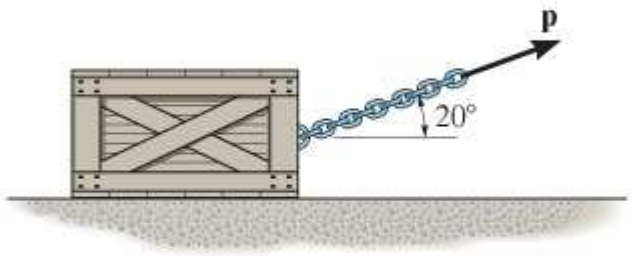
The crate has a mass of 80 kg and is being towed by a chain which is always directed at 20 $^{\circ}$ from the horizontal as shown.



Part A

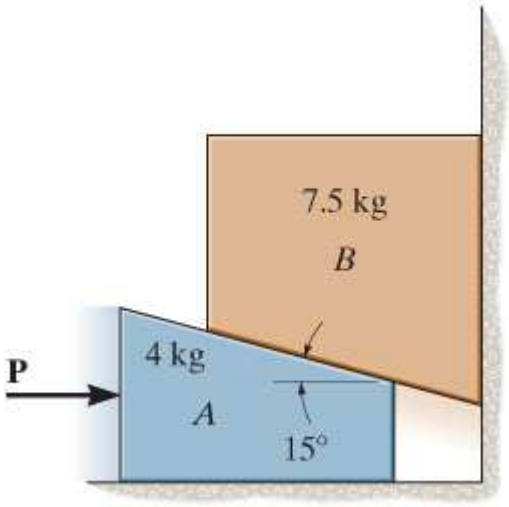
If the magnitude of $\mathbf{P}$ is increased until the crate begins to slide, determine the crate's initial acceleration if the coefficient of static friction is $\mu_s = 0.5$ and the coefficient of kinetic friction is $\mu_k = 0.3$.

Express your answer with the appropriate units.

a =1.66 $\frac{\mathrm{m}}{\mathrm{s}^2}$

Correct

C2 Practice Problem 1.2



Part A

If a horizontal force of P = 45 N is applied to block *A*, determine the acceleration of block *B*. Neglect friction. *Hint*: Show that $a_B = a_A \tan 15°$.

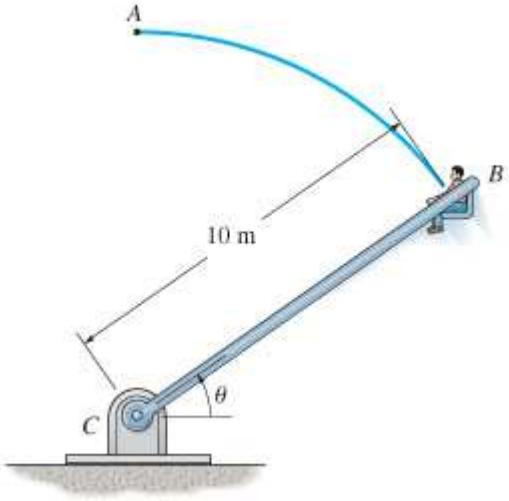
Express your answer with the appropriate units.

a_B =

Try Again

SC2 Practice Problem 2.1

The device shown is used to produce the experience of weightlessness in a passenger when he reaches point *A*, $\theta = 90^\circ$, along the path.



Part A

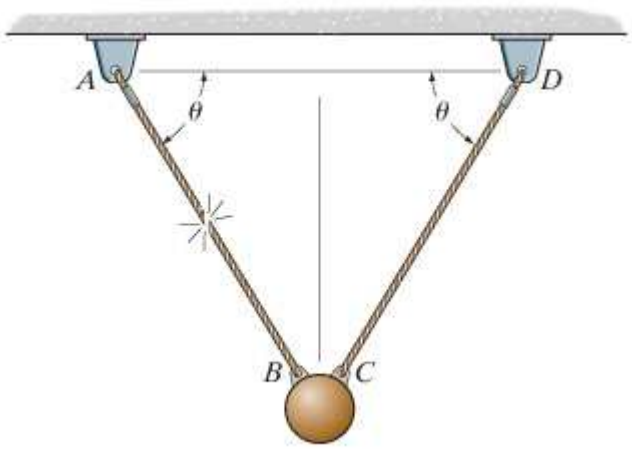
If the passenger has a mass of 75 kg, determine the minimum speed he should have when he reaches *A* so that he does not exert a normal reaction on the seat. The chair is pin-connected to the frame *BC* so that he is always seated in an upright position. During the motion his speed remains constant.

Express your answer with the appropriate units.

v =9.90 $\frac{\text{m}}{\text{s}}$

Correct

SC2 Practice Problem 2.2



Part A

Determine the tension in wire *CD* just after wire *AB* is cut. The small bob has a mass m.

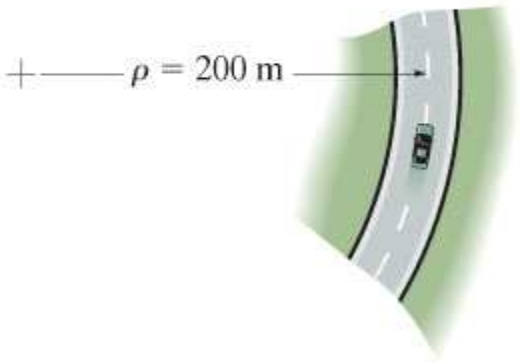
Express your answer in terms of the variables m, θ, and appropriate constants.

