Extra Practice 4

Due: 2:00pm on Wednesday, March 9, 2016

You will receive no credit for items you complete after the assignment is due. Grading Policy

Exercise 4.25

Two crates, A and B, sit at rest side by side on a frictionless horizontal surface. The crates have masses m_A and m_B. A horizontal force $\vec{F}$ is applied to crate A and the two crates move off to the right.

Part A

Draw labeled free-body diagram for crate A.

Draw the force vectors with their tails at the dot. The orientation of your vectors will be graded. The exact length of your vectors will not be graded but the relative length of one to the other will be graded.

ANSWER:

Part B

Draw labeled free-body diagram for crate B.

Draw the force vectors with their tails at the dot. The orientation of your vectors will be graded. The exact length of your vectors will not be graded but the relative length of one to the other will be graded.

ANSWER:

Part C

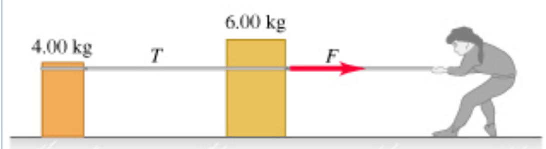
If the magnitude of force $\vec{F}$ is less than the total weight of the two crates, will it cause the crates to move?

ANSWER:

- Yes
- No

Problem 4.39

Two crates, one with mass 4.00 kg and the other with mass 6.00 kg, sit on the frictionless surface of a frozen pond, connected by a light rope . A woman wearing golf shoes (so she can get traction on the ice) pulls horizontally on the 6.00 kg crate with a force F that gives the crate an acceleration of 2.20 $\mathrm{m/s^2}$.



Part A

What is the acceleration of the 4.00 kg crate?

ANSWER:

[   ] $\mathrm{m/s^2}$

Part B

Use Newton's second law to find the tension T in the rope that connects the two crates.

ANSWER:

T = [   ] N

Part C

Which is larger in magnitude, force T or force F?

ANSWER:

- force T
- force F

Part D

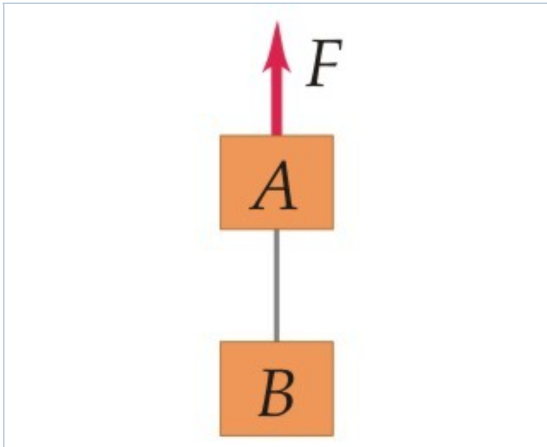
Use part (C) and Newton's second law to calculate the magnitude of the force F.

ANSWER:

F = [   ] N

Problem 4.49

Two boxes, A and B, are connected to each end of a light vertical rope, as shown in the following figure. A constant upward force 88.0 N is applied to box A. Starting from rest, box B descends 10.6 m in 3.90 s . The tension in the rope connecting the two boxes is 38.0 N



Part A

What is the mass of box B?

Express your answer with the appropriate units.

ANSWER:

m =

Part B

What is the mass of box A?

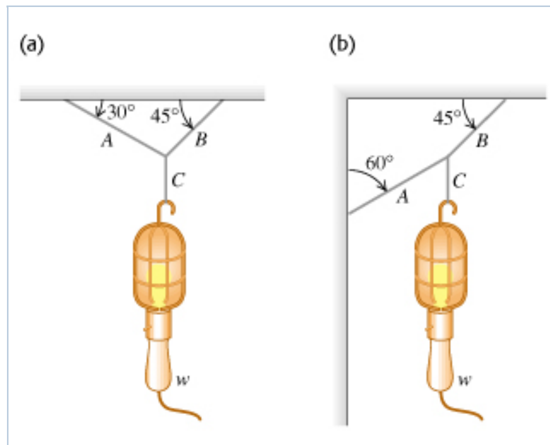
Express your answer with the appropriate units.

ANSWER:

m =

Exercise 5.7

Find the tension in each cord in the figure if the weight of the suspended object is w.



Part A

Find the tension of the cord A in the figure (a).

Express your answer in terms of w.

ANSWER:

T_A =

Part B

Find the tension of the cord B in the figure (a).

Express your answer in terms of w.

ANSWER:

T_B =

Part C

Find the tension of the cord C in the figure (a).

Express your answer in terms of w.

ANSWER:

T_C =

Part D

Find the tension of the cord A in the figure (b).

Express your answer in terms of w.

ANSWER:

T_A =

Part E

Find the tension of the cord B in the figure (b).

Express your answer in terms of w.

ANSWER:

T_B =

Part F

Find the tension of the cord C in the figure (b).

Express your answer in terms of w.

ANSWER:

T_C =

Exercise 5.9

A man pushes on a piano with mass 170 kg ; it slides at constant velocity down a ramp that is inclined at 14.0 $^\circ$ above the horizontal floor. Neglect any friction acting on the piano.

Part A

Calculate the magnitude of the force applied by the man if he pushes parallel to the incline.

Express your answer with the appropriate units.

ANSWER:

F =

Part B

Calculate the magnitude of the force applied by the man if he pushes parallel to the floor.

Express your answer with the appropriate units.

ANSWER:

F =

Exercise 5.13

On September 8, 2004, the *Genesis* spacecraft crashed in the Utah desert because its parachute did not open. The 210-kg capsule hit the ground at 311 $\mathrm{km/h}$ and penetrated the soil to a depth of 81.0 cm. Assume that just before the crash and in the soil the capsule moves vertically.

