Ch3 HW4 (1436690)

Current Score: 0/25.5 **Due:** Fri Sep 24 2010 09:00 AM EDT

Question	1	2	3	4	5	6	Total
Points	0/1.5	0/6	0/4	0/3	0/5	0/6	**0/25.5**

Description

Conservation of Momentum; Multiparticle momentum principle; Collisions

Instructions

Reading: Sec. 3.11-3.13

1. 0/1.5 points MI3 3.13.X.055. [1250503]

The windshield of a speeding car hits a hovering insect. Consider the time interval from just before the car hits the insect to just after the impact. For which choice of system is the change of momentum zero?

- The system consisting of the bug plus the car.
- The system consisting of the car alone.
- The system consisting of the bug alone.

Compare the magnitude of the change of momentum of the bug to that of the car:

- The magnitude of change of momentum of the car is bigger.
- The magnitudes of the change of momentum are equal.
- The magnitude of change of momentum of the bug is bigger.

Compare the magnitude of the change of velocity of the bug to that of the car:

- The magnitudes of the change of velocity are equal.
- The magnitude of change of velocity of the bug is bigger.
- The magnitude of change of velocity of the car is bigger.

2. 0/6 points mi3 3.13.x.024.nva [1544797]

You and a friend each hold a lump of wet clay. Each lump has a mass of 15 grams. You each toss your lump of clay into the air, where the lumps collide and stick together. Just before the impact, the velocity of one lump was < 3, 4, -3 > m/s, and the velocity of the other lump was < -4, 0, -7 > m/s.

What was the the total momentum of the lumps just before the impact?

$\vec{p}_{total}$ = [ ] $< -0.0150, 0.0600, -0.150 >$ kg·m/s.

What is the momentum of the stuck-together lump just after the collision?

$\vec{p}$ = [ ] $< -0.0150, 0.0600, -0.150 >$ kg·m/s.

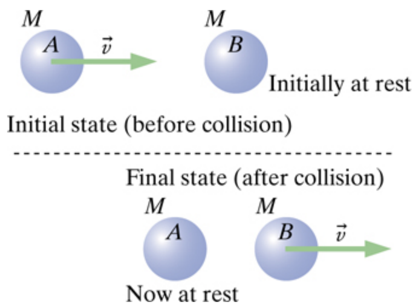
What is the velocity of the stuck-together lump just after the collision?

$\vec{v}_f$ = [ ] $< -0.500, 2.00, -5.00 >$ m/s.

---

3. 0/4 points MI3 3.11.X.020. [1259418]

Consider the head-on collision of two identical bowling balls, each with mass 6 kg (see figure). Ball *A* with velocity $\vec{v}$ = ‹ 5, 0, 0 › m/s strikes ball *B*, which was at rest. Then ball *A* stops and ball *B* moves with the same velocity $\vec{v}$ that ball *A* had initially.



(a) Choose a system consisting only of ball *A*.
What is the momentum change of the system during the collision?

$\Delta\vec{p}_{system} = \langle$ [ ] -30 , 0, 0 $\rangle$ kg · m/s

What is the momentum change of the surroundings?

$\Delta\vec{p}_{surroundings} = \langle$ [ ] 30 , 0, 0 $\rangle$ kg · m/s

(b) Choose a system consisting only of ball *B*.
What is the momentum change of the system during the collision?

$\Delta\vec{p}_{system} = \langle$ [ ] 30 , 0, 0 $\rangle$ kg · m/s

What is the momentum change of the surroundings?

$\Delta\vec{p}_{surroundings} = \langle$ [ ] -30 , 0, 0 $\rangle$ kg · m/s

(c) Choose a system consisting of both balls.
What is the momentum change of the system during the collision?

$\Delta\vec{p}_{system} = \langle$ [ ] 0 , 0, 0 $\rangle$ kg · m/s

What is the momentum change of the surroundings?

$\Delta\vec{p}_{surroundings} = \langle$ [ ] 0 , 0, 0 $\rangle$ kg · m/s

4. 0/3 points mi3 3.13.p.069.nva [1250539]

A bullet of mass 0.131 kg traveling horizontally at a speed of 300 m/s embeds itself in a block of mass 2.5 kg that is sitting at rest on a nearly frictionless surface.

What is the speed of the block after the bullet embeds itself in the block?

v = [ ] 14.9 m/s

---

5. 0/5 points MI3 3.13.P.058. [1544853]

A car of mass 2300 kg collides with a truck of mass 4100 kg, and just after the collision the car and truck slide along, stuck together. The car's velocity just before the collision was < 37, 0, 0 > m/s, and the truck's velocity just before the collision was < -19, 0, 25 > m/s.

(a) What is the velocity of the stuck-together car and truck just after the collision?

[ ] $< 1.13, 0, 16.0 >$ m/s

(b) In your analysis in part (a), why can you neglect the effect of the force of the road on the car and truck?

- Short collision time, negligible impulse compared to large impulse acting between car and truck.
- The road doesn't exert forces on the car or truck and doesn't affect the vehicles.

---

6. 0/6 points MI3 3.13.P.063. [1250511]

Object A has mass m_A = 7 kg and initial *momentum* $\vec{p}_{A,i}$ = < 20, -6, 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?

$\vec{p}_{\text{sys},i}$ = < [ ] 24 , [ ] 0 , 0 > 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?

$\vec{F}_{\text{net}}\Delta t$ = < [ ] 0 , [ ] 0 , 0 > N · s

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

$\vec{p}_{\text{sys},f}$ = < [ ] 24 , [ ] 0 , 0 > kg · m/s

Just after the collision, object A is observed to have momentum $\vec{p}_{A,f}$ = < 17, 3, 0 > kg · m/s. What is the momentum of object B just after the collision?

$\vec{p}_{B,f}$ = < [ ] 7 , [ ] -3 , 0 > kg · m/s

Assignment Details