WebAssign
CH02-HW04-SP12 (Homework)

Yinglai Wang
PHYS 172-SPRING 2012, Spring 2012
Instructor: Virendra Saxena

Current Score : 14.5 / 15 **Due :** Tuesday, January 24 2012 11:59 PM EST

---

1. 2.5/3 points | Previous Answers MI3 2.7.X.025

Study the example in the textbook entitled "Colliding Students." The following questions refer to this example.

What was chosen as the system to be analyzed?

- (•) The student on the left.
- ( ) The student on the right.
- ( ) Both students.
- ( ) Both students plus the Earth.

✓

Which components of the net force on the system were zero during the collision? (Check all that apply.)

- [ ] $F_{\text{net},x} = 0$
- [x] $F_{\text{net},z} = 0$
- [x] $F_{\text{net},y} = 0$

✓

What is the correct form of the x-component of the Momentum Principle for this situation?

- ( ) $mv_x = 0 + F_{\text{net},x}\Delta t$
- ( ) $0 = 0 + F_{\text{net},x}\Delta t$
- (•) $0 = mv_x + F_{\text{net},x}\Delta t$

✓

Which of these quantities were used in estimating the duration of the collision, Δt ? (Check all that apply.)

- [ ] An estimate of the student's average speed during the collision.
- [x] An estimate of how much the student's body was compressed.
- [ ] An estimate of the student's mass.
- [ ] The gravitational force on the student.

✗

How was the force exerted by one student on the other calculated?

- (•) The change in the student's momentum and the duration of the collision were known, so the Momentum Principle was applied to find the force.
- ( ) The force was estimated by assuming that it was four times as large as the student's weight.
- ( ) The magnitude of the force needed to break a bone was found, and the collision force was estimated to be 80% of this.

✓

About how large was the estimated force exerted by one student on the other, compared to the weight of the student?

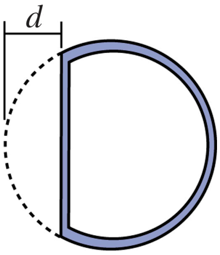
$\frac{F_{\text{by student}}}{F_{\text{by Earth}}}$ = 35.71 ✓

- *Read the eBook*
- Section 2.7

---

2. 4/4 points | Previous Answers MI3 2.7.P.069

A tennis ball has a mass of 0.057 kg. A professional tennis player hits the ball hard enough to give it a speed of 46 m/s (about 103 miles per hour.) The ball moves toward the left, hits a wall and bounces straight back to the right with almost the same speed (46 m/s). As indicated in the diagram below, high-speed photography shows that the ball is crushed about d = 2.2 cm at the instant when its speed is momentarily zero, before rebounding.



Making the very rough approximation that the large force that the wall exerts on the ball is approximately constant during contact, determine the approximate magnitude of this force.

What is the average speed of the ball during the period from first contact with the wall to the moment the ball's speed is momentarily zero?

$|\vec{v}_{avg}|$ = 23 m/s

How much time elapses between first contact with the wall, and coming to a stop?

Δt = 9.57e-4 seconds

What is the magnitude of the average force exerted by the wall on the ball during contact?

$|\vec{F}_{avg}|$ = 2739.81 N

In contrast, what is the magnitude of the gravitational force of the Earth on the ball?

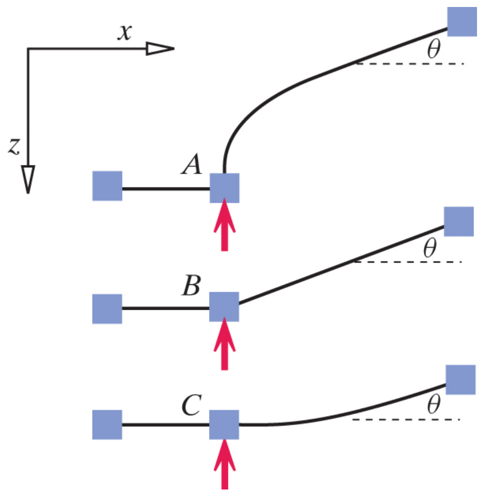
mg = 0.5586 N

- *Read the eBook*
- Section 2.7

---

3. 8/8 points | Previous Answers MI3 2.7.P.068

A 0.7 kg block of ice is sliding by you on a very slippery floor at 2.5 m/s. As it goes by, you give it a kick perpendicular to its path. Your foot is in contact with the ice block for 0.0035 seconds. The block eventually slides at an angle of 27 degrees from its original direction (labeled θ in the diagram). The overhead view shown in the diagram is approximately to scale. The arrow represents the average force your toe applies briefly to the block of ice.



Which of the possible paths shown in the diagram corresponds to the correct overhead view of the block's path?

B

Which components of the block's momentum are changed by the impulse applied by your foot? (Check all that apply. The diagram shows a top view, looking down on the xz plane.)

- [x] *z* component
- [ ] *x* component
- [ ] *y* component

What is the unit vector in the direction of the block's momentum after the kick?

$\hat{p}$ =

What is the *x*-component of the block's momentum after the kick?

p_{fx} = 1.75 kg · m/s

Remember that $\vec{p} = |\vec{p}|\hat{p}$. What is the magnitude of the block's momentum after the kick?

$|\vec{p}|$ = 1.97 kg · m/s

Use your answers to the preceding questions to find the *z*-component of the block's momentum after the kick (drawing a diagram is helpful):

p_{fz} = -0.889 kg · m/s

What was the magnitude of the average force you applied to the block?

$|\vec{F}_{avg}|$ = 254 N

- *Read the eBook*
- Section 2.7