Part A

What was its acceleration (in $\mathrm{m/s^2}$), assuming it to be constant, during the crash?

ANSWER:

a = $\mathrm{m/s^2}$

Part B

What was its acceleration (in g 's), assuming it to be constant, during the crash?

ANSWER:

a = g

Part C

What force did the ground exert on the capsule during the crash? Express the force in newtons.

Express your answer using two significant figures.

ANSWER:

F = N

Part D

What force did the ground exert on the capsule during the crash? Express the force as a multiple of the capsule's weight w.

ANSWER:

F = w

Part E

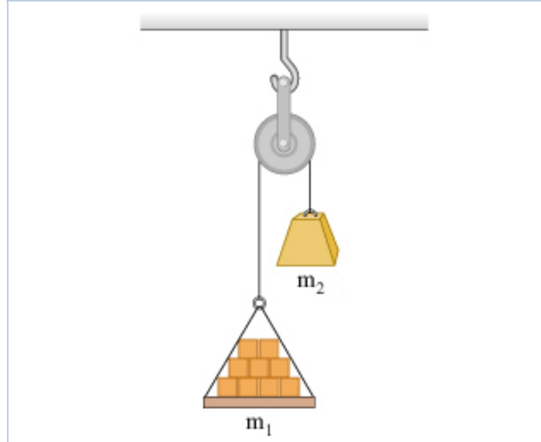
For how long did this force last?

ANSWER:

t = s

Exercise 5.15

A load of bricks with mass m_1 = 14.8 kg hangs from one end of a rope that passes over a small, frictionless pulley. A counterweight of mass m_2 = 28.2 kg is suspended from the other end of the rope, as shown in the figure. The system is released from rest. Use g = 9.80 $\mathrm{m/s^2}$ for the magnitude of the acceleration due to gravity.



Part A

What is the magnitude of the upward acceleration of the load of bricks?

ANSWER:

$\mathrm{m/s^2}$

Part B

What is the tension in the rope while the load is moving?

ANSWER:

N

Exercise 5.17

A light rope is attached to a block with mass 3.10 kg that rests on a frictionless, horizontal surface. The horizontal rope passes over a frictionless, massless pulley, and a block with mass m is suspended from the other end. When the blocks are released, the tension in the rope is 17.1 N .

Part A

Draw free-body diagram for the 3.10-kg block. Assume block is moving to the right.

Draw the vectors starting at the black dots. The location and orientation of the vectors will be graded. The length of the vectors will not be graded.

ANSWER:

Part B

Draw free-body diagram for the block with mass m .

Draw the vectors starting at the black dots. The location and orientation of the vectors will be graded. The length of the vectors will not be graded.

ANSWER:

Part C

What is the acceleration of either block?

Express your answer with the appropriate units.

ANSWER:

a =

Part D

Find m.

Express your answer with the appropriate units.

ANSWER:

m =

Part E

How does the tension compare to the weight of the hanging block?

ANSWER:

$\frac{T}{w}$ =

Exercise 5.27

A stockroom worker pushes a box with mass 11.8 kg on a horizontal surface with a constant speed of 3.10 $\mathrm{m/s}$. The coeflficient of kinetic friction between the box and the surface is 0.24.

Part A

What horizontal force must the worker apply to maintain the motion?

Express your answer with the appropriate units.

ANSWER:

F =

Part B

This question will be shown after you complete previous question(s).

Exercise 5.29

A crate of 32.2-kg tools rests on a horizontal floor. You exert a gradually increasing horizontal push on it and observe that the crate just begins to move when your force exceeds 331 N . After that you must reduce your push to 205 N to keep it moving at a steady 29.5 $\mathrm{cm/s}$.

Part A

What is the coefficient of static friction between the crate and the floor?

ANSWER:

μ_s =

Part B

What is the coefficient of kinetic friction between the crate and the floor?

ANSWER:

μ_k =

Part C

What push must you exert to give it an acceleration of 1.22 $\mathrm{m/s^2}$?

ANSWER:

F = N

Part D

Suppose you were performing the same experiment on this crate but were doing it on the moon instead, where the acceleration due to gravity is 1.62 $\mathrm{m/s^2}$. What magnitude push would cause it to move?

ANSWER:

F = N

Part E

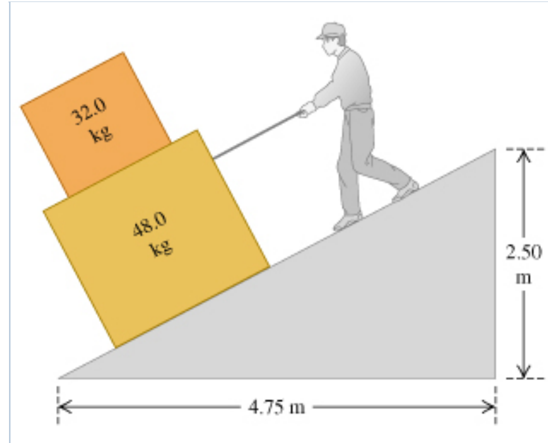
What would its acceleration be if you maintained the push in part C?

ANSWER:

a = $\mathrm{m/s^2}$

Exercise 5.33

You are lowering two boxes, one on top of the other, down the ramp shown in the figure by pulling on a rope parallel to the surface of the ramp. Both boxes move together at a constant speed of 15.0 $\mathrm{cm/s}$. The coefficient of kinetic friction between the ramp and the lower box is 0.483, and the coefficient of static friction between the two boxes is 0.773.



Part A

What force do you need to exert to accomplish this?

ANSWER:

T = ______ N

Part B

What is the magnitude of the friction force on the upper box?

ANSWER:

f = ______ N

Part C

What is the direction of the friction force on the upper box?

