolling along at 5 m/s.
3. The motion was the same as the 50 Newton force to the right in problem 1, except the crate travelled in the other direction, the direction of the unbalanced force.
4. In order to stop the box there needs to be an unbalanced force opposite to the direction of motion. If the force is small it will take a while to stop, as opposed to a large unbalanced force that would bring the crate to stop in a shorter amount of time.

Simulation Answer 5

The crate was motionless until the unbalanced force supplied by the man started. It was an object at rest and it stayed at rest. The crate also continued in a state of constant velocity once the man stopped pushing. An object in motion stayed in motion, because there was no unbalanced forces acting on it.



Additional Practice

Select the Net force button at the bottom of the pHet simulation and experiment with the different options. Remember a Net force of zero means no change in motion.

