Physical Science 101

Name _____

Momentum Exploration

Partner's Name _____

Things to consider:

Momentum is defined to be the product of mass and velocity:

Momentum= Mass x Velocity = m v

When we say that a system conserves momentum we mean that total momentum of each part before and event like a collision equals the total momentum after the event. For a two object system this Means that

Momentum before = Momentum after

$$m1v1b + m2v2b = m1v1a + m2v2a$$

Use the animation at

http://cs.clark.edu/~mac/PHSC101/Flash/collision1D/collision1D.html

to explore the ideas above.

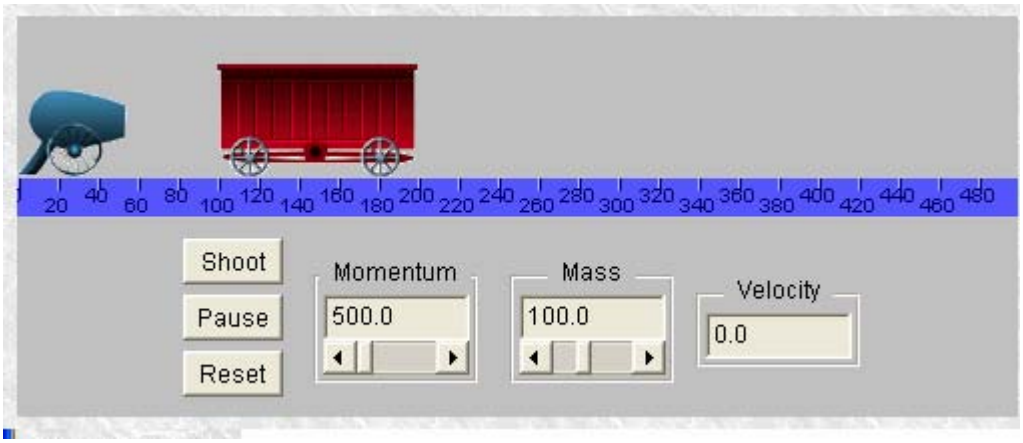
What changes must you make so that the two objects collide but do not move after the collision? Explain clearly .

Go to the URL below and work through the activities:

http://zebu.uoregon.edu/nsf/mo.html

The words and questions from this web site have been changed slightly below. Work through everything below using the environment from the URL above.

CONSERVATION OF LINEAR MOMENTUM



Understand the basic concept of momentum conservation by shooting one shot at various values of the momentum of the projectile and mass of the railcar. After a few trials you should be able to correctly predict what the railcar velocity will be for a given initial momentum and railcar mass.

Which values give the railcar its greatest velocity after one shot?

Momentum (of shot)=_____

mass (of car)=_____

What is the velocity after 2 shots, 3 shots, 4 shots? (by now its well off the screen but you can still shoot it)

V2=_____ V3=_____ V4=_____

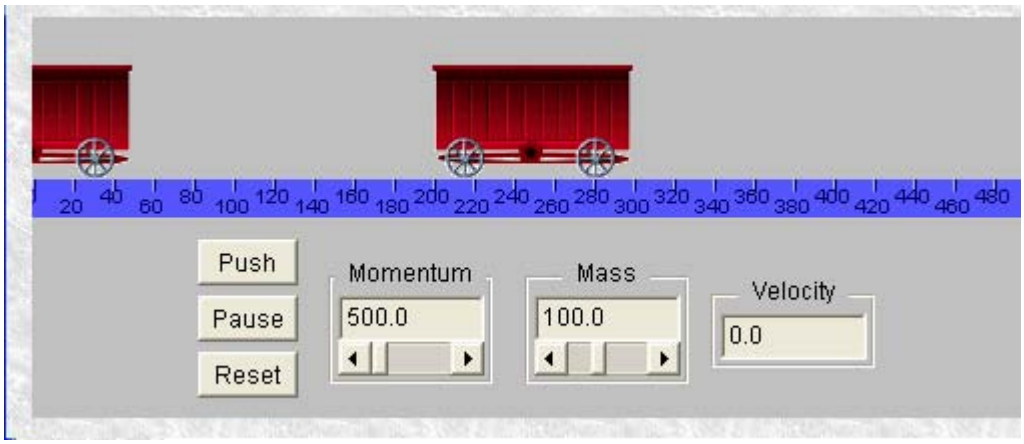
Which values give the rail car its smallest velocity after one shot?

