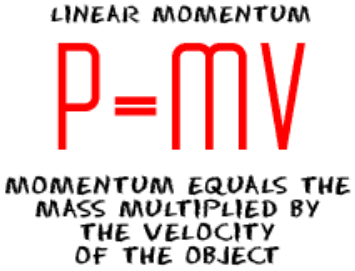
Impulse and Momentum

http://www.youtube.com/watch?v=hTZI-kpppuw&safety_mode=true&persist_safety_mode=1&safe=active
Physics of Football

Momentum: A property combining mass and velocity.

Mathematically,



Where: p = momentum (kgm/s)
m = mass (kg)
v = velocity (m/s)

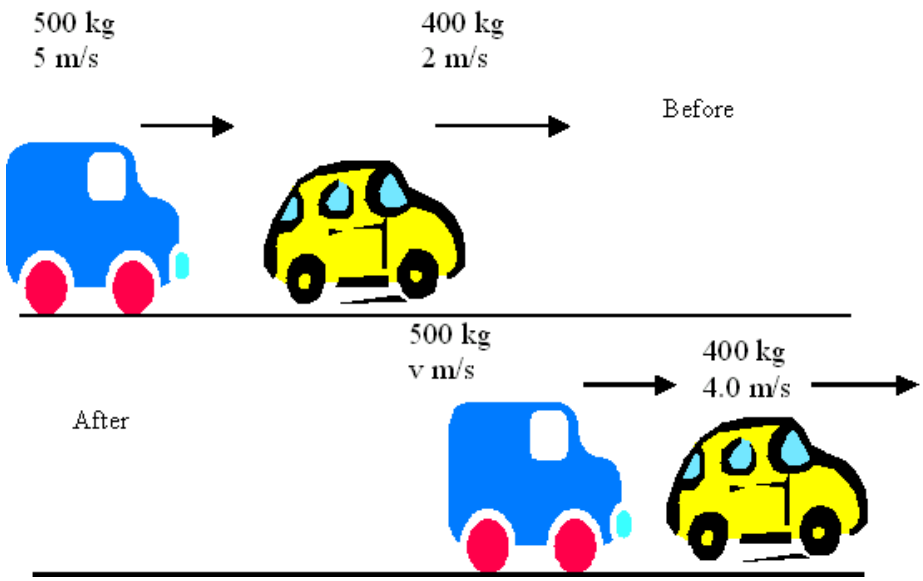
** conceptually, would you rather get hit by a tackling football player or a piece of chalk...what about if the chalk were moving at 340 m/s? They call them "bullets" in the military.*

The momentum of an object can only be changed by adding an external unbalanced force
**How is momentum the same as Inertia? Different?*

Ex: Calculate the momentum of a 1.0 kg duck moving at 28 m/s and a 200 kg sumo wrestler moving at 0.5 km/hr.

In a collision, momentum is conserved.

This can be used to determine velocities before and after a crash.

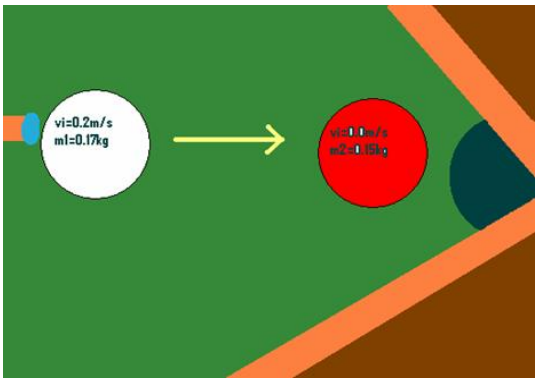


There are three kinds of collisions.

1. **Two masses collide and then move apart separately.**

   Ex: Two pool balls collide.

A 0.17kg pool ball travelling at 0.2m/s strikes a second ball with the same mass that is at rest. If the first ball rebounds at 0.15m/s, what is the velocity of the second ball after the collision?



2. Two objects collide and stick together.

Ex. car crash

A 1200 kg car travelling at 55 km/h [E] hits a 1350 kg car travelling at 67 km/h [W]. What is the velocity of the combined wreck after the collision?

3. Two connected masses come apart.

Ex: A bullet and a gun start off together and then move explosively apart.

A 29 kg gun fires a 57.6 g bullet with a muzzle velocity of 316 m/s.
What is the recoil velocity of the gun?

Example 1:
A train car with a mass of 1500 kg and an initial velocity of 20 km/hr [East] collides with a train car which is at rest and has a mass of 1000 kg. Calculate the velocity of the cars after the collision if they stick together.

Example 2:
A 50.0 kg figure skater is standing at rest on the ice. A 95.0 kg hockey player, also at rest, pushes the skater. Find the velocity of the figure skater if the hockey player moves backwards at 2.00 m/s after the push.

Example 3:

A 5.0 kg gun fires a 0.010kg bullet. If the bullet has a velocity of 200.0 m/s, what is the recoil velocity of the gun?

Example 4:

A 6.0 kg object, initially at rest, explodes into two parts. If a 2.0 kg part moves to the left at 10.0 m/s, at what velocity must the second part be moving after the explosion?

Example 5:

A neutron of mass 1.7×10^{-27} kg is moving at 2700 m/s and collides head on with a N atom at rest. If the mass of the N atom is 2.3×10^{-26} kg and the two particles stick together after the collision, what is their final velocity?

http://www.youtube.com/watch?v=rgLdIly2Xtw

http://video.google.ca/videoplay?docid=-2419281539546618318&ei=AztCS6fcFNSclAfNoonODw&q=hadron+particle+collider&hl=en#

Kinetic energy...

Elastic Collisions	Inelastic Collisions
No permanent damage to any object involved in the collision.	Some permanent damage to at least one of the objects involved in the collision.

HWK: p. 310 - 311
64,65,68,70,72

LAB...Airtrack Applet

http://www.nscl.msu.edu/~westfall/airtrack/airtrack.html