ANSWER:

- up the ramp
- down the ramp

Exercise 5.35

Part A

If the coefficient of kinetic friction between tires and dry pavement is 0.800, what is the shortest distance in which an automobile can be stopped by locking the brakes when traveling at 27.9 $\mathrm{m/s}$?

Express your answer using two significant figures.

ANSWER:

______ m

Part B

On wet pavement the coefficient of kinetic friction may be only 0.250. How fast should you drive on wet pavement in order to be able to stop in the same distance as in part A? (*Note:* Locking the brakes is *not* the safest way to stop.)

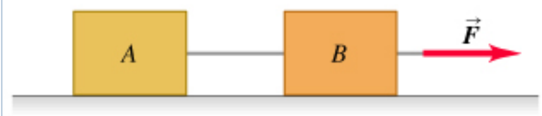
Express your answer using two significant figures.

ANSWER:

$\mathrm{m/s}$

Exercise 5.37

Two crates connected by a rope lie on a horizontal surface (the figure). Crate *A* has mass m_A and crate *B* has mass m_B. The coefficient of kinetic friction between each crate and the surface is μ_k. The crates are pulled to the right at constant velocity by a horizontal force $\vec{F}$.



Part A

In terms of m_A, m_B, and μ_k, calculate the magnitude of the force $\vec{F}$.

Express your answer in terms of some or all of the variables m_A, m_B, μ_k, and appropriate constants.

ANSWER:

F =

Part B

In terms of m_A, m_B, and μ_k, calculate the tension in the rope connecting the blocks. Include the free-body diagram or diagrams you used to determine each answer.

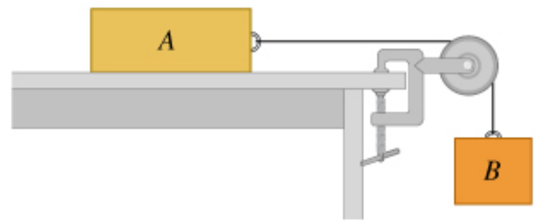
Express your answer in terms of some or all of the variables m_A, m_B, μ_k, and appropriate constants.

ANSWER:

T =

Exercise 5.39

As shown in the figure, block *A* (mass 2.30 kg) rests on a tabletop. It is connected by a horizontal cord passing over a light, frictionless pulley to a hanging block *B* (mass 2.39 kg). The coefficient of kinetic friction between block *A* and the tabletop is 0.214.



Part A

Draw the free-body diagram for block *A*.

Draw the force vectors with their tails at the center of the block A. The location and orientation of your vectors will be graded. The exact length of your vectors will not be graded but the relative length of one to the other will be graded.

ANSWER:

Part B

Draw the free-body diagram for block *B*.

Draw the force vectors with their tails at the center of the block B. The location and orientation of your vectors will be graded. The exact length of your vectors will not be graded but the relative length of one to the other will be graded.

ANSWER:

Part C

After the blocks are released from rest, find the speed of each block after moving 4.60 cm .

ANSWER:

v = m/s

Part D

After the blocks are released from rest, find the tension in the cord.

ANSWER:

T = N

Exercise 5.43

A stone with a mass of 0.700 kg is attached to one end of a string 0.800 m long. The string will break if its tension exceeds 50.0 N . The stone is whirled in a horizontal circle on a frictionless tabletop; the other end of the string remains fixed.

Part A

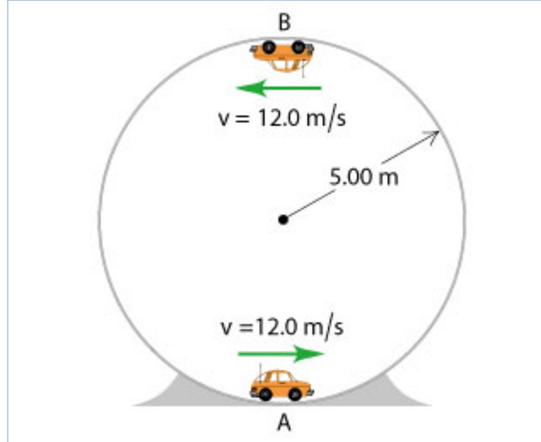
Find the maximum speed the stone can attain without breaking the string.

ANSWER:

v_{max} = m/s

Exercise 5.45

A small remote-control car with a mass of 1.64 kg moves at a constant speed of v = 12.0 $\mathrm{m/s}$ in a vertical circle inside a hollow metal cylinder that has a radius of 5.00 m .



Part A

What is the magnitude of the normal force exerted on the car by the walls of the cylinder at point *A* (at the bottom of the vertical circle)?

ANSWER:

N

Part B

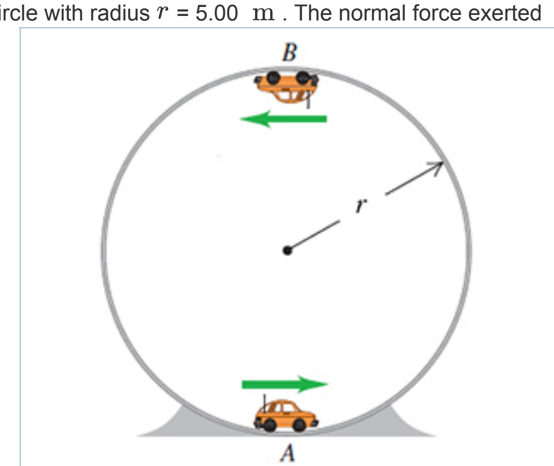
What is the magnitude of the normal force exerted on the car by the walls of the cylinder at point *B* (at the top of the vertical circle)?

ANSWER:

N

Exercise 5.47

A small model car with mass m travels at constant speed on the inside of a track that is a vertical circle with radius r = 5.00 m . The normal force exerted by the track on the car when it is at the bottom of the track (point A) is equal to 2.50mg.



