Physics A - PHY 2048C

Semester Review

12/06/2017

My Office Hours:
Thursday 2:00 - 3:00 PM

212 Keen Building

Review Question 1

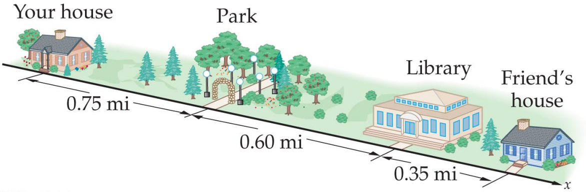
In one-dimensional motion, the average speed of an object that moves from one place to another and then back to its original place has which of the following properties?

A It is positive.

B It is negative.

C It is zero.

D It can be positive, negative, or zero.



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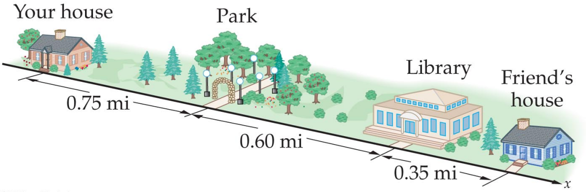

Review Question 2

In one-dimensional motion where the direction is indicated by a plus or minus sign, the average velocity of an object has which of the following properties?

A It is positive.

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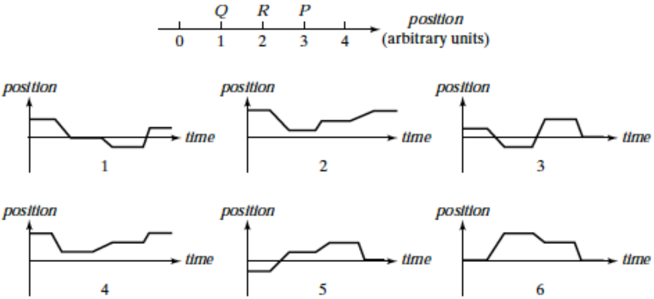
The magnitude of the velocity is called the speed and is a scalar quantity. The speed cannot be negative.

Remember that speed and velocity are not the same!

Review Question 3

A person initially at point P in the illustration stays there a moment and then moves along the axis to Q and stays there a moment. She then runs quickly to R, stays there a moment, and then strolls slowly back to P. Which of the position vs. time graphs below correctly represents this motion?



Review Question 4

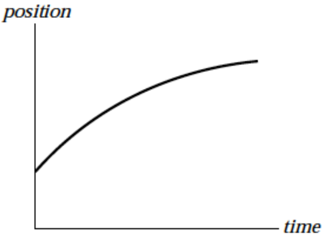
A train car moves along a long straight track. The graph shows the position as a function of time for this train. The graph shows that the train:

A speeds up all the time.

B slows down all the time.

C speeds up part of the time and slows down part of the time.

D moves at a constant velocity.



Review Question 5

A cart on a roller-coaster rolls down the track shown below. As the cart rolls beyond the point shown, what happens to its speed and acceleration in the direction of motion?

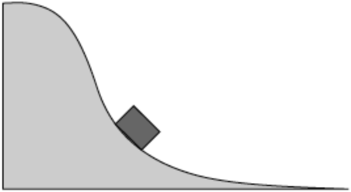
A Both decrease.

B The speed decreases, but the acceleration increases.

C Both remain constant.

D The speed increases, but the acceleration decreases.

E Both increase.



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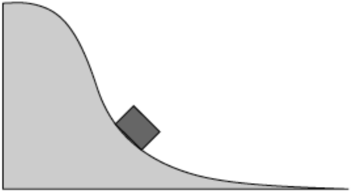


Review Question 6

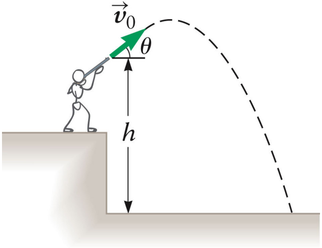
A bullet is fired from a rifle. For which situation is the “vertical” velocity zero?

A On the way up.

B At the top.

C On the way back down.

D None of the above.



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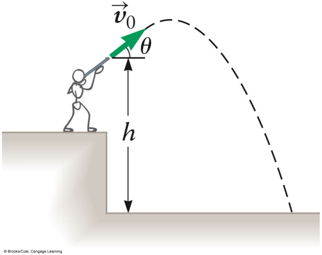

Review Question 7

A bullet is fired from a rifle. For which of the following situations is the "horizontal" velocity zero?

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B At the top.

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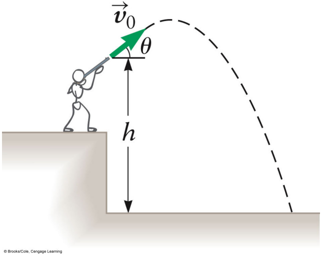

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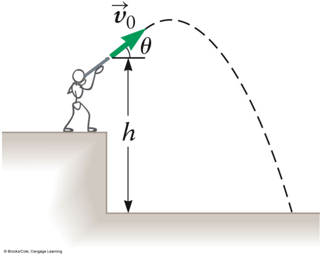

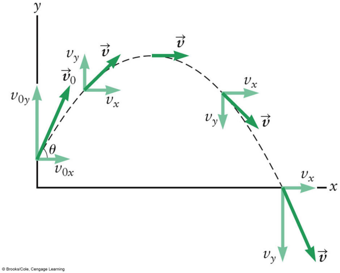

Review Question 8

If we know that a nonzero net force is acting on an object, which of the following must we assume regarding the object's condition? The object is:

A at rest.

B moving with a constant velocity.

C being accelerated.

D losing mass.

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Review Question 9

A thrown stone hits a window but does not break it. Instead, it reverses direction and ends up on the ground below the window. In this case, we know:

A The force of the stone on the glass
$>$ the force of the glass on the stone.

B The force of the stone on the glass
$=$ the force of the glass on the stone.

C The force of the stone on the glass
$<$ the force of the glass on the stone.

D The stone didn't slow down as it hit the glass.

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Review Question 10

Two projectiles are launched at 100 m/s, the angle of elevation for the first being 30° and for the second 60°. Which of the following statements is false?

A Both projectiles have the same acceleration while in flight.

B The second projectile has the lower speed at maximum altitude.

C Both projectiles have the same range.