T_{CD} = $mg\sin(theta)$

Correct

submit | my answers | give up | review part

SC2 Practice Problem 2.3



Part A

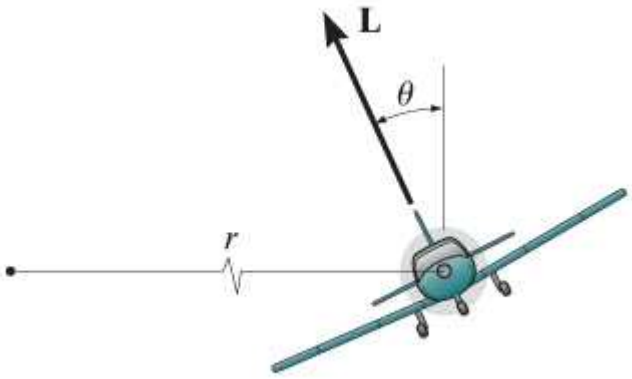
If the coefficient of static friction between the tires and the road surface is $\mu_s = 0.25$, determine the maximum speed of the 1.5 $-\mathrm{Mg}$ car without causing it to slide when it travels on the curve. Neglect the size of the car.

Express your answer with the appropriate units.

v_{max} =

SC2 Extra Practice Problem 2.4

A 5 $-\,\mathrm{Mg}$ airplane is flying at a constant speed of 350 $\mathrm{km/h}$ along a horizontal circular path of radius r = 3200 m.



Part A

Determine the uplift force $\mathbf{L}$ acting on the airplane. Neglect the size of the airplane.

Express your answer with the appropriate units.

L =

submit | my answers | give up | review part

Part B

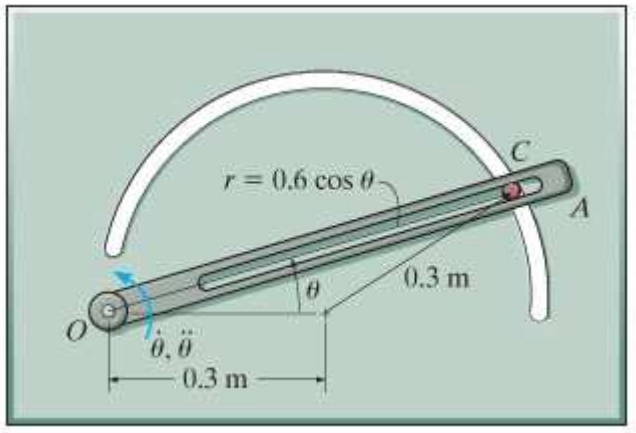
Determine the banking angle θ.

Express your answer with the appropriate units.

θ =

SC2 Practice Problem 3.1

Due to the constraint, the 0.5 $-\text{kg}$ cylinder *C* travels along the path described by $r = (0.6\cos\theta)\ \text{m}$.



Part A

If arm *OA* rotates counterclockwise with an angular velocity of $\dot{\theta} = 2\ \text{rad/s}$ and an angular acceleration of $\ddot{\theta} = 0.8\ \text{rad/s}^2$ at the instant $\theta = 30°$, determine the force exerted by the arm on the cylinder at this instant. The cylinder is in contact with only one edge of the smooth slot, and the motion occurs in the horizontal plane.

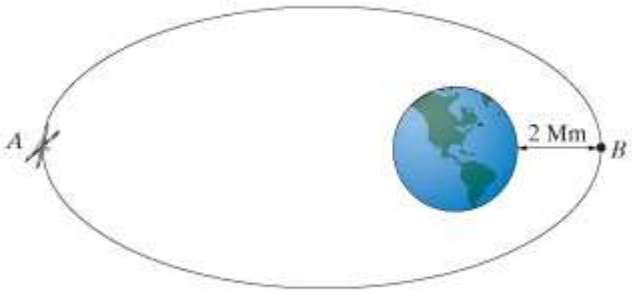
Express your answer with the appropriate units.

F =

Try Again

C2 Practice Problem 3.2

The satellite is moving in an elliptical orbit with an eccentricity 0.29.



Part A

Determine its speed when it is at its maximum distance *A* from the earth.

Express your answer with the appropriate units.

v_A =

submit | my answers | give up | review part

Part B

Determine its speed when it is at its minimum distance *B* from the earth.

Express your answer with the appropriate units.

v_B =

C2 Practice Problem 3.3

A communications satellite is to be placed into an equatorial circular orbit around the earth so that it always remains directly over a point on the earth's surface.

Part A

If this requires the period to be 24 hours (approximately), determine the radius of the orbit.

Express your answer with the appropriate units.

r =

submit | my answers | give up | review part

Part B

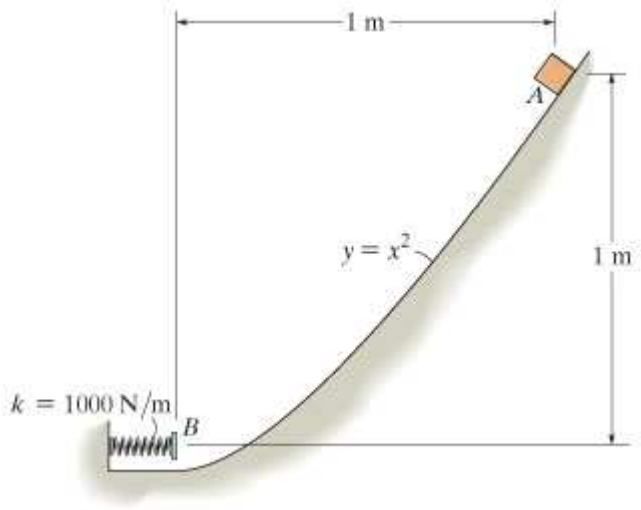
Determine the satellite's velocity.