Part A

How much time does it take the car to complete one revolution around the track.

Express your answer with the appropriate units.

ANSWER:

t = ______

Exercise 5.49

A 1067-kg car and a 2190-kg pickup truck approach a curve on the expressway that has a radius of 253 m .

Part A

At what angle should the highway engineer bank this curve so that vehicles traveling at 62.4 $\mathrm{mi/h}$ can safely round it regardless of the condition of their tires?

ANSWER:

ϕ = ______ $^\circ$

Part B

Should the heavy truck go slower than the lighter car?

ANSWER:

- yes
- no

Part C

As the car and truck round the curve at 62.4 $\mathrm{mi/h}$, find the normal force on the car to the highway surface.

ANSWER:

N_{car} = ______ N

Part D

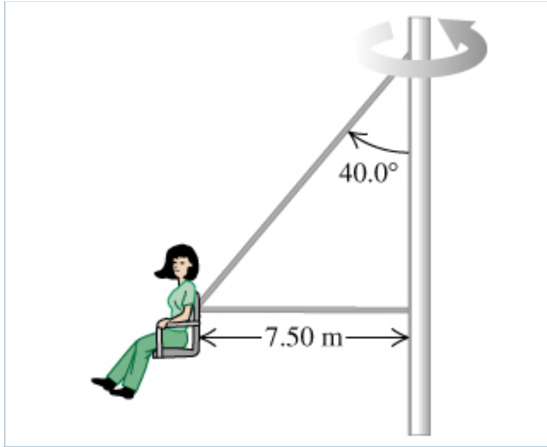
As the car and truck round the curve at 62.4 $\mathrm{mi/h}$, find the normal force on the truck to the highway surface.

ANSWER:

N_{truck} = ______ N

Exercise 5.51

In one of the versions of the "Giant Swing", the seat is connected to two cables, one of which is horizontal . The seat swings in a horizontal circle at a rate of 34.0 $\mathrm{rev/min}$.



Part A

If the seat weighs 235 N and a 889-N person is sitting in it, find the tension in the horizontal cable.

Express your answer with the appropriate units.

ANSWER:

T_1 =

Part B

F ind the tension in the inclined cable.

Express your answer with the appropriate units.

ANSWER:

T_2 =

Exercise 5.56

A stunt pilot of mass 51.0 kg who has been diving her airplane vertically pulls out of the dive by changing her course to a circle in a vertical plane.

Part A

If the plane's speed at the lowest point of the circle is 95.7 $\mathrm{m/s}$, what is the minimum radius of the circle for the acceleration at this point not to exceed $4.00g$?

ANSWER:

m

Part B

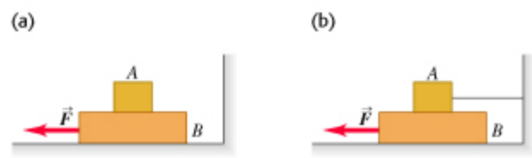
What is the apparent weight of the pilot at the lowest point of the pullout?

ANSWER:

N

Problem 5.79

Block *A* in weighs 1.25 N, and block *B* weighs 3.70 N. The coefficient of kinetic friction between all surfaces is 0.310.



Part A

Find the magnitude of the horizontal force $\vec{F}$ necessary to drag block B to the left at constant speed if A rests on B and moves with it (figure (a)).

Express your answer with the appropriate units.

ANSWER:

F =

Part B

Find the magnitude of the horizontal force $\vec{F}$ necessary to drag block B to the left at constant speed if A is held at rest (figure (b)).

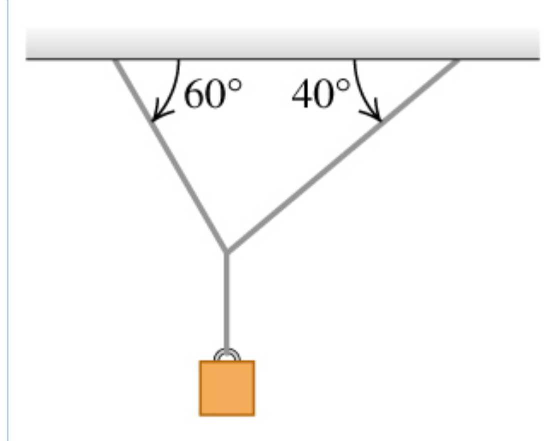
Express your answer with the appropriate units.

ANSWER:

F =

Problem 5.61

Two ropes are connected to a steel cable that supports a hanging weight as shown in the figure .



Part A

Draw a free-body diagram showing all of the forces acting at the knot that connects the two ropes to the steel cable.

Draw the force vectors with their tails at the knot. The orientation of your vectors will be graded. The exact length of your vectors will not be graded but the relative length of one to the other will be graded.

ANSWER:

Part B

Based on your force diagram, which of the two ropes will have the greater tension?

ANSWER:

- the left rope
- the right rope

Part C

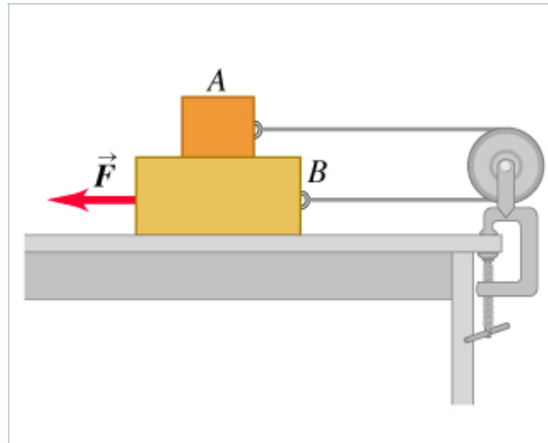
If the maximum tension either rope can sustain without breaking is 5900 N , determine the maximum value of the hanging weight that these ropes can safely support. You can ignore the weight of the ropes and the steel cable.