D All of the above statements are false.

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`http://phet.colorado.edu/sims/`

➜ Projectile Motion

Review Question 11

In the absence of an external force, a moving object will

A stop immediately.

B slow down and eventually come to a stop.

C move faster and faster.

D move with constant velocity for a while and then slow to a stop.

E move with constant velocity.

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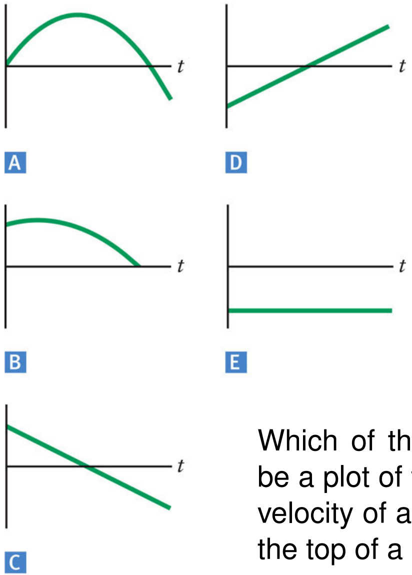


Which of the graphs in the figure might be a plot of the vertical component of the velocity of a projectile that is thrown from the top of a building?

Review Question 13

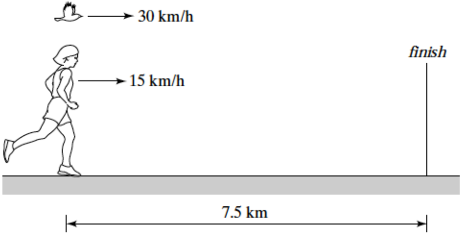
A marathon runner runs at a steady 15 km/hr. When the runner is 7.5 km from the finish, a bird begins flying from the runner to the finish at 30 km/hr. When the bird reaches the finish line, it turns around and flies back to the runner, and then turns around again, repeating the back-and-forth trips until the runner reaches the finish line. How many kilometers does the bird travel?

A 10 km

B 15 km

C 20 km

D 30 km



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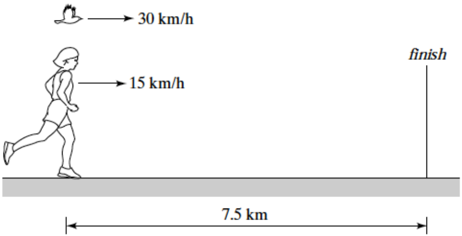

Review Question 14

As a basketball player starts to jump for a rebound, he begins to move upward faster and faster until he leaves the floor. During this time that he is in contact with the floor, the force of the floor on his shoes is:

A bigger than his weight.

B equal in magnitude and opposite in direction to his weight.

C less than his weight.

D zero.

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- C less than his weight.
- D zero.

Review Question 15

When objects are touching one another, the action-reaction forces are often referred to as contact forces.

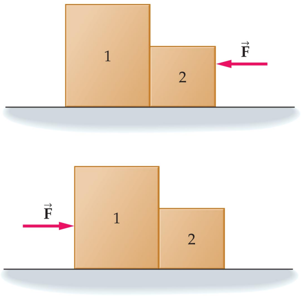
In the figure, masses m_1 and m_2 are such that $m_1 > m_2$ and they lay on a level, frictionless surface. We can apply a horizontal force either from the left or from the right. The contact force between masses m_1 and m_2 is

A zero newtons.

B larger when $\vec{F}$ is applied from the left.

C larger when $\vec{F}$ is applied from the right.

D the same in either case.



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In the figure, masses m_1 and m_2 are such that $m_1 > m_2$ and they lay on a level, frictionless surface. We can apply a horizontal force either from the left or from the right.

1. Find the net force, F:

   $\sum F_x = F = 20.0 \text{ N}$

2. Acceleration:

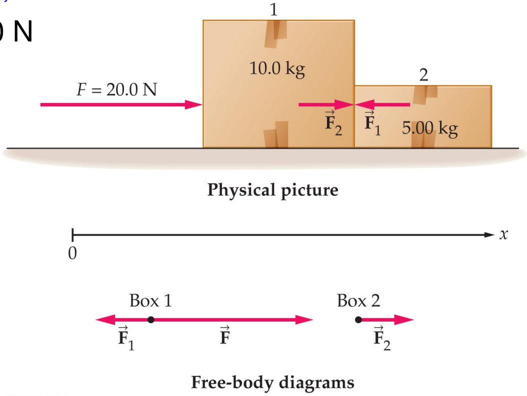
   $a_x = \frac{20.0 \text{ N}}{15.0 \text{ kg}}$

3. Contact force, f:

   $F_2 = f = m_2\, a_x$

   $F - f = m_1\, a_x$

   ➜ $f = 6.67 \text{ N}$



Review Question 16

It is late and Carlos is sliding down a rope from his third floor window to meet his friend Juan. As he slides down the rope faster and faster, he becomes frightened and grabs harder on the rope, increasing the tension in the rope. As soon as the upward tension in the rope becomes equal to his weight:

A Carlos will stop.

B Carlos will slow down.

C Carlos will continue down at a constant velocity.

D the rope must break.

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Review Question 17

A baseball is thrown by the center fielder (from shoulder level) to home plate where it is caught (on the fly at shoulder level) by the catcher. At what point is the magnitude of the acceleration at a minimum? Note: Air resistance is negligible.

A Just after leaving the center fielder's hand.

B Just before arriving at the catcher's mitt.

C At the top of the trajectory.

D Acceleration is constant during the entire trajectory.

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Review Question 18

Suppose you have been asked to remove a few lead bricks. In terms of minimizing the effort, would it be better to

A push the bricks?

B pull the bricks?

C It does not matter, the mass of the bricks remains the same.

Review Question 18

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A push the bricks?

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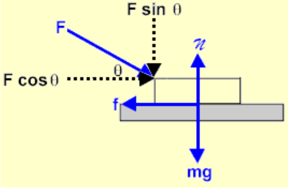
In case of pushing, a component of the pushing force adds to the normal force and increases the friction force.



Review Question 19

An object is held in place by friction on an inclined surface. The angle of inclination is increased until the object starts moving. If the surface is kept at this angle, the object

A slows down.

B moves at uniform speed.

C speeds up.

D None of the above.