Express your answer with the appropriate units.

v =

C3 Practice Problem 1.1

The 3-kg block is released from rest at *A* and slides down the smooth parabolic surface.



Part A

Determine the maximum compression of the spring.

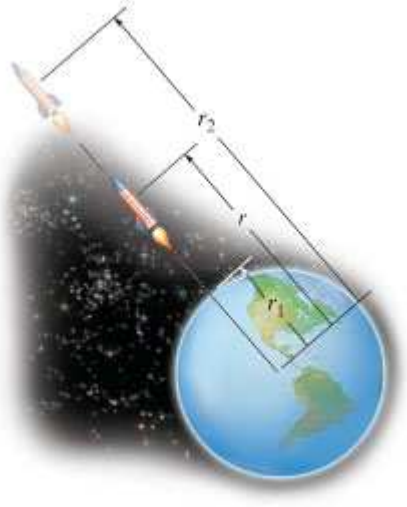
Express your answer with the appropriate units.

s =0.243 m

Correct

SC3 Practice Problem 1.2

A rocket of mass m is fired vertically from the surface of the earth, i.e., at $r = r_1$.



Part A

Assuming no mass is lost as it travels upward, determine the work it must do against gravity to reach a distance r_2. The force of gravity is $F = GM_e m/r^2$, where M_e is the mass of the earth and r the distance between the rocket and the center of the earth.

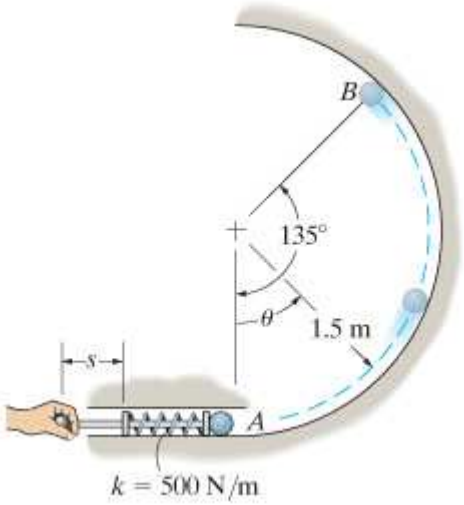
Express your answer in terms of some or all of the variables m, M_e, r_1, r_2, G.

$U_{1-2} = -G \cdot M_e \cdot m \cdot \left(\frac{1}{r_2} - \frac{1}{r_1}\right)$

Correct

SC3 Practice Problem 1.3

The 0.2-kg ball of negligible size is fired up the smooth vertical circular track using the spring plunger.



Part A

The plunger keeps the spring compressed 0.03 m when s = 0.Determine how far s it must be pulled back and released so that the ball will begin to leave the track when θ = 135 $^\circ$.

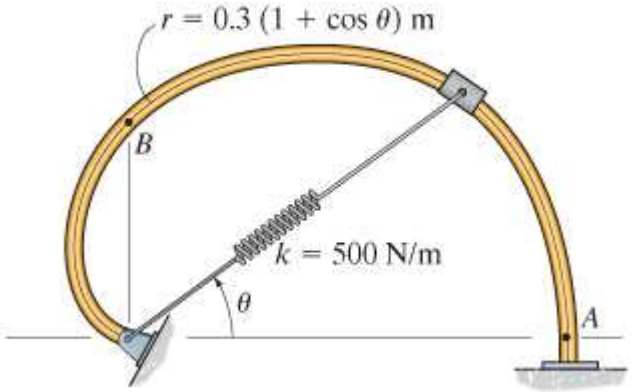
Express your answer with the appropriate units.

s =0.129 m

Correct

SC3 Practice Problem 2.1

The 5-kg collar slides along the smooth vertical rod.



Part A

If the collar is nudged from rest at *A*, determine its speed when it passes point *B*. The spring has an un stretched length of 200 mm.

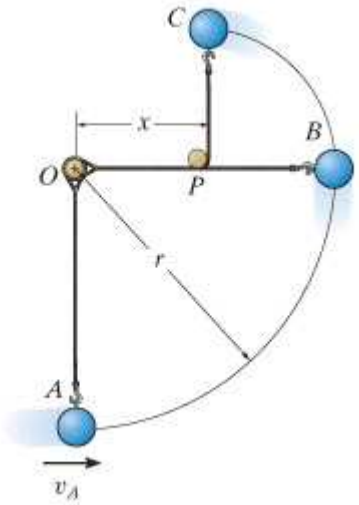
Express your answer with the appropriate units.

v_B =3.02 $\frac{\mathrm{m}}{\mathrm{s}}$

Correct

SC3 Practice Problem 2.2

The ball of mass m is given a speed of $v_A = \sqrt{5gr}$ at position *A*. When it reaches *B*, the cord hits the peg *P*, after which the ball describes a smaller circular path.