Momentum (of shot)=_____

mass (of car)=_____

How many of these shots are needed to propel the railcar to a velocity of 50 or greater?

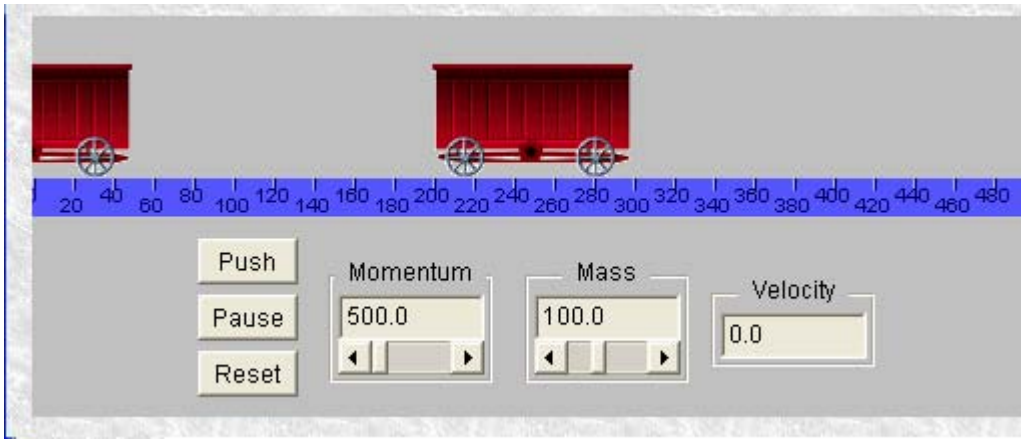
In this case, two railcars collide and conservation of momentum occurs in an inelastic situation. When the first railcar impacts the stationary railcar it will couple to it. The amount of energy lost is in the coupling is exactly in accord with momentum conservation which then determines the final velocity of the coupled car system.



We start initially with the first railcar having a **Mass of 100**. The initial momentum of the first railcar and mass of the second cart are adjustable via the sliders. The student should try a range of different combinations to test their ability to correctly predict the velocity of the coupled cart system.

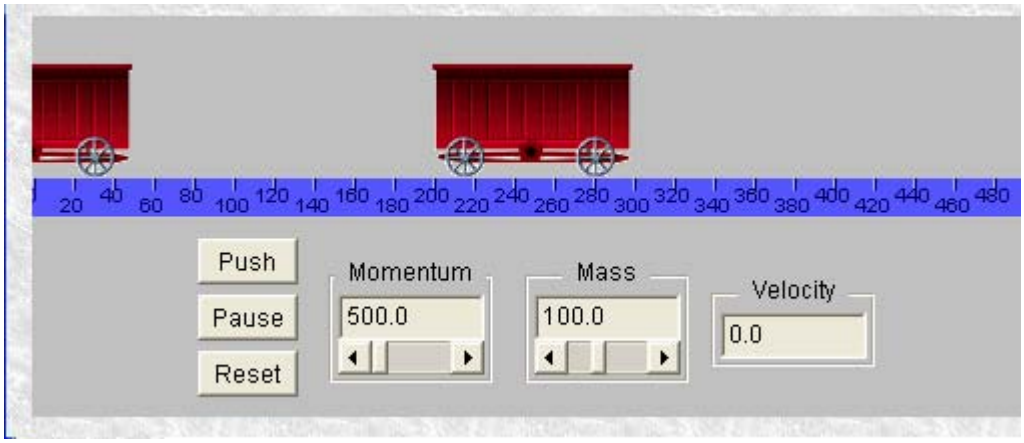
Explain how to predict the velocity of the coupled system when the momentum of the first railcar is 1000.0 kg-m/s and the mass of the second is 200.0 kg.

Now the mass of the first railcar is unknown. Through a series of trials the student should be able to determine the mass of the first railcar by observing the final velocity of the coupled car system.



What is the mass of the first railcar? Explain how you figured this out.

In this case the mass of the first railcar is also unknown but is greater than the mass in the previous case. Using the same procedure as above, e.g. experimentation(!), try to determine the mass of the first cart.



What is the mass of the first railcar? Explain how you figured this out.