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Review Question 20

You are pushing horizontally on a wooden crate across the floor at constant speed. You decide to turn the crate on end, reducing by half the surface area in contact with the floor. In the new orientation, to push the same crate across the same floor with the same speed, the force that you apply must be about

A four times as great.

B twice as great.

C equally great.

D half as great.

E one-fourth as great.

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The force of friction is independent of contact area.

Review Question 21

You are pushing a wooden crate across the floor at constant speed. You decide to double your speed. To maintain the new speed, the force that you apply must be about

A twice as large as before.

B the same as before.

C half as large as before.

D something else.

Review Question 21

You are pushing a wooden crate across the floor at constant speed. You decide to double your speed. To maintain the new speed, the force that you apply must be about

A twice as large as before.

B the same as before.

C half as large as before.

D something else.

To maintain constant speed, the sum of the forces must be zero. The kinetic force of friction is independent of speed, so the external force required to oppose it will be independent of speed.

Review Question 22

For the bug on the spinning CD (at constant rate) in uniform circular motion, which of the following is constant?

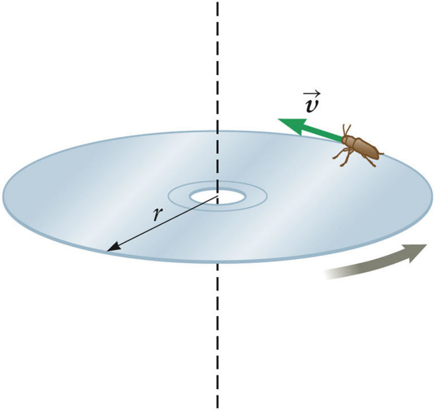
A Its speed.

B Its velocity.

C Its acceleration.

D Its position.

E None of the above.



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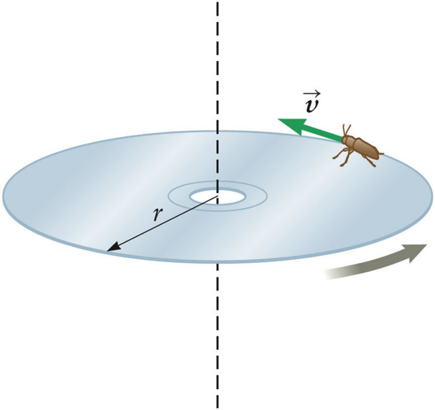

Review Question 23

A car is going around a racetrack at constant speed. The curves around the track have different radii. In which turn is the magnitude of the car's acceleration the greatest?

A It is greatest in the turn with the greater radius.

B It is greatest in the turn with the smaller radius.

C The acceleration is zero everywhere because of the constant speed.

D More information is needed to determine the answer.

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Remember the centripetal acceleration:

$$a_c = \frac{v^2}{r}$$

Review Question 24

Consider a point on a bicycle tire that is momentarily in contact with the ground as the bicycle rolls across the ground with a constant speed. The direction for the acceleration for this point at that moment is:

A down toward the ground.

B upward.

C forward

D at that moment the acceleration is zero.

Review Question 24

Consider a point on a bicycle tire that is momentarily in contact with the ground as the bicycle rolls across the ground with a constant speed. The direction for the acceleration for this point at that moment is:

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D at that moment the acceleration is zero.

Review Question 25

Consider a child who is swinging. As she reaches the lowest point in her swing:

A the tension in the rope is equal to her weight.

B the tension in the rope is equal to her mass times her acceleration.

C her acceleration is downward at 9.81 m/s^2.

D None of the above.

Review Question 25

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Review Question 26

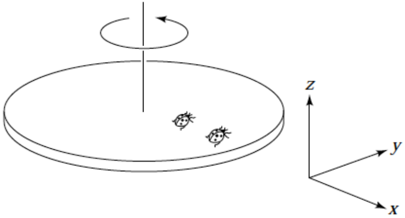
A ladybug sits at the outer edge of a merry-go-round, and a gentleman bug sits halfway between her and the axis of rotation. The merry-go-round makes a complete revolution once each second. The gentleman bug's angular speed is

A half the ladybug's.

B the same as the ladybug's.

C twice the ladybug's.

D impossible to determine.



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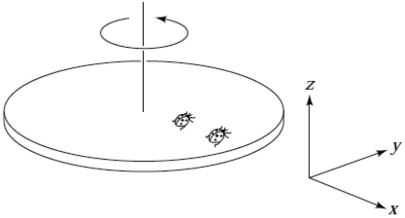

Review Question 27

A ladybug sits at the outer edge of a merry-go-round, and a gentleman bug sits halfway between her and the axis of rotation. The merry-go-round makes a complete revolution once each second. The gentleman bug's linear speed is

A half the ladybug's.

B the same as the ladybug's.

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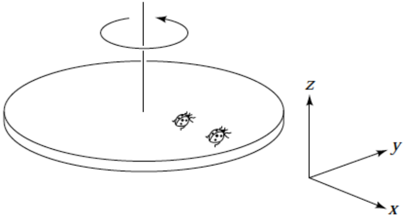

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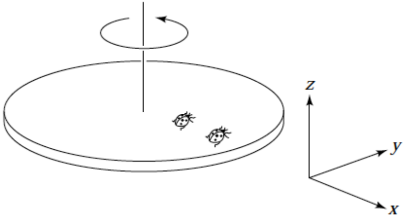
$$v = \text{circumference} / T$$

$$= 2\pi \cdot \text{radius} / T$$



Review Question 28

You are a passenger in a car, not wearing a seat belt. The car makes a sharp left turn. From your perspective in the car, what do you feel is happening to you?

A You are thrown to the right.

B You feel no particular change.

C You are thrown to the left.

D You are thrown to the ceiling.

E You are thrown to the floor.

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- D You are thrown to the ceiling.
- E You are thrown to the floor.

The passenger has the tendency to continue moving in a straight line. From your perspective in the car, it feels like you are being thrown to the right, hitting the passenger door.

Review Question 29

During that sharp left turn, you found yourself hitting the passenger door. What is the correct description of what is actually happening?

A The centrifugal force is pushing you into the door.

B The door is exerting a leftward force on you.

C Both of the above.

D Neither of the above.

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During that sharp left turn, you found yourself hitting the passenger door. What is the correct description of what is actually happening?