Part A

If $x = \frac{2}{3}r$, determine the speed of the ball when it is at the highest point *C*.

Express your answer in terms of some or all of the variables m, g, r.

v_C = $\sqrt{\frac{7}{3} \cdot g \cdot r}$

Correct

submit | my answers | give up | review part

Part B

Determine the tension in the cord when it is at the highest point *C*.

Express your answer in terms of some or all of the variables m, g, r.

T = $6 \cdot m \cdot g$

Correct

C3 Practice Problem 3.1

The 5.0 Mg humpback whale is stuck on the shore due to changes in the tide. In an effort to rescue the whale, a 14 Mg tugboat is used to pull it free using an inextensible rope tied to its tail.

Part A

To overcome the frictional force of the sand on the whale, the tug backs up so that the rope becomes slack and then the tug proceeds forward at 3 $\mathrm{m/s}$. If the tug then turns the engines off, determine the average frictional force $\mathbf{F}$ on the whale if sliding occurs for 2.0 s before the tug stops after the rope becomes taut.

Express your answer with the appropriate units.

F =21.0 kN

Correct

submit my answers give up review part

Part B

Also, what is the average force on the rope during the tow?

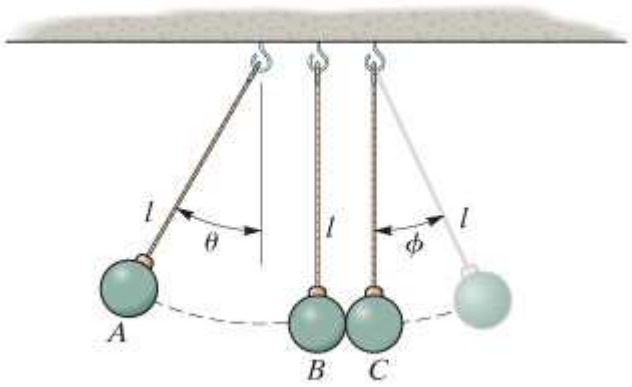
Express your answer with the appropriate units.

T =21.0 kN

Correct

SC3 Practice Problem 3.2

The three balls each have a mass of m = 3 kg and are hanging down ropes with a length of l = 1 m.



Part A

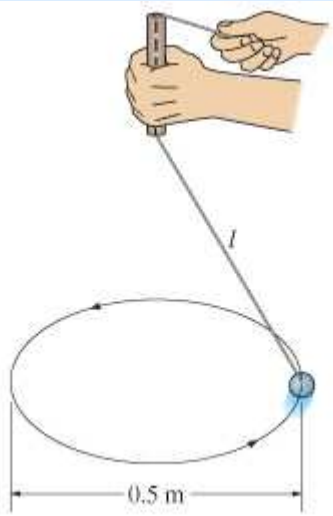
If A is released from rest at θ = 85 deg, determine the angle ϕ to which C rises after collision. The coefficient of restitution between each ball is e = 0.9.

ϕ =1.31 rad

Correct

SC3 Practice Problem 3.3

The 2 kg ball rotates around a 0.5 m diameter circular path with a constant speed.



Part A

If the cord length is shortened from $l = 1\ \mathrm{m}$ to $l' = 0.5\ \mathrm{m}$, by pulling the cord through the tube, determine the new diameter of the path d'.

d' = m

submit | my answers | give up | review part

Part B

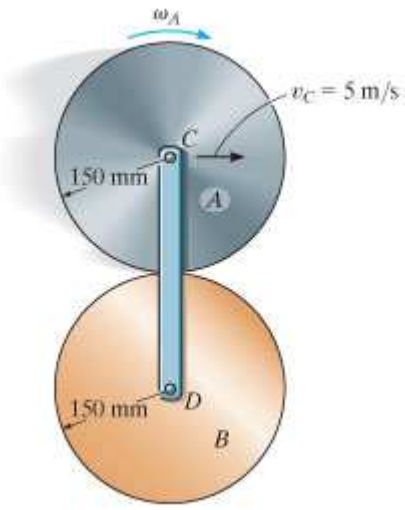
Also, what is the tension in the cord in each case?

Enter your answers numerically separated by a comma.

T_1, T_2 = N

SC4 Practice Problem 1.1

Disk A rolls without slipping over the surface of the fixed cylinder B.



Part A

Determine the angular velocity of A if its center C has a speed $v_C = 5\ \text{m/s}$.

Express your answer with the appropriate units.

ω =33.3 $\frac{\text{rad}}{\text{s}}$

Correct

submit | my answers | give up | review part

Part B

How many revolutions will A rotate about its center just after link DC completes one revolution?

θ =2.00 rev.

Correct

SC4 Practice Problem 1.2

Piston P moves upward with a velocity of 7.5 m/s at the instant shown.

Part A

Determine the angular velocity of the crankshaft AB at this instant.

$\frac{\text{rad}}{\text{s}}$

330

Correct

The hydraulic cylinder D extends with a velocity of v_B = 1.2 m/s and an acceleration of a_B = 0.45 m/s^2.