ANSWER:

w = ______ N

Problem 5.87

Block *A* in the figure weighs 1.52 N , and block *B* weighs 4.41 N . The coefficient of kinetic friction between all surfaces is 0.36.



Part A

Find the magnitude of the horizontal force $\vec{F}$ necessary to drag block *B* to the left at constant speed if A and B are connected by a light, flexible cord passing around a fixed, frictionless pulley.

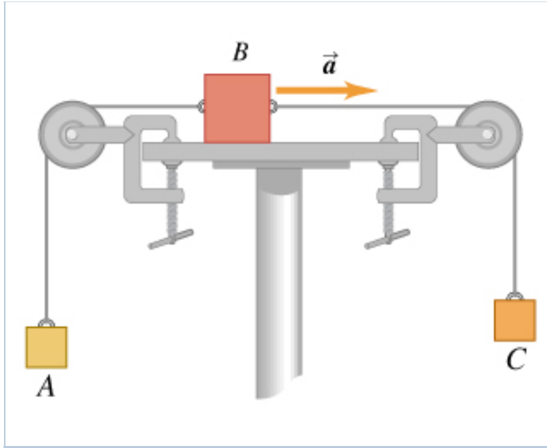
Express your answer using two significant figures.

ANSWER:

F = ______ N

Problem 5.89

Block *A* in the figure has a mass of 3.50 kg , and block *B* has mass 14.0 kg . The coefficient of kinetic friction between block *B* and the horizontal surface is 0.35.



Part A

What is the mass of block *C* if block *B* is moving to the right and speeding up with an acceleration 1.80 $\mathrm{m/s^2}$?

ANSWER:

m_{C} = ______ kg

Part B

What is the tension in each cord when block *B* has this acceleration?

ANSWER:

T_{AB} = ______ N

Part C

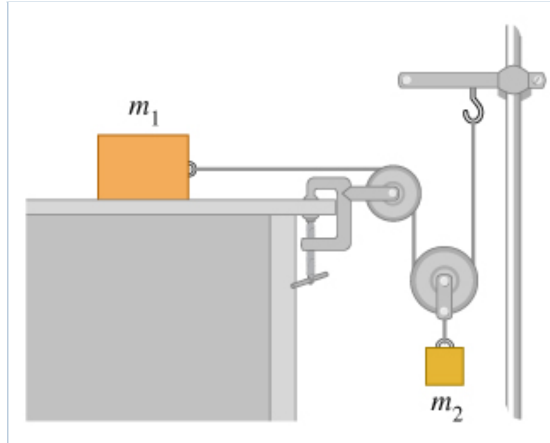
ANSWER:

T_{BC} = ______ N

Problem 5.91

Part A

In terms of m_1 , m_2 , and g , find the acceleration of the first block in the figure . There is no friction anywhere in the system.



ANSWER:

a =

Part B

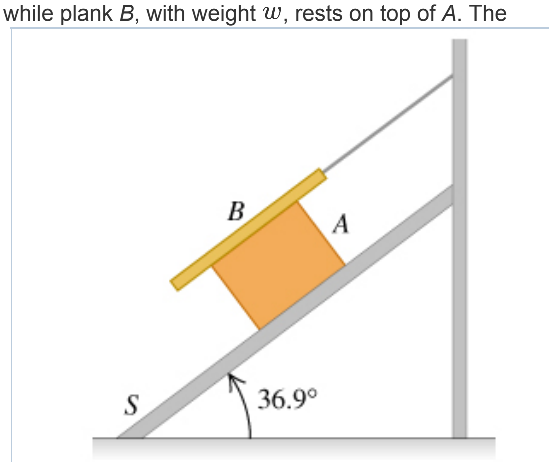
In terms of m_1 , m_2 , and g , find the acceleration of the second block in the figure. There is no friction anywhere in the system.

ANSWER:

a =

Problem 5.97

Block *A*, with weight $3w$, slides down an inclined plane *S* of slope angle 36.9 $^\circ$ at a constant speed while plank *B*, with weight w, rests on top of *A*. The plank is attached by a cord to the wall (the figure).



Part A

Draw a diagram of all the forces acting on block *A*.

Draw the force vectors with their tails at the center of the block *A*. The orientation of your vectors will be graded. The exact length of your vectors will not be graded.

ANSWER:

Part B

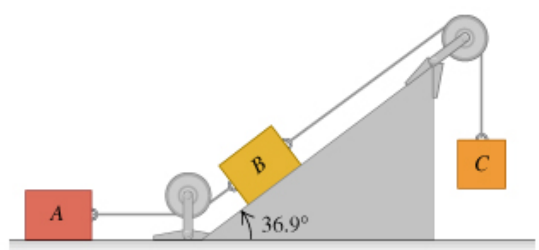
If the coefficient of kinetic friction is the same between *A* and *B* and between *S* and *A*, determine its value.

ANSWER:

μ =

Problem 5.101

Blocks *A*, *B*, and *C* are placed as in the figure and connected by ropes of negligible mass. Both *A* and *B* weigh 25.4 N each, and the coefficient of kinetic friction between each block and the surface is 0.37. Block *C* descends with constant velocity.



Part A

Draw free-body diagram showing the forces acting on *A*.

Draw the force vectors with their tails at the center of the block *A*. The location and orientation of your vectors will be graded. The exact length of your vectors will not be graded but the relative length of one to the other will be graded.

ANSWER:

Part B

Draw free-body diagram showing the forces acting on *B*.

Draw the force vectors with their tails at the center of the block *B*. The location and orientation of your vectors will be graded. The exact length of your vectors will not be graded but the relative length of one to the other will be graded.

