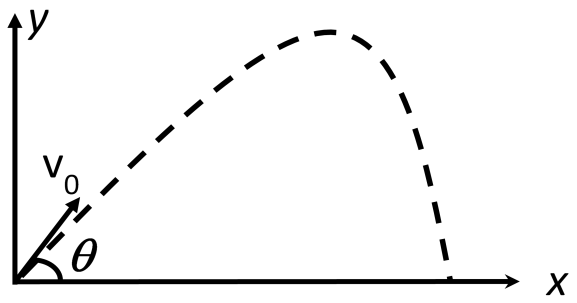
S21 MT1 Q1

A source in a laboratory experiment emits particles from the origin of the coordinate space with speed 2.4 $\mathrm{m/s}$ and at an angle 30.0° from the x axis. The experiment is designed so that the acceleration of the particles changes with time t as $\vec{a} = -2.4t\hat{j}$, and gravity can be ignored.



Part A

Find the x coordinate of the particles as a function of time.

ANSWER:

$x(t) =$ fr m

All attempts used; correct answer withheld by instructor

Part B

Find the y coordinate of the particles as functions of time.

ANSWER:

$y(t) =$ $jbhb$ m

✖ **Incorrect; Try Again; 2 attempts remaining**

Part C

Find the maximum value of y achieved during this trajectory.

ANSWER:

$y =$

Part D

Find the value of x where the particles hit y=0.

ANSWER:

$x =$

Part E

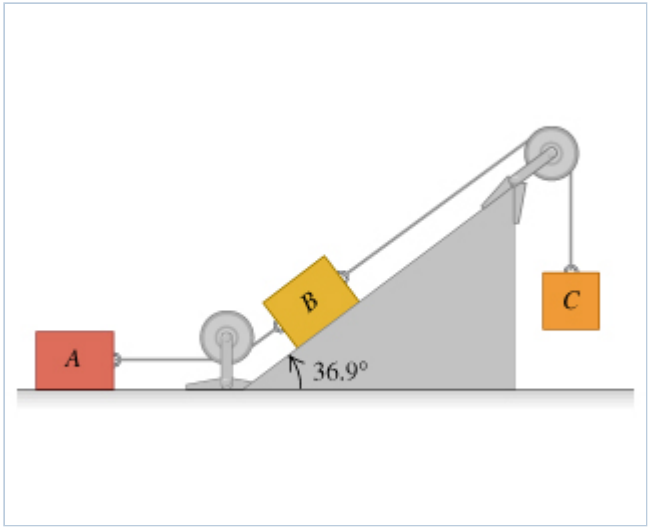
We design another experiment where the acceleration is given by $\vec{a} = -Dt^2\hat{j}$. What are the units of D? Use Standard International (SI) units in your answer.

ANSWER:

$[D] =$

Problem 5.103

Blocks *A*, *B*, and *C* are placed as in the figure and connected by ropes of negligible mass. Both *A* and *B* weigh 21.7 N each, and the coefficient of kinetic friction between each block and the surface is 0.35. Block *C* descends with constant velocity.



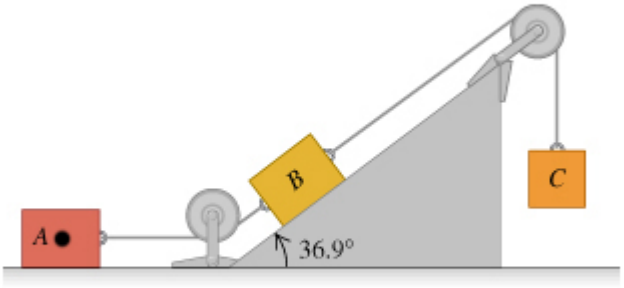
Part A

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:

No elements selected



Select the elements from the list and add them to the canvas setting the appropriate attributes.

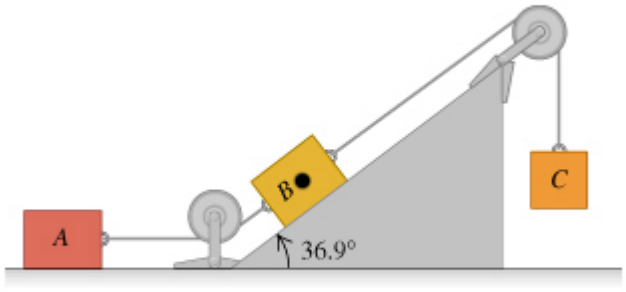
Part B

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:

No elements selected



Select the elements from the list and add them to the canvas setting the appropriate attributes.

Part C

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

Express your answer in newtons.

ANSWER:

T_1 = N

Part D

What is the weight of block *C*?

Express your answer in newtons.

ANSWER:

w_C = N

Part E

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

Express your answer in meters per second squared.

ANSWER:

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

Problem 3.43 - Copy - Copy

An airplane is heading due south at a speed of 440 $\mathrm{km/h}$. A wind begins blowing from the southwest at a speed of 30.0 $\mathrm{km/h}$.

Part A

Calculate the magnitude of velocity of the plane relative to the ground.

ANSWER:

v = $vvs \ \ km/h$

✖ **Incorrect; Try Again; 2 attempts remaining**

Part B

How far from its intended position will the plane be after 16 minutes if the pilot takes no corrective action?

ANSWER:

d = km

Part C

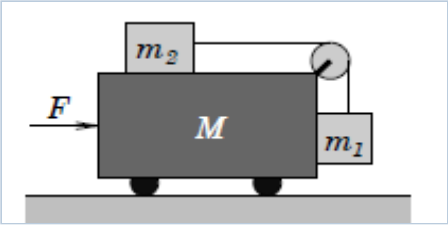
In what angle θ from south should the pilot aim the plane so that it will fly due south?

ANSWER:

θ = degree

Problem 3 - Copy

Masses m_1 =2.0 kg and m_2 =1.0 kg are placed on a mass M=9.0 kg as shown in the figure .g = 9.8 m/s^2.



Part A

What should be the value for Force F in order not to move m_1 and m_2 relative to M? Ignore any friction for this part.

Express your answer with the appropriate units.

ANSWER:

F =

Part B

Now assume that there is friction between ground and mass M. What should be the value for Force F in order not to move m_1 and m_2 relative to M? μ = 0.40.

Express your answer with the appropriate units.

ANSWER:

F =

Problem 5.101

A racetrack curve has radius 90.0 m and is banked at an angle of 21.0°. The coefficient of static friction between the tires and the roadway is 0.400. A race car with mass 1200 kg rounds the curve with the maximum speed to avoid skidding.

Part A

As the car rounds the curve, what is the normal force exerted on it by the road?

Express your answer with the appropriate units.

ANSWER:

$n =$ $bgdfgbd$ ddddddddddddddddddddddddddddddd

Part B

What is the car's radial acceleration?

Express your answer with the appropriate units.

ANSWER:

$a_{\mathrm{rad}} =$

Part C

What is the car's speed?

Express your answer with the appropriate units.

ANSWER:

$v =$