Part A

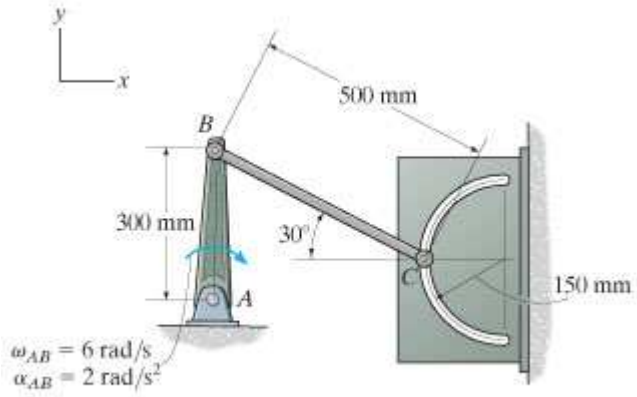
Determine the acceleration of A at the instant shown.

a_A =3.95 $\frac{\text{m}}{\text{s}^2}$

Correct

SC4 Practice Problem 2.1

Crank *AB* rotates with an angular velocity of $\omega_{AB} = 6\ \text{rad/s}$ and an angular acceleration of $\alpha_{AB} = 2\ \text{rad/s}^2$.



Part A

Determine the acceleration of *C* at the instant shown.

Enter the x and y components of the acceleration separated by a comma.

$(a_C)_x$, $(a_C)_y$ =64.8,152 m/s^2

Correct

submit | my answers | give up | review part

Part B

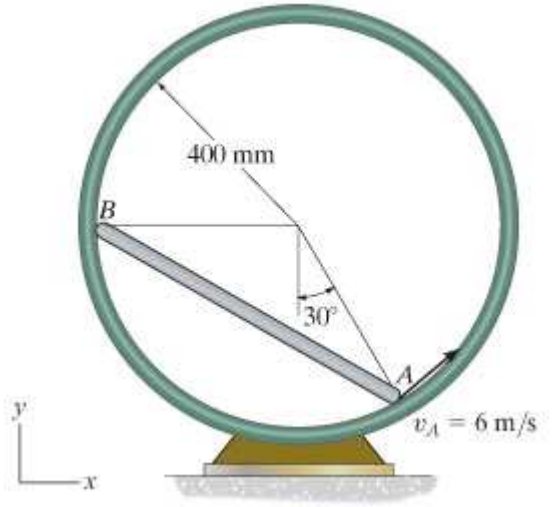
Determine the angular acceleration of *BC* at the instant shown. Assume the counterclockwise rotation as positive.

Express your answer with the appropriate units.

α_{BC} =347 $\frac{\text{rad}}{\text{s}^2}$

Correct

SC4 Practice Problem 2.2



Part A

If end *A* of the rod moves with a constant velocity of $v_A = 6\ \text{m/s}$, determine the angular velocity of the rod at the instant shown. Assume the counterclockwise rotation as positive.

Express your answer with the appropriate units.

ω_{AB} =15.0 $\frac{\text{rad}}{\text{s}}$

Correct

submit | my answers | give up | review part

Part B

Determine the angular acceleration of the rod at the instant shown.

Express your answer with the appropriate units.

α_{AB} =0 $\frac{\text{rad}}{\text{s}^2}$

Correct

submit | my answers | give up | review part

Part C

Determine the acceleration of end *B* at the instant shown.

Enter the x and y components of the acceleration separated by a comma.

$(a_B)_x$, $(a_B)_y$ =90.0,0.00×10^0 m/s^2

Correct

C4 Practice Problem 2.3

Determine the angular velocity and the angular acceleration of the plate CD of the stone-crushing mechanism at the instant AB is horizontal. At this instant $\theta = 30°$ and $\phi = 90°$. Driving link AB is turning with a constant angular velocity of $\omega_{AB} = 4\ rad/s$.

Part A

What is the angular velocity of the plate CD of the stone-crushing mechanism at the instant AB is horizontal?

ω_{CD} =1.00 $\frac{\text{rad}}{\text{s}}$

Correct

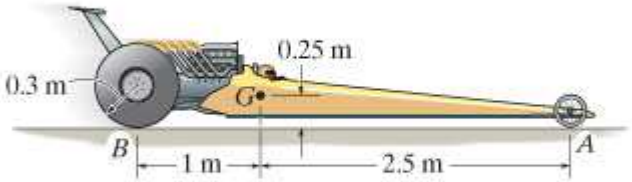
submit my answers give up review part

Part B

What is the angular acceleration of the plate CD of the stone-crushing mechanism at the instant AB is horizontal?

α_{CD} =

Completed; correct answer withheld by instructor



Part A

If no slipping occurs, determine the frictional force $\mathbf{F_B}$ which must be developed at each of the rear drive wheels B in order to create an acceleration of $a = 7\ \mathrm{m/s^2}$. Neglect the mass of the wheels and assume that the front wheels are free to roll.

Express your answer with the appropriate units.

F_B =

submit | my answers | give up | review part

Part B

What are the normal reactions of each wheel on the ground?

Express your answer with the appropriate units.

N_A =

submit | my answers | give up | review part

Part C

Express your answer with the appropriate units.

N_B =

SC4 Practice Problem 3.2

The pendulum consists of a 15-kg sphere and a 5-kg slender rod.