ANSWER:

Part C

Find the tension in the rope connecting blocks *A* and *B*.

ANSWER:

T_1 = [ ] N

Part D

What is the weight of block *C*?

ANSWER:

w_C = [ ] N

Part E

If the rope connecting *A* and *B* were cut, what would be the acceleration of *C*?

ANSWER:

a = [ ] m/s^2

Problem 5.105

On the ride "Spindletop" at the amusement park Six Flags Over Texas, people stood against the inner wall of a hollow vertical cylinder with radius 2.5 m. The cylinder started to rotate, and when it reached a constant rotation rate of 0.60 rev/s, the floor on which people were standing dropped about 0.5 m. The people remained pinned against the wall.

Part A

Draw a force diagram for a person on this ride, after the floor has dropped. (Assume the vertical axis of the cylinder to be at the left.)

Draw the force vectors with their tails at the dot. The orientation of your vectors will be graded. The exact length of your vectors will not be graded but the relative length of one to the other will be graded.

ANSWER:

Part B

What minimum coefficient of static friction is required if the person on the ride is not to slide downward to the new position of the floor?

Express your answer using two significant figures.

ANSWER:

μ_{min} =

Part C

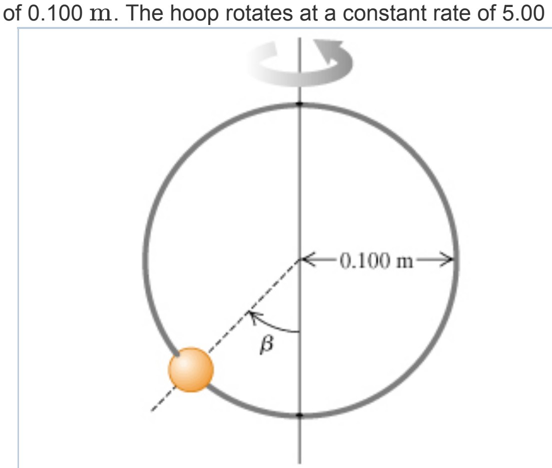
Does your answer in part B depend on the mass of the passenger? (*Note:* When the ride is over, the cylinder is slowly brought to rest. As it slows down, people slide down the walls to the floor.)

ANSWER:

- yes
- no

Problem 5.107

A small bead can slide without friction on a circular hoop that is in a vertical plane and has a radius of 0.100 m. The hoop rotates at a constant rate of 5.00 $\mathrm{rev/s}$ about a vertical diameter (the figure).



Part A

Find the angle β at which the bead is in vertical equilibrium. (Of course, it has a radial acceleration toward the axis.)

ANSWER:

β = °

Part B

Is it possible for the bead to "ride" at the same elevation as the center of the hoop?

ANSWER:

- yes
- no

Part C

What will happen if the hoop rotates at 1.00 $\mathrm{rev/s}$?

ANSWER:

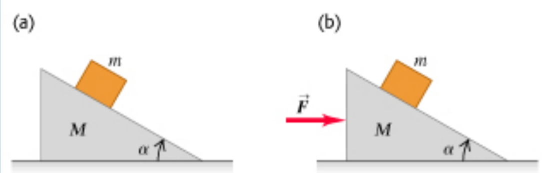
Essay answers are limited to about 500 words (3800 characters maximum, including spaces).

3785 Character(s) remaining

(none provided)

Problem 5.113

A wedge with mass M rests on a frictionless horizontal tabletop. A block with mass m is placed on the wedge and a horizontal force $\vec{F}$ is applied to the wedge.



Part A

What must the magnitude of $\vec{F}$ be if the block is to remain at a constant height above the tabletop?

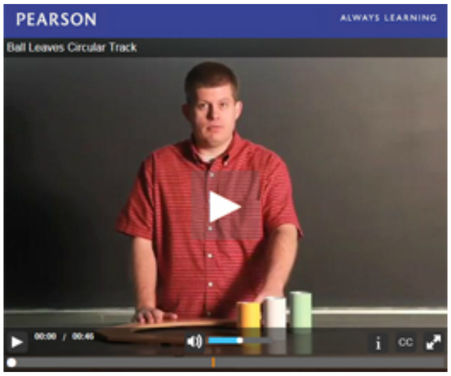
Express your answer in terms of the variables m, M, α, and constant g.

ANSWER:

F =

Video Tutor: Ball Leaves Circular Track

First, launch the video below. You will be asked to use your knowledge of physics to predict the outcome of an experiment. Then, close the video window and answer the questions at right. You can watch the video again at any point.



Part A

Consider the video demonstration that you just watched. Which of the following changes would make it more likely for the ball to hit both the white can *and* the green can?

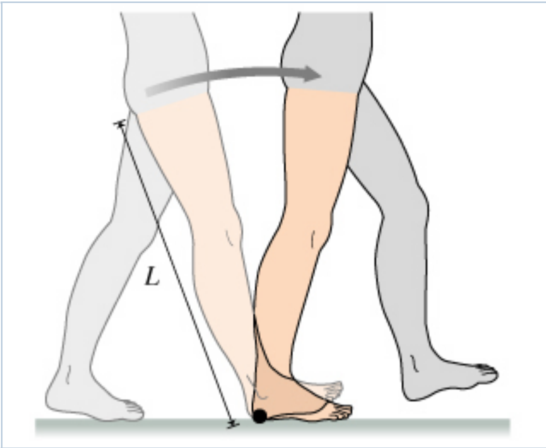
You did not open hints for this part.

