Momentum

gpb video: Physics 601

Phys Std:

- What is momentum?
- What is the equation for momentum?
- How is momentum changed?
- What is impulse?

Mass in motion

• $\vec{p} = \vec{v}m$ units: kg*m/s

(Direction comes from velocity --> direction of motion)

- An impulse is needed

 → an impulse changes momentum; likewise, a change in momentum causes an impulse
- Impulse is "force applied over a time interval"
 (i.e. hitting a golf ball exerts a force on the ball for a certain time. "Following through" increases the time interval and therefore increases the impulse. This increases the momentum of the ball by making it travel faster)

impulse = Force x time impulse = a change in momentum

$$\vec{F}t = \Delta \vec{v}m$$
 \leftarrow impulse eqn units: kg*m/s or N*s

ex #1: If the contact time doubles (force remaining constant), the impulse <u>doubles</u>, and the change in momentum doubles

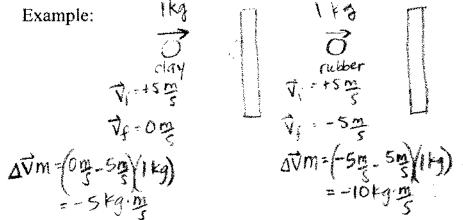
Padding increases the time interval during collisions, thereby decreasing the impact force.

ex #2: Quadrupling the time interval, <u>decreases</u> the impact force by <u>t</u>.

ex #3: A 20 kg object is moving at 5 m/s when a force brings it to a stop in 0.05 seconds. If brought to a stop in 0.1 seconds instead, the required force to stop it would be halved the resulting impulse would be same. & the resulting change in momentum would be same.

ex #4: A 2 kg object moving at 3 m/s encounters a

- 20 N force over a 0.1 second time interval.
- a) The impulse experienced by the object is $2 N \cdot \varsigma$
- b) The momentum change experienced by the object is 2 kg·m/s
- c) The final momentum is 4 kg. mg
- Why do bouncing objects experience a greater momentum change?
- · because of the direction change



**Since Δ vm is greater, impact force is greater

- Is momentum conserved during collisions?
- Yes, as long as the system is closed and isolated from external forces.
- Is energy conserved during collisions?
- Only in ELASTIC COLLISIONS, where objects bounce off of each other
- Energy is <u>not</u> conserved in INELASTIC COLLISIONS, where objects stick to each other