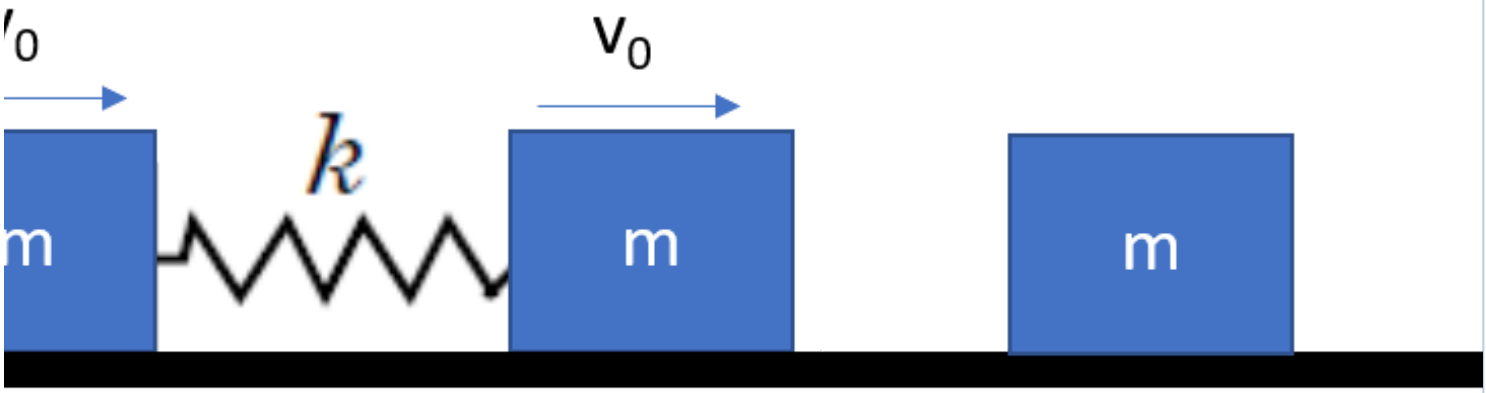
Midterm 2- Problem 1



All masses are same

Two blocks that have equal masses,m =8 kg are both moving with velocity $v0 = 9\ \mathrm{m/s}$. They are connected by a spring with spring constant $k = 10\ \mathrm{N/m}$, which is not compressed or stretched before the collision. The front block hits another block of the same mass, and gets stuck to it.

Part A

What is the velocity of the combined block immediately after the collision?

Express your answer with the appropriate units.

ANSWER:

v = 4.50 $\frac{\mathrm{m}}{\mathrm{s}}$

✔ **Correct**

Part B

What is the maximum compression in the spring?

Express your answer with the appropriate units.

ANSWER:

x_{max} = 10.8 m

✖ **Incorrect; Try Again; One attempt remaining**

Part C

If the collision were elastic, what would be the maximum compression in the spring?

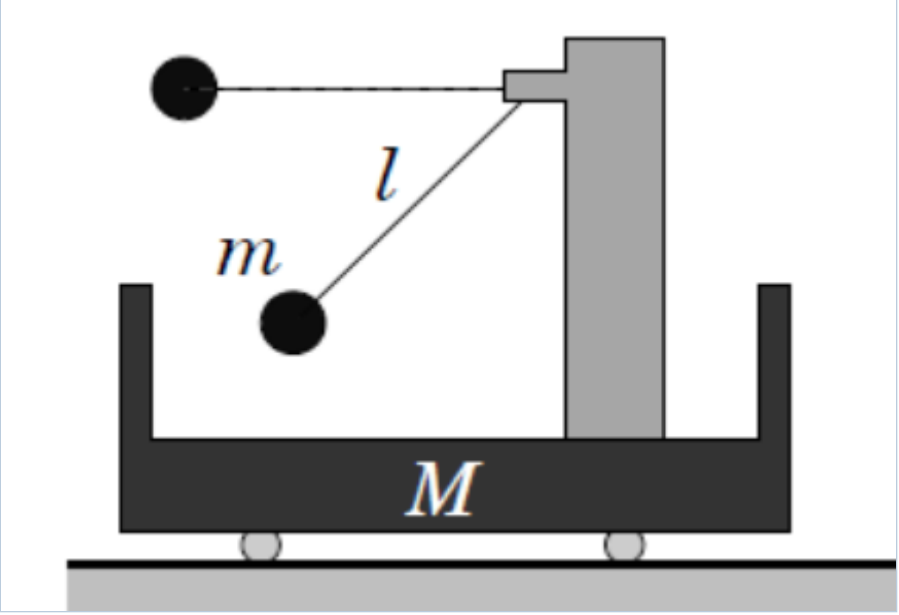
Express your answer with the appropriate units.