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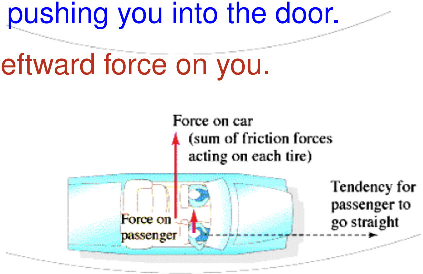
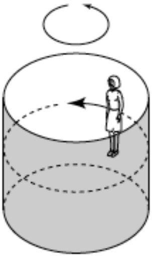


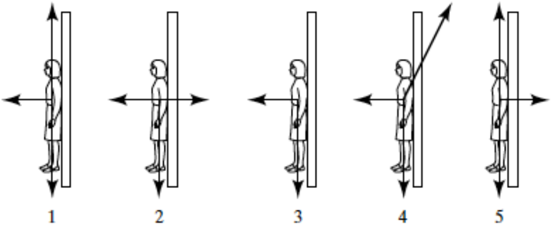
The passenger has the tendency to continue moving in a straight line. There is a centripetal force, provided by the door, that forces the passenger into a circular path.

Review Question 30

A rider in a “barrel of fun” finds herself stuck with her back to the wall.

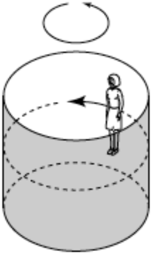
Which diagram correctly shows the forces acting on her?

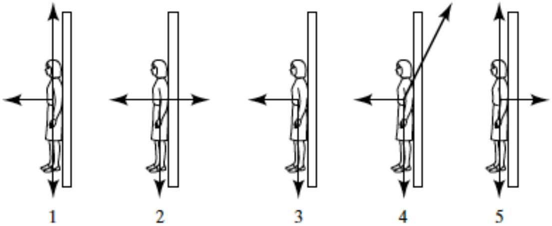




Review Question 30

The normal force of the wall on the rider provides the centripetal force needed to keep her going around in a circle. The downward force of gravity is balanced by the upward frictional force on her, so she does not slip vertically.





Review Question 31

An astronaut is in a capsule in a stable orbit, about two Earth radii from the center of Earth. Her weight is:

1. 0 N.
2. the same as on the surface of Earth.
3. about one-half of her weight on the surface of Earth.
4. about one-third of her weight on the surface of Earth.
5. about one-quarter of her weight on the surface of Earth.

Review Question 31

An astronaut is in a capsule in a stable orbit, about two Earth radii from the center of Earth. Her weight is:

1. 0 N.
2. the same as on the surface of Earth.
3. about one-half of her weight on the surface of Earth.
4. about one-third of her weight on the surface of Earth.
5. about one-quarter of her weight on the surface of Earth.

$$m_{\mathrm{person}}\, g = \frac{G\, m_{\mathrm{person}}\, m_{\mathrm{Earth}}}{r_{\mathrm{Earth}}^2}$$

Review Question 32

If our Earth were twice as massive but it revolved at the same distance from the Sun, its orbital period would be:

1. 4 years.
2. 3 years.
3. 2 years.
4. 1 year.
5. 6 months.

Review Question 32

If our Earth were twice as massive but it revolved at the same distance from the Sun, its orbital period would be:

1. 4 years.
2. 3 years.
3. 2 years.
4. 1 year.

$$m_{\mathrm{Earth}} \frac{v^2_{\mathrm{Earth}}}{r_{\mathrm{Earth}}} = \frac{G\, m_{\mathrm{Sun}}\, m_{\mathrm{Earth}}}{r^2_{\mathrm{Earth}}}$$

5. 6 months.

Review Question 33

Assuming Earth orbits the Sun on a perfectly circular track. Does the Sun do work on Earth?

1. Yes
2. No
3. Only in the Spring and in the Fall.
4. Only in the Summer and in the Winter.

Review Question 33

Assuming Earth orbits the Sun on a perfectly circular track. Does the Sun do work on Earth?

1. Yes
2. No
3. Only in the Spring and in the Fall.
4. Only in the Summer and in the Winter.

Question 34

In the reference frame of the interface between two surfaces, the work done by static friction is:

A positive.

B negative.

C zero.

Review Question 34

In the reference frame of the interface between two surfaces, the work done by static friction is:

A positive.

B negative.

C zero.

There is never displacement between the surfaces.

Review Question 35

Consider a tug-of-war as in the figure below, in which two teams pulling on a rope are evenly matched so that no motion takes place. Is work done on the rope?

A Yes

B No

Arthur Tilley/FPG/Getty Images

Review Question 35

Consider a tug-of-war as in the figure below, in which two teams pulling on a rope are evenly matched so that no motion takes place. Is work done on the rope?

A Yes

B No


Arthur Tilley/FPG/Getty Images

Review Question 36

Consider a tug-of-war as in the figure below, in which two teams pulling on a rope are evenly matched so that no motion takes place. Is work done on the pullers?

A Yes

B No

Arthur Tilley/FPG/Getty Images

Review Question 36

Consider a tug-of-war as in the figure below, in which two teams pulling on a rope are evenly matched so that no motion takes place. Is work done on the pullers?

A Yes

B No

Arthur Tilley/FPG/Getty Images

Review Question 37

As an object is lowered into a deep hole in the surface of the Earth, which of the following must be assumed in regard to its potential energy?

A It increases.

B It decreases.

C It remains constant.

D One cannot tell from the information given.

Review Question 37

As an object is lowered into a deep hole in the surface of the Earth, which of the following must be assumed in regard to its potential energy?

A It increases.

B It decreases.

C It remains constant.

D One cannot tell from the information given.

Review Question 38

Two blocks with the same mass are released from the top of a building. One falls straight down while the other slides down a smooth ramp. If all friction is ignored, which one is moving faster when it reaches the bottom?

A The block that went straight down.

B The block that went down the ramp.

C They both will have the same speed.

D Insufficient information to work the problem.

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Two blocks with the same mass are released from the top of a building. One falls straight down while the other slides down a smooth ramp. If all friction is ignored, which one is moving faster when it reaches the bottom?

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B The block that went down the ramp.

C They both will have the same speed.

D Insufficient information to work the problem.

