WebAssign
CH10-HW01-SP12 (Homework)

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PHYS 172-SPRING 2012, Spring 2012
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Current Score : 22 / 22 **Due :** Tuesday, March 27 2012 11:59 PM EDT

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1. 4/4 points | Previous Answers MI3 10.1.X.009

A ball whose mass is 0.4 kg hits the floor with a speed of 7 m/s and rebounds upward with a speed of 6 m/s. If the ball was in contact with the floor for 2 ms (2×10^{-3} s), what was the average magnitude of the force exerted on the ball by the floor?

F_{avg} = 2600 N.

Calculate the magnitude of the gravitational force that the Earth exerts on the ball:

mg = 3.92 N

In a collision, for a brief time there are forces between the colliding objects that are much greater than external forces. Which of the following is true during the collision between the bouncing ball and the floor?

- (•) The magnitude of the force exerted by the floor is much greater than the magnitude of the gravitational force exerted by the Earth.
- ( ) The force exerted by the floor and the gravitational force exerted by the Earth are approximately equal in magnitude.
- ( ) The magnitude of the gravitational force exerted by the Earth is much greater than the magnitude of the force exerted by the floor.

- *Read the eBook*
- Section 10.1

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2. 1/1 points | Previous Answers MI3 10.2.X.011

Two asteroids in outer space collide, and stick together. The mass of each asteroid, and the velocity of each asteroid before the impact, are known. To find the momentum of the stuck-together asteroids after the impact, what approach would be useful?

- ( ) Use the energy principle.
- ( ) Use the relationship between velocity, displacement, and time.
- ( ) It depends on whether the collision was elastic or inelastic.
- ( ) It depends on whether or not the speed of the asteroids was near the speed of light.
- (•) Use the momentum principle.

- *Read the eBook*
- Section 10.2

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3. 17/17 points | Previous Answers MI3 10.5.X.015

Object A has mass m_A = 7 kg and initial momentum $\vec{p}_{A,i}$ = < 18, -7, 0 > kg · m/s, just before it strikes object B, which has mass m_B = 9 kg. Just before the collision object B has initial momentum $\vec{p}_{B,i}$ = < 4, 6, 0 > kg · m/s.

Consider a system consisting of both objects A and B. What is the total initial momentum of this system, just before the collision?

$\vec{p}_{sys,i}$ = kg · m/s

The forces that A and B exert on each other are very large but last for a very short time. If we choose a time interval from just before to just after the collision, what is the approximate value of the impulse applied to the two-object system due to forces exerted on the system by objects outside the system?

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

Therefore, what does the momentum principle predict that the total final momentum of the system will be, just after the collision?

$\vec{p}_{sys,f}$ = kg · m/s

Just after the collision, object A is observed to have momentum $\vec{p}_{A,f}$ = < 15, 3, 0 > kg · m/s. What is the momentum of object B just after the collision?

$\vec{p}_{B,f}$ = kg · m/s

At this point we've learned all that we can from applying the momentum principle. Next we'll see what additional information we can obtain by using the energy principle.

Before the collision, what was the magnitude of the momentum of object A?

$|\vec{p}_{A,i}|$ = 19.313 kg · m/s

Before the collision, what was the kinetic energy of object A? Remember that you can calculate kinetic energy not only from $K = (1/2)m|\vec{v}|^2$ but more directly from $K = (1/2)|\vec{p}|^2/m$.

$K_{A,i}$ = 26.643 J

Before the collision, what was the magnitude of the momentum of object B?

$|\vec{p}_{B,i}|$ = 7.211 kg · m/s

Before the collision, what was the kinetic energy of object B?

$K_{B,i}$ = 2.889 J

After the collision, what was the magnitude of the momentum of object A?

$|\vec{p}_{A,f}|$ = 15.297 kg · m/s

After the collision, what was the kinetic energy of object A?

$K_{A,f}$ = 16.714 J

After the collision, what was the magnitude of the momentum of object B?

$|\vec{p}_{B,f}|$ = 8.062 kg · m/s

After the collision, what was the kinetic energy of object B?

$K_{B,f}$ = 3.611 J

Before the collision, what was the total kinetic energy of the system?

$K_{sys,i} = K_{A,i} + K_{B,i}$ = 29.532 J

After the collision, what was the total kinetic energy of the system?

$K_{sys,f} = K_{A,f} + K_{B,f}$ = 20.325 J What kind of collision was this? (Remember that an "elastic" collision is one where the final value of the total kinetic energy is equal to the initial value of the total kinetic energy.)

- not enough information to decide
- elastic
- inelastic (selected)

Assume that all of the energy is either kinetic energy or thermal energy. Calculate the increase of thermal energy of the two objects.

$\Delta E_{A,\text{thermal}} + \Delta E_{B,\text{thermal}}$ = 9.207 J

In the preceding analysis, what assumption did you make about Q (energy flow from surroundings into the system due to a temperature difference)?

- Q can be ignored because colliding objects never get hot.
- Q was negligible because the process lasted only a short time. (selected)
- $Q = \Delta E_{\text{thermal}}$

- *Read the eBook*
- Section 10.5