ANSWER:

x_{max} =

Midterm 2- Problem 2

A mass $m = 9\ \mathrm{kg}$ is connected to a massless rope with length $l = 10\ \mathrm{m}$ and hanged on a car with mass $M = 20\ \mathrm{kg}$ as shown in the figure. After the mass is released from rest at horizontal position, the mass sticks on the car (rope is vertical). Assume that there is no friction on any surface. (g= 9.8 m/s^2)



Part A

What is the velocity of the mass m just before the collision?

Express your answer with the appropriate units.

ANSWER:

v =

Part B

What is the velocity of the car with mass M after the collision?

Express your answer with the appropriate units.

ANSWER:

v =

Part C

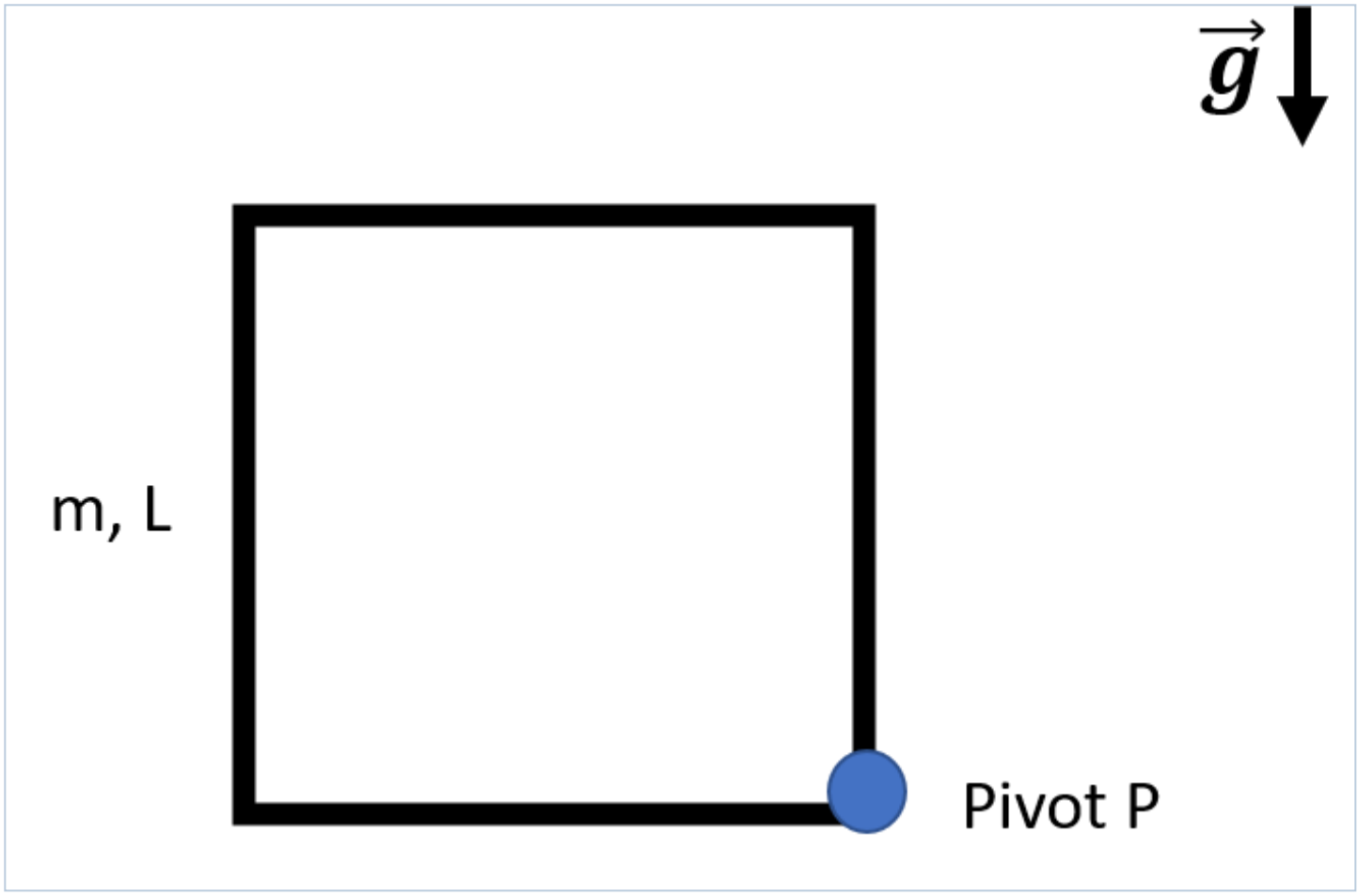
What distance does the car move?

Express your answer with the appropriate units.