Energy Skate Park: Basics

phet.colorado.edu/en/simulation/energy-skate-park-basics

Review Question 39

Four expert skiers travel down the ski trails shown in the figures. All have the same initial height (at the start of the trail) and the same final height (at the bottom on the far right), and there is no friction on any of the trails. Which skier will be faster at the bottom on the far right?

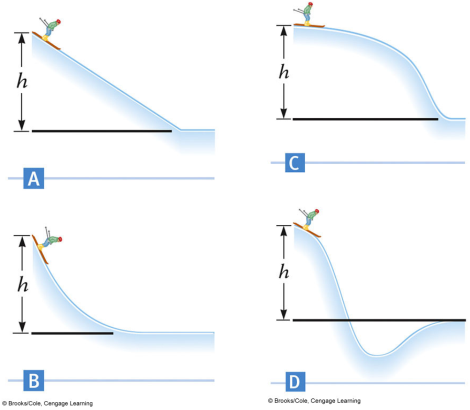
A A

B B

C C

D D

E All arrive with the same speed.



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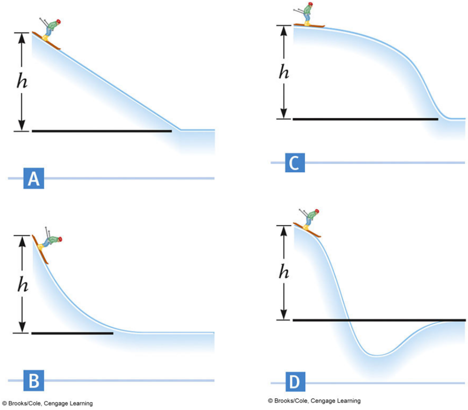
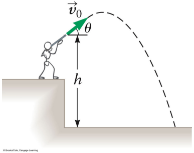


Review Question 40

Three different mass projectiles are launched at different angles of elevation from the top of a building. Each particle has the same initial kinetic energy. Which particle has the greatest kinetic energy just as it impacts with the ground?

- A The one launched at the highest angle of elevation.
- B The one with the highest mass.
- C The one with the lowest mass.
- D They all will have the same kinetic energy on impact.



Kinetic Energy = $1/2 m v^2$

Potential Energy = mgh

Review Question 40

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Review Question 41

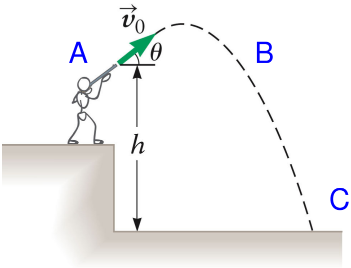
A bullet is fired from a rifle with a speed v_0 at an angle θ with respect to the horizontal axis from a cliff that is a height h above the ground below. What is the kinetic energy of the bullet at point A when it has just left the rifle?

A $KE = \frac{1}{2}mv_0^2$

B $KE = \frac{1}{2}m(v_0 \cos\theta)^2$

C $KE = \frac{1}{2}m(v_0 \sin\theta)^2$

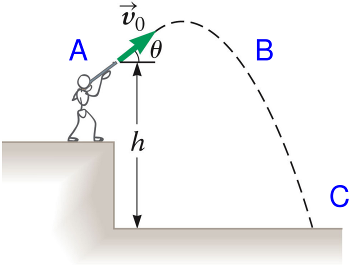
D $KE = mgh$



Review Question 41

A bullet is fired from a rifle with a speed v_0 at an angle θ with respect to the horizontal axis from a cliff that is a height h above the ground below. What is the kinetic energy of the bullet at point A when it has just left the rifle?

- A $KE = \frac{1}{2}mv_0^2$
- B $KE = \frac{1}{2}m(v_0 \cos\theta)^2$
- C $KE = \frac{1}{2}m(v_0 \sin\theta)^2$
- D $KE = mgh$



Review Question 42

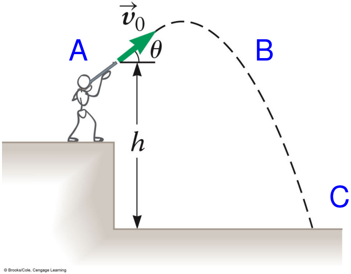
A bullet is fired from a rifle with a speed v_0 at an angle θ with respect to the horizontal axis from a cliff that is a height h above the ground below. What is the kinetic energy of the bullet at point B when it is at the same height as when it left the rifle?

A $KE = \frac{1}{2}mv_0^2$

B $KE = \frac{1}{2}m(v_0 \cos\theta)^2$

C $KE = \frac{1}{2}m(v_0 \sin\theta)^2$

D $KE = mgh$



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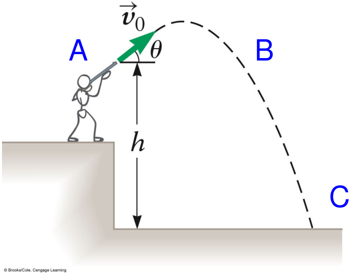
A bullet is fired from a rifle with a speed v_0 at an angle θ with respect to the horizontal axis from a cliff that is a height h above the ground below. What is the kinetic energy of the bullet at point B when it is at the same height as when it left the rifle?

A $KE = \frac{1}{2}mv_0^2$

B $KE = \frac{1}{2}m(v_0 \cos\theta)^2$

C $KE = \frac{1}{2}m(v_0 \sin\theta)^2$

D $KE = mgh$



Review Question 43

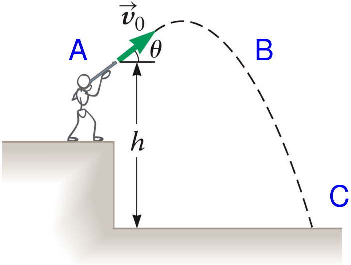
A bullet is fired from a rifle with a speed v_0 at an angle θ with respect to the horizontal axis from a cliff that is a height h above the ground below. What is the kinetic energy of the bullet at point C just as it impacts with the ground?

A $KE = \frac{1}{2}mv_0^2$

B $KE = \frac{1}{2}m(v_0 \cos\theta)^2$

C $KE = \frac{1}{2}m(v_0 \sin\theta)^2$

D $KE = \frac{1}{2}mv_0^2 + mgh$



Review Question 43

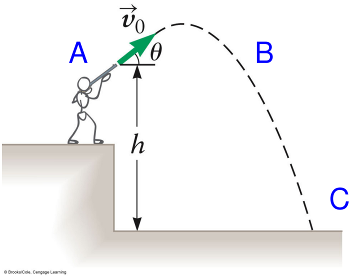
A bullet is fired from a rifle with a speed v_0 at an angle θ with respect to the horizontal axis from a cliff that is a height h above the ground below. What is the kinetic energy of the bullet at point C just as it impacts with the ground?