ANSWER:

- Use a ball that is heavier than the original ball.
- Roll the ball slower.
- Roll the ball faster.
- Use a ball that is lighter than the original ball, but still heavier than an empty can.
- None of the above

Froude Number Conceptual Question

While walking, your hip moves along an approximately circular path centered on your foot. The radius of this circular path is the distance between your foot and your hip, designated L. Since your entire weight is supported by the hip attached to the leg in contact with the ground, we can approximate your entire mass as undergoing circular motion of radius L. The force that leads to this circular motion is the force of gravity.



Since a person's leg is nearly vertical while walking, the force causing the centripetal acceleration is approximately equal to the person's weight. Substituting the expressions for weight and centripetal acceleration into Newton's 2nd law, $F = ma$, gives

$$mg \approx m\left(\frac{v^2}{L}\right),$$

where m is the mass of the person. This equation simplifies to

$$g \approx \frac{v^2}{L}.$$

For a 1.8-m (around 6-ft) tall person, L is approximately 0.90 m, so v is approximately 3.0 $\mathrm{m/s}$. This is quite close to a person's maximum walking speed. (Note that a person can intentionally walk slower than the maximum speed found through our analysis. However, moving faster requires that the person break into a run, in which case the feet no longer maintain contact with the ground.) Scientists define the Froude number Fr as the ratio

$$Fr \equiv \frac{v^2}{gL}.$$

Notice that for maximum walking speed of a human, $Fr \approx 1$.

Part A

Imagine a small child whose legs are half as long as her parent's legs. If her parent can walk at maximum speed V, at what maximum speed can the child walk?

You did not open hints for this part.

ANSWER:

- V
- $V/2$
- $2V$
- $\sqrt{2}V$
- $V/\sqrt{2}$

Part B

Imagine an astronaut who can walk on the earth at maximum speed V. At what maximum speed can the astronaut walk on the moon, where the acceleration due to gravity is one-sixth of that on the earth?

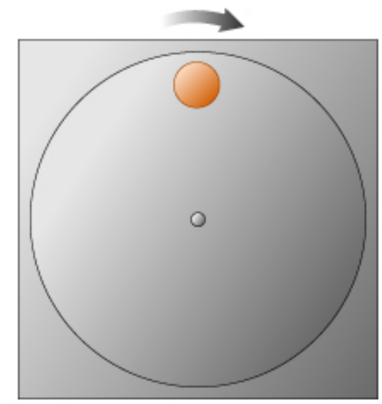
You did not open hints for this part.

ANSWER:

- V
- $V/6$
- $6V$
- $\sqrt{6}V$
- $V/\sqrt{6}$

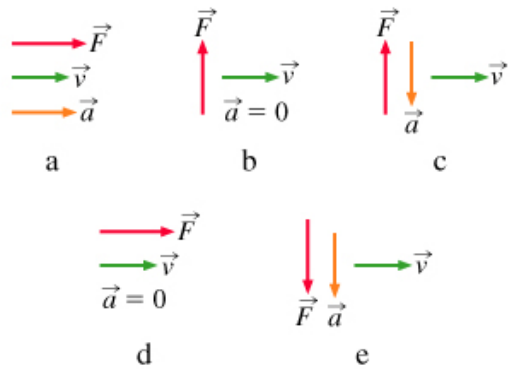
A Mass on a Turntable: Conceptual

A small metal cylinder rests on a circular turntable that is rotating at a constant rate, as illustrated in the diagram.



Part A

Which of the following sets of vectors best describes the velocity, acceleration, and net force acting on the cylinder at the point indicated in the diagram?



You did not open hints for this part.

ANSWER:

- a
- b
- c
- d
- e

Part B

Let R be the distance between the cylinder and the center of the turntable. Now assume that the cylinder is moved to a new location $R/2$ from the center of the turntable. Which of the following statements accurately describe the motion of the cylinder at the new location?

Check all that apply.

You did not open hints for this part.

ANSWER:

- The speed of the cylinder has decreased.
- The speed of the cylinder has increased.
- The magnitude of the acceleration of the cylinder has decreased.
- The magnitude of the acceleration of the cylinder has increased.
- The speed and the acceleration of the cylinder have not changed.

± Rolling Friction and Bicycle Tires

Two bicycle tires are set rolling with the same initial speed of 4.00 $\mathrm{m/s}$ along a long, straight road, and the distance each travels before its speed is reduced by half is measured. One tire is inflated to a pressure of 40 psi and goes a distance of 17.3 m ; the other is at 105 psi and goes a distance of 93.2 m . Assume that the net horizontal force is due to rolling friction only and take the free-fall acceleration to be g = 9.80 $\mathrm{m/s^2}$.

Part A

What is the coefficient of rolling friction μ_{r} for the tire under low pressure?

You did not open hints for this part.

ANSWER:

μ_{r} =

Part B

This question will be shown after you complete previous question(s).

Skydiving

A sky diver of mass 80.0 kg (including parachute) jumps off a plane and begins her descent.

Throughout this problem use 9.80 $\mathrm{m/s^2}$ for the magnitude of the acceleration due to gravity.

Part A

At the beginning of her fall, does the sky diver have an acceleration?

You did not open hints for this part.

ANSWER:

- No; the sky diver falls at constant speed.
- Yes and her acceleration is directed upward.
- Yes and her acceleration is directed downward.

Part B

At some point during her free fall, the sky diver reaches her terminal speed. What is the magnitude of the drag force $F_{\rm drag}$ due to air resistance that acts on the sky diver when she has reached terminal speed?

Express your answer in newtons.

You did not open hints for this part.

ANSWER:

$F_{\rm drag}$ = ______ $\rm N$

Part C

For an object falling through air at a high speed v, the drag force acting on it due to air resistance can be expressed as

$$F = Kv^2,$$

where the coefficient K depends on the shape and size of the falling object and on the density of air. For a human body, the numerical value for K is about 0.250 $\rm kg/m$.

Using this value for K, what is the terminal speed $v_{\rm terminal}$ of the sky diver?

