

- **Three Common Exams:** **45%**
(15% each)
- **Quizzes :** **7%**
- **Homework:** **8%**
- **Workshop:** **10%**
- **Final exam:** **30%**

A 80+
 B+ 75-79
 B 70-74
 C+ 65-69
 C 55-64
 D 50-54
 F < 50

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Evaluations for all courses will be conducted online for Spring 2009.

The course evaluation site will be active
from 9:00 am Monday, April 20
until midnight of Wednesday, May 6th.

The URL address to the evaluations will be provided through an email to the students.

Students will use their NJIT UCID and UCID password (same as "Highlander Pipeline") to login and go to a landing page which will have all their courses listed.

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Work and Energy for Exam 3

"Impulse" and "Momentum" till final exam.

Today...

Definition of impulse

Definition of momentum

Impulse-Momentum Theorem

3

Data : Fatality of a driver in head-on collision

(With a passenger) < (Without a passenger)



Definition of Impulse

Impulse: $\vec{I} \equiv \vec{F} \times \Delta t$ F : force, Δt : time

→ A vector quantity

→ SI Unit: N s

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Definition of (Linear) Momentum

(Linear) Momentum $\vec{p} = m\vec{v}$ (m: mass, v: velocity)

→ A vector quantity

→ SI Unit: kg m/s

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Impulse-Momentum Theorem

Let's rewrite Newton's Second Law

$$\vec{F}_{net} = m\vec{a} = m \frac{\vec{v}_f - \vec{v}_i}{\Delta t} = \frac{m\vec{v}_f - m\vec{v}_i}{\Delta t} = \frac{\Delta\vec{p}}{\Delta t}$$

$$\vec{F}_{net} \Delta t = \Delta\vec{p}$$

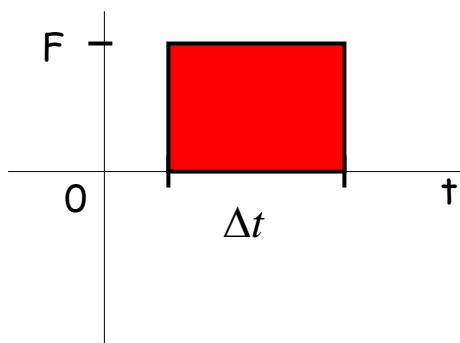
$$\vec{I}_{net} = \vec{p}_f - \vec{p}_i$$

Net impulse is equal to the change in momentum

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Impulse by a constant force

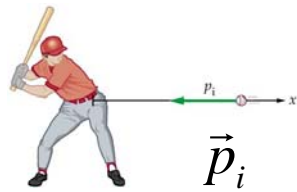
$$I = F \Delta t$$



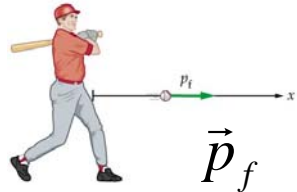
(Area in F vs. t graph)
= (Impulse by F)

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Impulse by a varying force

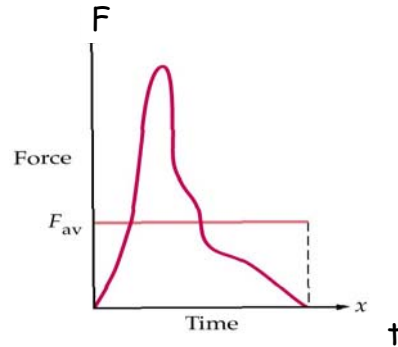


\vec{p}_i



\vec{p}_f

Impulse is an area under F(t) graph!



$$\vec{F}_{\text{net, average}} \times \Delta t = \vec{I}_{\text{net}} = \Delta \vec{p}$$

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iClicker Quiz

A paratrooper whose chute fails to open lands in snow; he is hurt slightly.

Had he landed on bare ground, the stopping time would have been 10 times shorter and the collision lethal.

Does the presence of the snow (a) increase, (b) decrease, or (c) leave unchanged the values of

- (1) the paratrooper's change in momentum,
- (2) the impulse stopping the paratrooper, and
- (3) the force stopping the paratrooper?

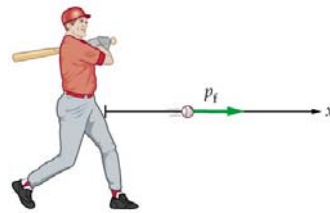
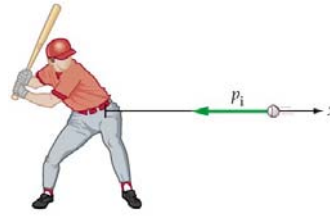


Example 2

A 0.150 kg baseball, thrown with a speed of 40 m/s, is hit straight back at the pitcher with a speed of 50 m/s.

(a) What is the impulse delivered by the bat to the baseball?

(b) Find the magnitude of the average force exerted by the bat on the ball if the two are in contact for 2.0×10^{-3} s.



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iClicker Quiz

A ball with original momentum $+4.0$ kg·m/s hits a wall and bounces straight back without losing any kinetic energy.

The change in momentum of the ball is :

- a. 0.
- b. -4.0 kg·m/s.
- c. 8.0 kg·m/s.
- d. -8.0 kg·m/s.

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