A $KE = \frac{1}{2}mv_0^2$

B $KE = \frac{1}{2}m(v_0 \cos\theta)^2$

C $KE = \frac{1}{2}m(v_0 \sin\theta)^2$

D $KE = \frac{1}{2}mv_0^2 + mgh$



Review Question 44

In an automobile collision, how does an airbag lessen the blow to the passenger? Assume as a result of the collision, the passenger stops.

A The air bag decreases the momentum change of the passenger in the collision.

B During the collision, the force from the air bag is greater than the force from the windshield or dashboard, so the passenger cannot hit the hard objects.

C The stopping impulse is the same for either the hard objects or the airbag. However, unlike the windshield or dashboard, the air bag gives some, increasing the time for the slowing process and thus decreasing the average force on the passenger.

D The airbag is there to ensure the seatbelt holds.

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Review Question 45

A moderate force will break an egg. However, an egg dropped on the road usually breaks, while one dropped on the grass usually does not break. This is because for the egg dropped on the grass:

A the change in momentum is greater.

B the change in momentum is less.

C the time interval for stopping is greater.

D the time interval for stopping is less.

Review Question 45

A moderate force will break an egg. However, an egg dropped on the road usually breaks, while one dropped on the grass usually does not break. This is because for the egg dropped on the grass:

A the change in momentum is greater.

B the change in momentum is less.

C the time interval for stopping is greater.

D the time interval for stopping is less.

Review Question 46

Suppose the entire population of the world gathers in one spot and, at the sounding of a prearranged signal, everyone jumps up. While all the people are in the air, does our Earth gain momentum in the opposite direction?

A No; the inertial mass of Earth is so large that the planet's change in motion is imperceptible.

B Yes; because of its much larger inertial mass, however, the change in momentum of Earth is much less than that of all the jumping people.

C Yes; Earth recoils, like a rifle firing a bullet, with a change in momentum equal to and opposite that of the people.

D It depends.

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D It depends.

Review Question 47

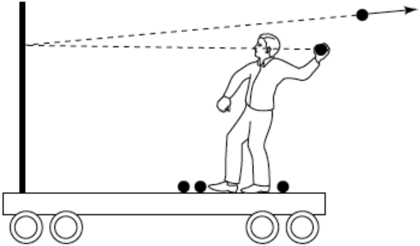
Suppose you are on a cart, initially at rest on a track with very little friction. You throw balls at a partition that is rigidly mounted on the cart. If the balls bounce straight back as shown in the figure, is the cart put in motion?

A Yes, it moves to the right.

B Yes, it moves to the left.

C No, it remains in place.

D More information is needed.



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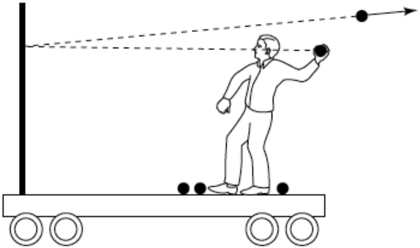

Review Question 48

Suppose a ping-pong ball and a bowling ball are rolling toward you. Both have the same momentum, and you exert the same force to stop each. How do the time intervals to stop them compare?

A It takes less time to stop the ping-pong ball.

B Both take the same time.

C It takes more time to stop the ping-pong ball.

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B Both take the same time.

C It takes more time to stop the ping-pong ball.

$\vec{F}_{\mathrm{ave}}\,\Delta t = \Delta\vec{p}$: Because force equals the time rate of change of momentum, the two balls lose momentum at the same rate. If both balls initially have the same $\vec{p}$, it takes the same amount of time to stop them.

Review Question 49

A moderate force will break an egg. However, an egg dropped on the road usually breaks, while one dropped on the grass usually does not break. This is because for the egg dropped on the grass:

A the change in momentum is greater.

B the change in momentum is less.

C the time interval for stopping is greater.

D the time interval for stopping is less.

Review Question 49

A moderate force will break an egg. However, an egg dropped on the road usually breaks, while one dropped on the grass usually does not break. This is because for the egg dropped on the grass:

A the change in momentum is greater.

B the change in momentum is less.

C the time interval for stopping is greater.

D the time interval for stopping is less.

Review Question 50

If all three collisions in the figure shown are totally inelastic, which bring(s) the car on the left to a halt?

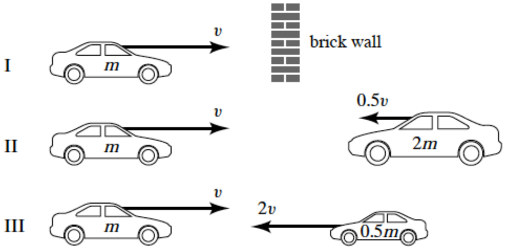
A I

B II

C III

D All three

E I and II



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If all three collisions in the figure shown are totally inelastic, which bring(s) the car on the left to a halt?

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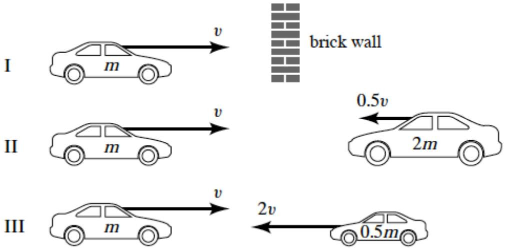
B II

C III

D All three

E I and II



Review Question 51

If all three collisions in the figure shown are totally inelastic, which cause(s) the most damage?

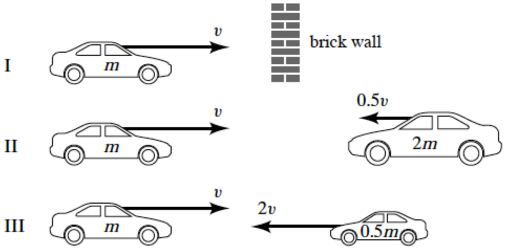
A All three cause the same damage.