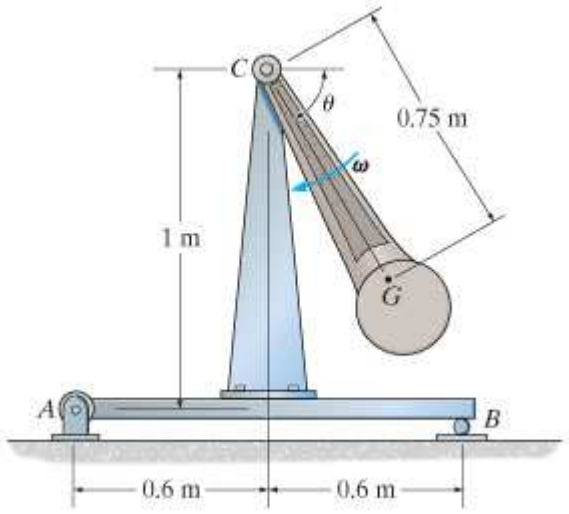
Part A

Compute the reaction at the pin O just after the cord AB is cut.

F_O =

SC4 Practice Problem 3.3

The 110 kg pendulum has a center of mass at G and a radius of gyration about G of $k_G = 250\,\text{mm}$.



Part A

Determine the horizontal component of reaction on the beam by the pin A at the instant $\theta = 0°$ when the pendulum is rotating at $\omega = 5\ \text{rad/s}$. Neglect the weight of the beam and the support.

Express your answer with the appropriate units.

A_x =

submit | my answers | give up | review part

Part B

Determine the vertical component of reaction on the beam by the pin A at the instant $\theta = 0°$ when the pendulum is rotating at $\omega = 5\ \text{rad/s}$.

Express your answer with the appropriate units.

A_y =

submit | my answers | give up | review part

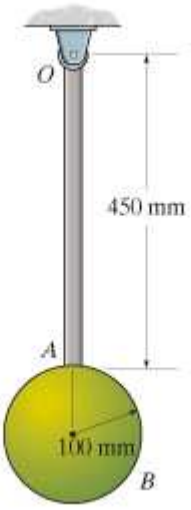
Part C

Determine the normal reaction of the roller B at the instant $\theta = 0°$ when the pendulum is rotating at $\omega = 5\ \text{rad/s}$.

Express your answer with the appropriate units.

N_B =

SC5 Practice Problem 1.1



Part A

Determine the mass moment of inertia of the pendulum about an axis perpendicular to the page and passing through point O. The slender rod has a mass of 10 kg and the sphere has a mass of 14 kg.

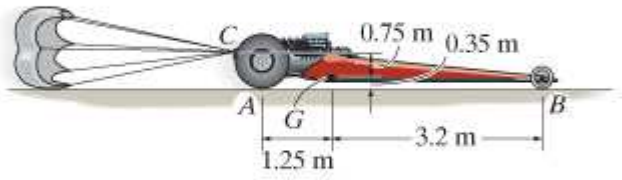
Express your answer with the appropriate units.

I_O =4.97 $\text{kg}\cdot\text{m}^2$

Correct

SC5 Practice Problem 1.2

The dragster has a mass of 1380 kg and a center of mass at G.



Part A

If a braking parachute is attached at C and provides a horizontal braking force of $F = (1.6v^2)\,\text{N}$, where v is in meters per second, determine the critical speed the dragster can have upon releasing the parachute, such that the wheels at B are on the verge of leaving the ground; i.e., the normal reaction at B is zero.

Express your answer with the appropriate units.

v =119 $\frac{\text{m}}{\text{s}}$

Correct

submit my answers give up review part

Part B

If such a condition occurs, determine the dragster's initial deceleration. Neglect the mass of the wheels and assume the engine is disengaged so that the wheels are free to roll.

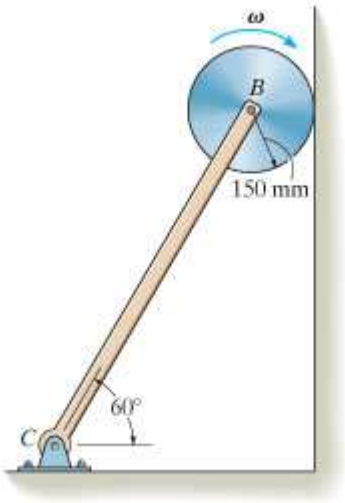
Express your answer with the appropriate units.

a_G =16.4 $\frac{\text{m}}{\text{s}^2}$

Correct

SC5 Practice Problem 1.3

The disk has a mass of $20\,\text{kg}$ and is originally spinning at the end of the strut with an angular velocity of $\omega = 60\,\text{rad/s}$.



Part A

If it is then placed against the wall, where the coefficient of kinetic friction is $\mu_k = 0.3$, determine the time required for the motion to stop.

Express your answer with the appropriate units.

t =3.11 s

Correct

submit my answers give up review part

Part B

What is the force in strut BC during this time?

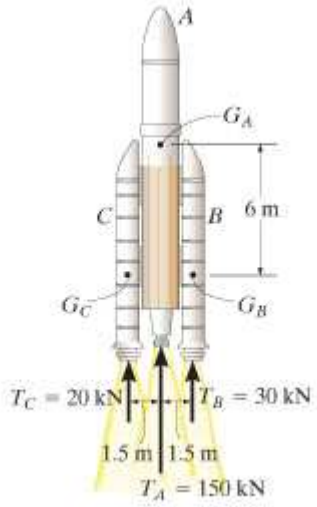
Express your answer with the appropriate units.