Express you answer in meters per second.

You did not open hints for this part.

ANSWER:

$v_{\rm terminal}$ = ______ $\rm m/s$

Part D

When the sky diver descends to a certain height from the ground, she deploys her parachute to ensure a safe landing. (Usually the parachute is deployed when the sky diver reaches an altitude of about 900 $\rm m$--3000 $\rm ft$.) Immediately after deploying the parachute, does the skydiver have a nonzero acceleration?

You did not open hints for this part.

ANSWER:

- No; the sky diver keeps falling at constant speed.
- Yes and her acceleration is directed downward.
- Yes and her acceleration is directed upward.

Part E

When the parachute is fully open, the effective drag coefficient of the sky diver plus parachute increases to 60.0 $\rm kg/m$. What is the drag force $F_{\rm drag}$ acting on the sky diver immediately after she has opened the parachute?

Express your answer in newtons.

You did not open hints for this part.

ANSWER:

F_{drag} = $\quad$ N

Part F

What is the terminal speed v_{terminal} of the sky diver when the parachute is opened?

Express your answer in meters per second.

You did not open hints for this part.

ANSWER:

v_{terminal} = $\quad$ m/s

Static Friction and Frictional Force Ranking Task

Below are six crates at rest on level surfaces. The crates have different masses and the frictional coefficients [given as (μ_s, μ_k)] between the crates and the surfaces differ. The same external force is applied to each crate, but none of the crates move.

Part A

Rank the crates on the basis of the frictional force acting on them.

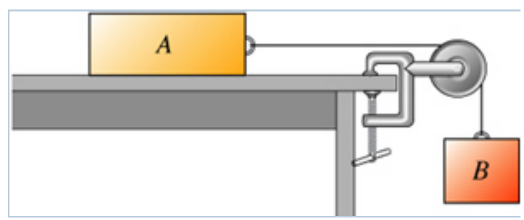
Rank from largest to smallest. To rank items as equivalent, overlap them.

You did not open hints for this part.

ANSWER:

Kinetic Friction in a Block-and-Pulley System

Consider the system shown in the figure . Block *A* has weight w_A and block *B* has weight w_B . Once block *B* is set into downward motion, it descends at a constant speed. Assume that the mass and friction of the pulley are negligible.



Part A

Calculate the coefficient of kinetic friction μ between block *A* and the table top.

Express your answer in terms of some or all of the variables w_A (double-u subscript A), w_B, and g (the acceleration due to gravity).

You did not open hints for this part.

ANSWER:

μ =

Part B

This question will be shown after you complete previous question(s).

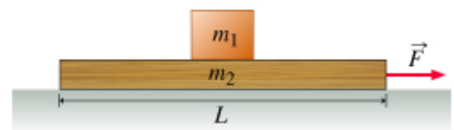
Part C

This question will be shown after you complete previous question(s).

Board Pulled Out from under a Box

A small box of mass m_1 is sitting on a board of mass m_2 and length L . The board rests on a frictionless horizontal surface. The coefficient of static friction between the board and the box is μ_s . The coefficient of kinetic friction between the board and the box is, as usual, less than μ_s .

Throughout the problem, use g for the magnitude of the acceleration due to gravity. In the hints, use F_f for the magnitude of the friction force between the board and the box.



Part A

Find F_{min} , the constant force with the least magnitude that must be applied to the board in order to pull the board out from under the the box (which will then fall off of the opposite end of the board).

Express your answer in terms of some or all of the variables μ_s , m_1 , m_2 , g, and L. Do *not* include F_f in your answer.

You did not open hints for this part.

ANSWER:

F_{min} =

Free-Body Diagrams

Learning Goal:

To gain practice drawing free-body diagrams

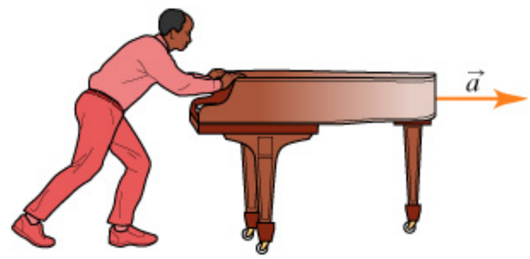
Whenever you face a problem involving forces, always start with a free-body diagram.
To draw a free-body diagram use the following steps:

1. Isolate the object of interest. It is customary to represent the object of interest as a point in your diagram.
2. Identify all the forces acting on the object and their directions. Do not include forces acting on other objects in the problem. Also, do not include quantities, such as velocities and accelerations, that are not forces.
3. Draw the vectors for each force acting on your object of interest. When possible, the length of the force vectors you draw should represent the relative magnitudes of the forces acting on the object.

In most problems, after you have drawn the free-body diagrams, you will explicitly label your coordinate axes and directions. Always make the object of interest the origin of your coordinate system. Then you will need to divide the forces into *x* and *y* components, sum the *x* and *y* forces, and apply Newton's first or second law.

In this problem you will only draw the free-body diagram.

Suppose that you are asked to solve the following problem:
Chadwick is pushing a piano across a level floor (see the figure). The piano can slide across the floor without friction. If Chadwick applies a horizontal force to the piano, what is the piano's acceleration?
To solve this problem you should start by drawing a free-body diagram.



Part A

Determine the object of interest for the situation described in the problem introduction.

You did not open hints for this part.

ANSWER:

For this situation you should draw a free-body diagram for
- the floor.
- Chadwick.
- the piano.

Part B

This question will be shown after you complete previous question(s).

Part C

This question will be shown after you complete previous question(s).

Part D

This question will be shown after you complete previous question(s).

Part E

This question will be shown after you complete previous question(s).

Score Summary:

Your score on this assignment is 0.0%.
You received 0 out of a possible total of 195 points.