B I

C II

D III

E I and II



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B I

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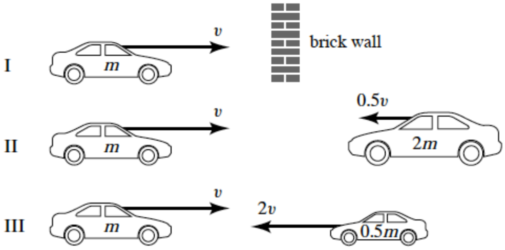


Review Question 52

In a two-body collision (elastic or inelastic), if the momentum of the system is conserved, then which of the following best describes the kinetic energy after the collision?

A Must be less.

B Must also be conserved.

C May also be conserved.

D Is doubled in value.

Review Question 52

In a two-body collision (elastic or inelastic), if the momentum of the system is conserved, then which of the following best describes the kinetic energy after the collision?

A Must be less.

B Must also be conserved.

C May also be conserved.

D Is doubled in value.

Review Question 53

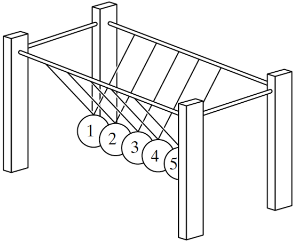
If ball 1 in the arrangement shown here is pulled back and then let go, ball 5 bounces forward. If balls 1 and 2 are pulled back and released, balls 4 and 5 bounce forward, and so on. The number of balls bouncing on each side is equal because

A of conservation of momentum in this special case.

B the collisions are all elastic.

C the collisions are all inelastic.

D Neither of the above.



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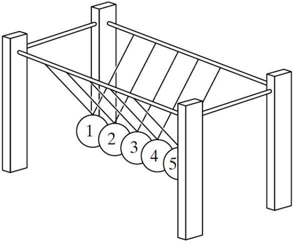

Review Question 54

An hourglass timer is first weighed when all the sand is in the lower chamber. The hourglass is then turned over and placed on the scale. While the sand falls, but before sand hits the bottom, the balance will show

- A more weight than before.
- B the same weight as before.
- C less weight than before.
- D unpredictable results.

Review Question 54

An hourglass timer is first weighed when all the sand is in the lower chamber. The hourglass is then turned over and placed on the scale. While the sand falls, but before sand hits the bottom, the balance will show

A more weight than before.

B the same weight as before.

C less weight than before.

D unpredictable results.

When the stream of sand begins to fall, the freely falling sand does not contribute to the weight, so there is slightly less weight registered for a small time interval. Also, the center of mass has a small downward acceleration, so the normal force (measured weight) should be slightly less than the true weight.

Review Question 55

An hourglass timer is first weighed when all the sand is in the lower chamber. The hourglass is then turned over and placed on the scale. While the sand falls from the upper chamber in a steady stream and hits the bottom, the balance will show

A more weight than before.

B the same weight as before.

C less weight than before.

D unpredictable results.

Review Question 55

An hourglass timer is first weighed when all the sand is in the lower chamber. The hourglass is then turned over and placed on the scale. While the sand falls from the upper chamber in a steady stream and hits the bottom, the balance will show

- A more weight than before.
- B the same weight as before.
- C less weight than before.
- D unpredictable results.

The force which results from the impact of the falling stream remains constant and helps make the total weight equal to the weight of the hourglass before inversion. The center of mass of the system is moving downward with a constant velocity, so the external forces must sum to zero.

Review Question 56

An hourglass timer is first weighed when all the sand is in the lower chamber. The chamber is then turned over and placed on the scale. When the upper chamber runs out of sand, but sand is still hitting the bottom, the balance will show

A more weight than before.

B the same weight as before.

C less weight than before.

D unpredictable results.

Review Question 56

An hourglass timer is first weighed when all the sand is in the lower chamber. The chamber is then turned over and placed on the scale. When the upper chamber runs out of sand, but sand is still hitting the bottom, the balance will show

- A more weight than before.
- B the same weight as before.
- C less weight than before.
- D unpredictable results.

The center of mass is decreasing in downward speed, so the net force is up. The normal force of the scale (observed weight of the hourglass) must exceed the true weight for a short time.

Review Question 57

Consider a point on a bicycle wheel as the wheel turns about a fixed axis, neither speeding up nor slowing down. Compare the linear and angular accelerations of the point.

A Both are zero.

B Only the angular acceleration is zero.

C Only the linear acceleration is zero.

D Neither is zero.

Review Question 57

Consider a point on a bicycle wheel as the wheel turns about a fixed axis, neither speeding up nor slowing down. Compare the linear and angular accelerations of the point.

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B Only the angular acceleration is zero.

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D Neither is zero.

Review Question 58

Consider two merry-go-rounds whose radii differ by a factor of two. If they have the same angular velocities, how do their periods compare?

A The larger merry-go-round has a shorter period.

B The larger merry-go-round has a longer period.

C The periods are the same.

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C The periods are the same.

Review Question 59

The Earth moves about the Sun in an elliptical orbit. As the Earth moves closer to the Sun, which of the following best describes the Earth-Sun system's moment of inertia?

A Decreases.

B Increases.

C Remains constant.

D None of the above choices are valid.

Review Question 59

The Earth moves about the Sun in an elliptical orbit. As the Earth moves closer to the Sun, which of the following best describes the Earth-Sun system's moment of inertia?

A Decreases.

B Increases.

C Remains constant.

D None of the above choices are valid.

Review Question 60

Consider the torque wrench shown in the figure. It has a long handle, and we suppose one user applies a force $F_1 = 50$ N at a distance of 10 cm from the head of the wrench. If a second user applies a force F_2 at a point 25 cm from the head, what value of F_2 will produce the same torque?

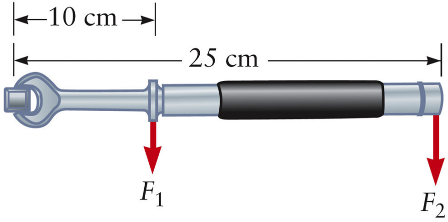
A 10 N

B 20 N

C 50 N

D 100 N

E 125 N



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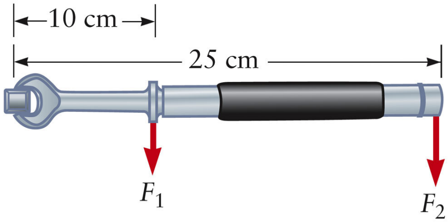


Review Question 61

If a nonzero torque is applied to an object, that object will experience:

A a constant angular speed.