F_{CB} =193 N

Correct

SC5 Practice Problem 2.1

The rocket consists of the main section A having a mass of $10\,\text{Mg}$ and a center of mass at G_A. The two identical booster rockets B and C each have a mass of $2\,\text{Mg}$ with centers of mass at G_B and G_C, respectively. At the instant shown, the rocket is traveling vertically and is at an altitude where the acceleration due to gravity is $g = 8.75\,\text{m/s}^2$.



Part A

If the booster rockets B and C suddenly supply a thrust of $T_B = 30\,\text{kN}$ and $T_C = 20\,\text{kN}$, respectively, determine the angular acceleration of the rocket. The radius of gyration of A about G_A is $k_A = 2\,\text{m}$ and the radii of gyration of B and C about G_B and G_C are $k_B = k_C = 0.75\,\text{m}$.

Express your answer with the appropriate units.

α =9.73×10^{-2} $\dfrac{\text{rad}}{\text{s}^2}$

Correct

submit | my answers | give up | review part

Part B

And what is the acceleration of the center of mass of the rocket as a whole G

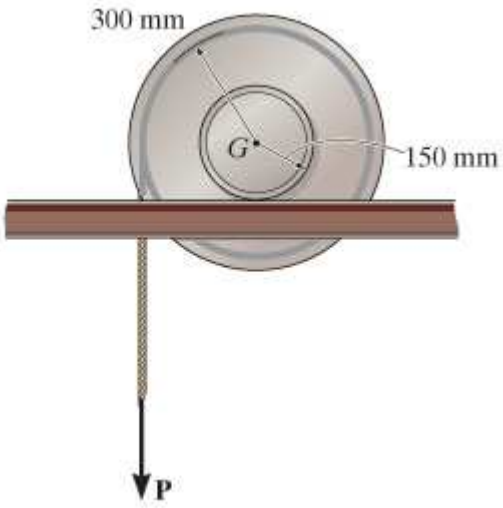
Express your answer with the appropriate units.

a_G =5.54 $\dfrac{\text{m}}{\text{s}^2}$

Correct

C5 Practice Problem 2.2

The spool has a mass of $100\,\text{kg}$ and a radius of gyration of $k_G = 200\,\text{mm}$ about its center of mass G.



Part A

If a vertical force of $P = 500\,\text{N}$ is applied to the cable, determine the acceleration of G. The coefficients of static and kinetic friction between the rail and the spool are $\mu_s = 0.2$ and $\mu_k = 0.15$, respectively.

Express your answer with the appropriate units.

a_G =2.22 $\frac{\text{m}}{\text{s}^2}$

Correct

submit my answers give up review part

Part B

Determine the angular acceleration of the spool.

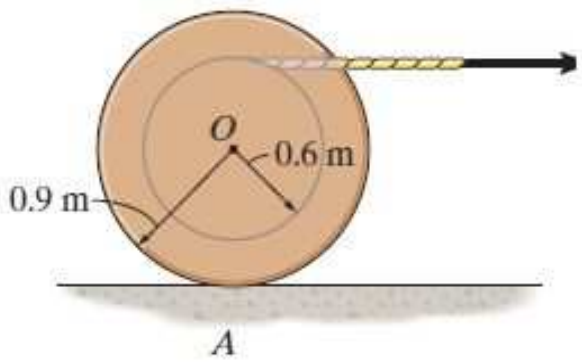
Express your answer with the appropriate units.

α =29.2 $\frac{\text{rad}}{\text{s}^2}$

Correct

SC5 Practice Problem 3.1

The spool has a weight of 75 kg and a radius of gyration k_O = 0.675 m.



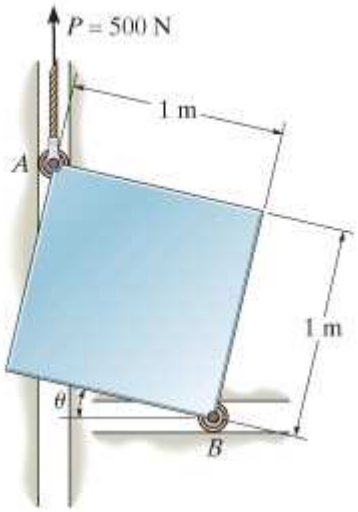
Part A

If a cord is wrapped around its inner core and the end is pulled with a horizontal force of P = 200 N, determine the angular velocity of the spool after the center O has moved 3 m to the right. The spool starts from rest and does not slip at A as it rolls. Neglect the mass of the cord.

ω =4.59 $\frac{\text{rad}}{\text{s}}$

Correct

SC5 Practice Problem 3.2



Part A

If corner A of the 60 kg plate is subjected to a vertical force of $P = 500\ \text{N}$, and the plate is released from rest when $\theta = 0°$, determine the angular velocity of the plate when $\theta = 0°$.

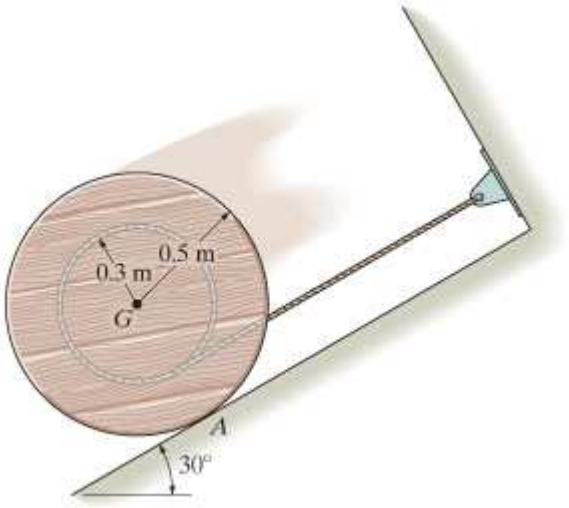
Express your answer with the appropriate units. Assume the counterclockwise rotation as positive.

