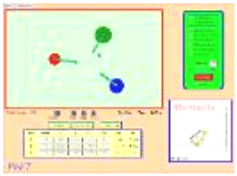
PH201 Prelab8 Momentum (Many thanks to: C. Bires, Simulations at http://phet.colorado.edu/) Name: _____

PhET Explorations: Momentum and Simple 1D Collisions


Collision Lab

Introduction: When objects move, they have *momentum*. **Momentum, p=m*v**, is simply the product of an object's mass (kg) and its velocity (m/s). The unit for momentum, p, is kgm/s. We know that the velocity of an object can be changed by an external force which results in an acceleration of the object. Therefore we can also change the momentum of an object by an external force. If this external force is applied for a finite time, we call the product of force F and that time duration Δt the **impulse J = F*Δt**. Often the term impulse and momentum are related to physical processes including collisions.

During a collision, an object's momentum can be can be changed by the **impulse**, from a second object (as compared to an external force) that acts for a certain time of the object). During our lab we will confirm the momentum-impulse theorem:

$$\Delta p = m\Delta v = F\Delta t$$

Go to: https://phet.colorado.edu/sims/collision-lab/collision-lab_en.html

Procedure: *Play with the Sims → Physics → Motion → Collision Lab* Run Now!

Perfectly *Inelastic* Collisions: 

To begin a collision:  To restart a collision: 

Prelab Questions:

1) First take some time to familiarize yourself with 1D **inelastic** collisions. Play. Investigate. Learn. What did you observe?

2) Have a close look at the center of mass in the simulation. What do you observe for the motion of the center of mass?

3) Contrast an inelastic collision with an elastic collision. Do not investigate elastic collision any further than to answer the following question. What happens to the motion of the center of mass?

4) Describe an example from day to day experience that includes the change of momentum based on an impulse:

PH201 Prelab8 Momentum (Many thanks to: C. Bires, Simulations at http://phet.colorado.edu/) Name: _____

The following is not part of the prelab. If we would be together in the classroom, here is another 20min worth of work of you feel inspired to play a bit more. As we are new to conservation of momentum and conservation laws in general, you might be extra motivated to understand these concepts. Enjoy, if you decide to do so!

- Complete the below table without the simulation and **check your work in the simulation**.

m_1	m_2	v_1	v_2	p_{total}	v_{12}'
1.20 kg	1.20 kg	+1.50 m/s	-1.80 m/s		
2.40 kg	4.80 kg	+1.30 m/s		7.00 kgm/s	
1.50 kg	5.50 kg	+3.20 m/s	+.800 m/s		
2.50 kg		1.20 m/s			0.0 m/s

Describe the effect of an **inelastic** collision on the two-object system.

_____

Conclusion Questions:

1. A 500. gram cart moving at .360 m/s has how much momentum? **(careful...units!)** _____

2. A .230 kg baseball is thrown with a speed of 41 m/s. What is the ball's momentum? _____

3. If the above ball comes to rest in the catcher's mitt in .085 seconds, how much force does the ball apply on the catcher's mitt? (hint: use the impulse-momentum theorem) _____

4. If a 250. gram cart moving to the right with a velocity of +.31 m/s collides inelastically with a 500. gram cart traveling to the left with a velocity of -.22 m/s, what is the total momentum of the system before the collision? _____

5. What is the resulting velocity of the above two-car system (stuck together)? _____