B an angular acceleration.

C a constant moment of inertia.

D an increasing moment of inertia.

Review Question 61

If a nonzero torque is applied to an object, that object will experience:

A a constant angular speed.

B an angular acceleration.

C a constant moment of inertia.

D an increasing moment of inertia.

Review Question 62

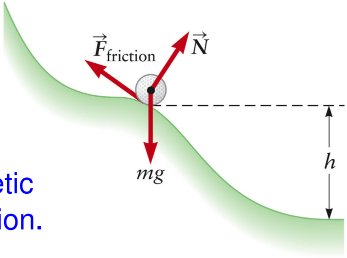
It is interesting to compare the result for the rolling ball with the result for an object (such as a skier) that slides down a frictionless hill. Which of the following statement is correct?

A The ball has a higher linear speed because it does not slip.

B The sliding object has a higher speed because the hill is frictionless in that case.

C The ball and skier have the same speed at the bottom of the hill.

D The ball has a smaller linear speed because some of its kinetic energy goes into rotational motion.



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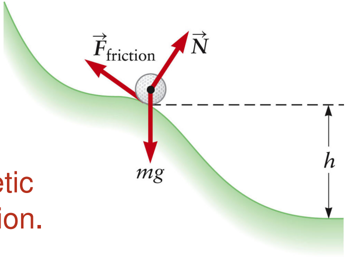
It is interesting to compare the result for the rolling ball with the result for an object (such as a skier) that slides down a frictionless hill. Which of the following statement is correct?

A The ball has a higher linear speed because it does not slip.

B The sliding object has a higher speed because the hill is frictionless in that case.

C The ball and skier have the same speed at the bottom of the hill.

D The ball has a smaller linear speed because some of its kinetic energy goes into rotational motion.



Review Question 63

Compare the rolling and the sliding cylinder.

Which one will arrive at the bottom first?

A The rolling cylinder.

B The sliding cylinder.

Review Question 63

Compare the rolling solid and the rolling hollow cylinder.

Which one will arrive at the bottom first?

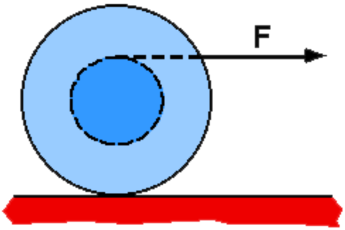
A The solid cylinder with $I = 1/2\, m\, R^2$.

B The hollow cylinder with $I = 1/2\, m\, (R^2_{\max} + R^2_{\min})$.

Review Question 64

A spool has string wrapped around its center axle and is sitting on a horizontal surface. If the string is pulled in the horizontal direction when tangent to the top of the axle, then which of the following is true?

- A The spool will roll to the right.
- B The spool will not roll, only slip.
- C The spool will roll to the left.
- D The motion cannot be determined.



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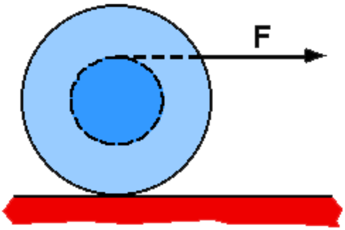

Review Question 65

A 40 kg boy is standing on the edge of a stationary circular platform of 30 kg that is free to rotate. The boy then tries to walk around the platform in a counterclockwise direction. As he does:

A the platform doesn't rotate.

B the platform rotates clockwise just fast enough so that the boy remains stationary relative to the ground.

C the platform rotates in a clockwise direction while the boy goes around in a counterclockwise direction relative to the ground.

D both go around with equal angular velocities but in opposite directions.

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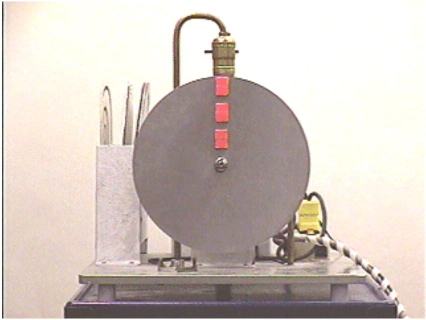
Review Question 66

Three identical magnets, the orange rectangles, are stuck to a magnetic stainless steel disc as shown in the photograph. The disc will now be rotated, slowly at first and then at a faster and faster angular speed. In what order will the magnets fly off the disc?

A Outer, middle, inner.

B Inner, middle, outer.

C All at the same time.



Review Question 66

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A Outer, middle, inner.

B Inner, middle, outer.

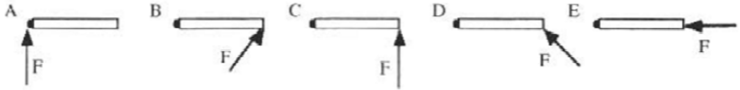
C All at the same time.

$$F_c = m\frac{v^2}{r} = m\omega^2 r$$

Centripetal force is proportional to the square of the angular speed and goes linearly with the radius for a constant angular speed. If the magnets have the same strength the one at the larger radius will therefore fly off first.

Review Question 67

A door (seen from above in the figures below) has hinges on the left hand side. Which force produces the largest torque? The magnitudes of all forces are equal.



A Figure A

B Figure B

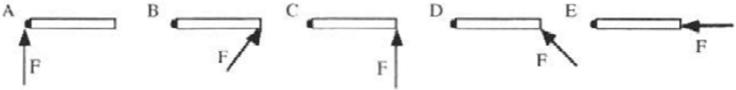
C Figure C

D Figure D

E Figure E

Review Question 67

A door (seen from above in the figures below) has hinges on the left hand side. Which force produces the largest torque? The magnitudes of all forces are equal.



A Figure A $\tau = \vec{F} \times \vec{r} = 0$

B Figure B $\tau = \vec{F} \times \vec{r} = \mathbf{F}_{\perp} \cdot \mathbf{L}$

C Figure C $\tau = \vec{F} \times \vec{r} = \mathbf{F} \cdot \mathbf{L}$

D Figure D $\tau = \vec{F} \times \vec{r} = \mathbf{F}_{\perp} \cdot \mathbf{L}$

E Figure E $\tau = \vec{F} \times \vec{r} = 0$