ANSWER:

d =

Midterm 2- Problem 3



A square shaped frame is formed by uniform rods. The mass of the rod that forms the edges has mass $m = 7\ \mathrm{kg}$ and length L=10 m .The frame can rotate freely around pivot point P. The frame is released from rest in a horizontal position as shown in the figure and rotating under the action of gravitational force. (g= 9.8 m/s^2, I_{cm} for a rod of mass M and length L = 1/12 ML^2)

Part A

Find the moment of inertia of the body around the pivot axis.

Express your answer with the appropriate units.

ANSWER:

I =

Part B

Calculate the maximum angular velocity of the body.

Express your answer with the appropriate units.

ANSWER:

ω_{max} =

Part C

Calculate the maximum center of mass velocity of the body.

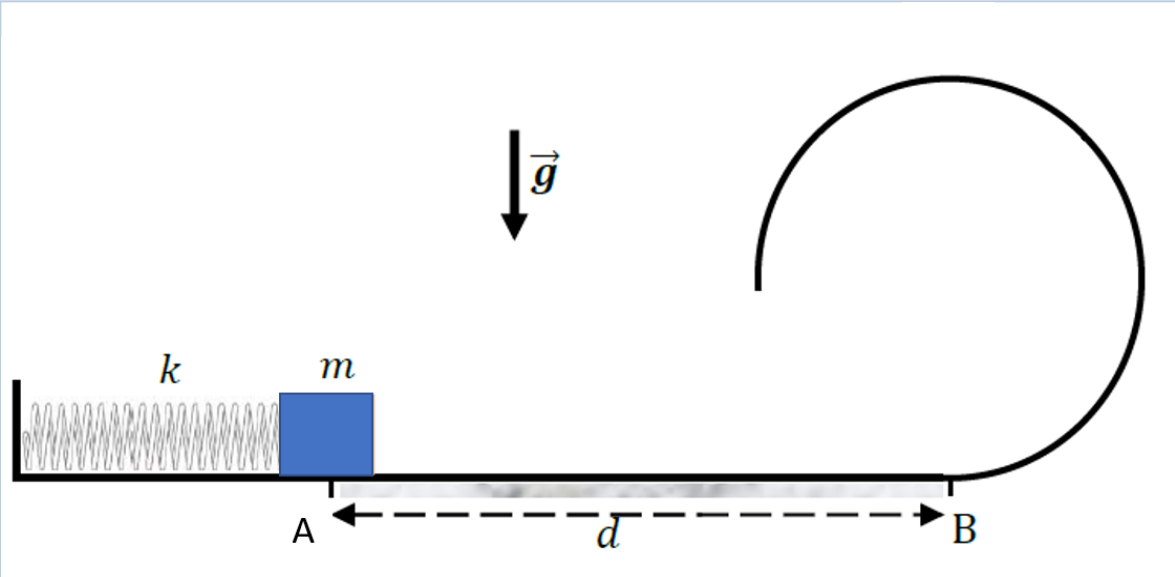
Express your answer with the appropriate units.

ANSWER:

$v_{cm,max}$ =

Midterm 2- Problem 4

A massless spring with spring constant $k = 12\ \mathrm{N/m}$ is compressed a distance of x with mass $m = 10\ \mathrm{kg}$. Mass and the spring are not connected. The spring is released at point A, the mass moves on a horizontal surface a distance $d = 4\ \mathrm{m}$ before moving around the circular track whose radius is $8\ \mathrm{m}$. From point A to B, the horizantal surface has the coefficient of friction μ=0.9, while the circular track is frictionless. (g=9.8 m/s^2)



Part A

What should be the minimum value of x, for mass to travel only the distance d to reach point B?

Express your answer with the appropriate units.

ANSWER:

x_{min} =

Part B

What should be the minimum value of x, for mass to travel around the circular track without losing contact at the top point?

Express your answer with the appropriate units.

ANSWER:

x_{min} =

Part C

Calculate the thermal energy release during the motion at Part B.

Express your answer with the appropriate units.

ANSWER:

$E_{thermal}$ =

Problem 7.74

A small object with mass m = 0.0900 kg moves along the $+x$-axis. The only force on the object is a conservative force that has the potential-energy function $U(x) = -\alpha x^2 + \beta x^3$, where $\alpha = 2.50\ \mathrm{J/m^2}$ and β = 0.300 $\mathrm{J/m^3}$. The object is released from rest at small x.

Part A

When the object is at x = 4.00 m, what is its speed?

Express your answer with the appropriate units.

ANSWER:

v =

Part B

When the object is at x = 4.00 m, what is the magnitude of its acceleration?

Express your answer with the appropriate units.

ANSWER:

a =

Part C Complete previous part(s) Instructors: View all hidden parts

Part D

What is the maximum value of x reached by the object during its motion?

Express your answer with the appropriate units.

ANSWER:

x_{max} =