Read 7.6

H.w Due today

Next H.w available (long)
Don't wait until last minute!

Lots of clickers

Review

- $\vec{p} = m\vec{v}$ conserved in collisions
- change in momentum same for objects in collision
- $K = \frac{p^2}{2m}$

Interactive Question

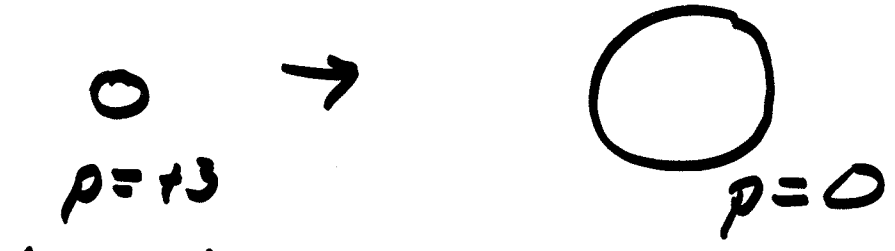
A bullet is fired from a rifle. Neglect any external forces on the rifle. In doing so the bullet gains a certain amount of momentum and the rifle gains

A) more momentum.
B) the same amount of momentum.
C) less momentum.
D) the answer depends on how we define the system.

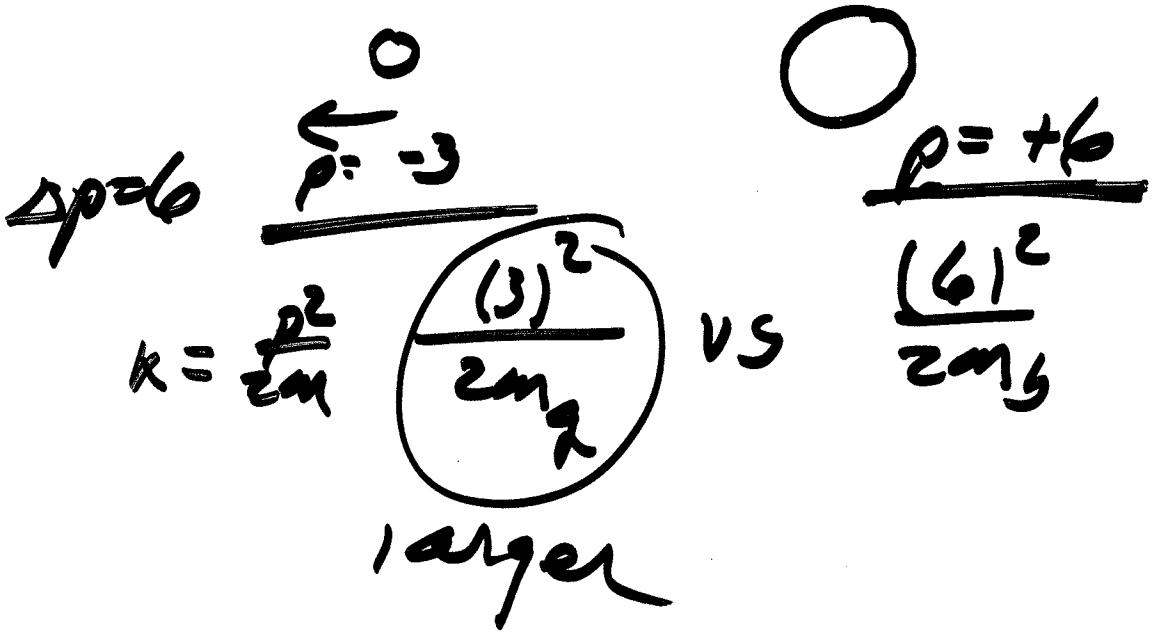
Interactive Question

A golf ball is fired at a bowling ball initially at rest and bounces back elastically. Compared to the bowling ball, the golf ball after the collision has

A) more momentum but less kinetic energy.
B) more momentum and more kinetic energy.
C) less momentum and less kinetic energy.
D) less momentum but more kinetic energy.
E) none of the above.


p = +3
(example)
p = 0

$\Delta p = 6$


$\Delta p = 6$
p = -3
p = +6
$k = \frac{p^2}{2m}$
$\frac{(3)^2}{2m_2}$
vs
$\frac{(6)^2}{2m_3}$
larger

Interactive Question

Consider two objects with different masses. Is it possible for the two objects to simultaneously have the same momentum and kinetic energy?

A) No, this is never possible.
B) Yes, this is possible for a certain non-zero velocity.
C) Yes, this is possible for many velocities.
D) Yes, but only if their velocities are both zero.

Look at momentum and kinetic energy changes

$W_{net} = \Sigma F d = \Delta K$ (F and d same direction $\cos\theta = 1$)

$Impulse = \Sigma \vec{F}_{ext} \Delta t = \Delta \vec{p}$

- Work is a scalar, Impulse a vector
- change in Kinetic Energy has to do with force acting over a distance
- change in momentum has to do with force acting over time

Interactive Question

Consider two carts, of masses m and $2m$, at rest on an air track. If you push first one cart for 3 s and then the other for the same length of time, exerting equal force on each, the momentum of the light cart is

A) four times
B) twice
C) equal to
D) one-half
E) one-quarter

the momentum of the heavy cart.

Interactive Question

Consider two carts, of masses m and $2m$, at rest on an air track. If you push first one cart for 3 s and then the other for the same length of time, exerting equal force on each, the kinetic energy of the light cart is

A) larger than

B) equal to

C) smaller than

the kinetic energy of the heavy cart.

Interactive Question

Two objects are sitting on a "frictionless" air hockey table. Object *A* has twice the mass of object *B*. Both objects are pushed with the same force for the same distance. Which statement is true?

A) The objects have the same momentum but different kinetic energies.

B) The objects have the same momentum and the same kinetic energies.

C) The objects have different momentum and different kinetic energies.

D) The objects have different momentum but the same kinetic energies.

Interactive Question

A small car meshes with a large truck in a head-on collision. Which of the following statements concerning the magnitude of the collision force is correct?

A) The truck experiences the greater average force.
B) The small car experiences the greater average force.
C) The small car and the truck experience the same average force.
D) It is impossible to tell since the masses and velocities are not given.

Interactive Question

A compact car and a large truck collide head on and stick together. Which undergoes the larger momentum change?

A) car

B) truck

C) the momentum change is the same for both

D) you can't tell without knowing the final velocity and combined mass.

Interactive Question

A compact car and a large truck collide head on and stick together. Which undergoes the larger acceleration during the collision?

A) car

B) truck

C) both experience the same acceleration

D) you can't tell without knowing the final velocity and combined mass.

Elastic Collisions

In certain collisions both momentum and kinetic energy are conserved.

These are called elastic collisions

All collisions (that are isolated) conserve momentum
(isolated: no external forces)

when working problems
if key words elastic collision
→ momentum + Kinetic Energy conserved

if inelastic
only momentum conserved
→ objects hit + stick together