ω_2 =-2.06 $\frac{\text{rad}}{\text{s}}$

Correct

SC6 Practice Problem 1.1

The spool has a mass of 60 kg and a radius of gyration k_G = 0.30 m.



Part A

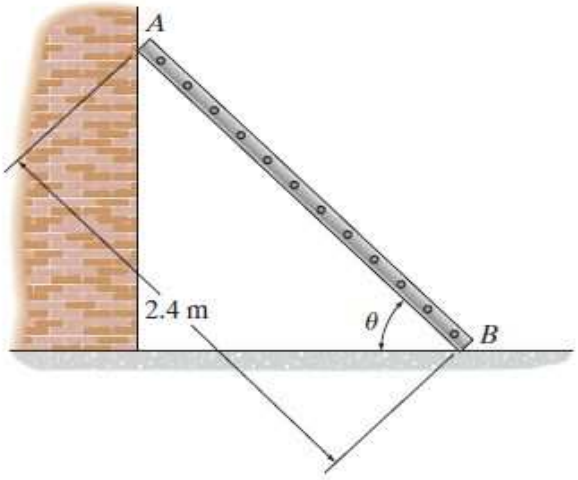
If it is released from rest, determine how far its center descends down the plane before it attains an angular velocity of ω = 6 $\mathrm{rad/s}$. Neglect the mass of the cord which is wound around the central core. The coefficient of kinetic friction between the spool and plane at A is $\mu_k = 0.2$.

Express your answer with the appropriate units.

s_G =

SC6 Practice Problem 1.2

The 15- kg ladder is placed against the wall at an angle of $\theta = 45°$ as shown.



Part A

If it is released from rest, determine its angular velocity at the instant just before $\theta = 0°$. Neglect friction and assume the ladder is a uniform slender rod.

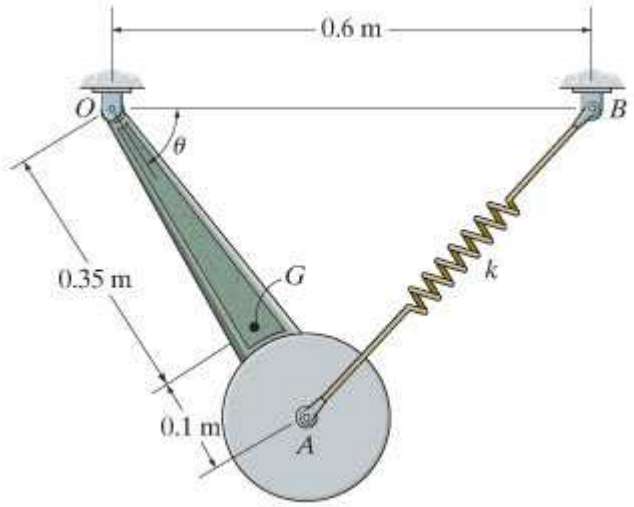
Express your answer with the appropriate units.

ω =2.94 $\frac{\text{rad}}{\text{s}}$

Correct

SC6 Practice Problem 2.1

The 34 kg pendulum has its mass center at G and a radius of gyration about point G of k_G = 310 mm .



Part A

If it is released from rest when $\theta = 0°$, determine its angular velocity at the instant $\theta = 90°$. Spring AB has a stiffness of k = 300 $\mathrm{N/m}$ and is unstretched when $\theta = 0°$.

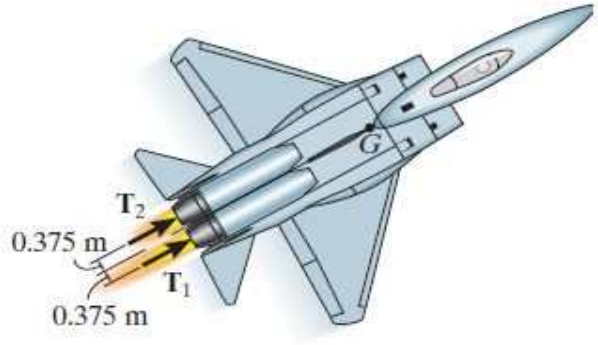
Express your answer with the appropriate units. Assume the counterclockwise rotation as positive.

ω =-4.11 $\frac{\mathrm{rad}}{\mathrm{s}}$

Correct

C6 Practice Problem 2.2

The pilot of a crippled jet was able to control his plane by throttling the two engines. If the plane has a mass of 8500 kg and a radius of gyration of k_G = 1.41 m about the mass center G, determine the angular velocity of the plane and the velocity of its mass center G in t = 5 s if the thrust in each engine is altered to T_1 = 25 kN and T_2 = 4 kN as shown. Originally the plane is flying straight at 360 m/s. Neglect the effects of drag and the loss of fuel.



Part A

What is the angular velocity of the plane?

Express your answer with the appropriate units. Assume the counterclockwise rotation as positive.

ω =2.33 $\frac{\text{rad}}{\text{s}}$

Correct

submit my answers give up review part

Part B

What is the velocity of the plane's mass center?

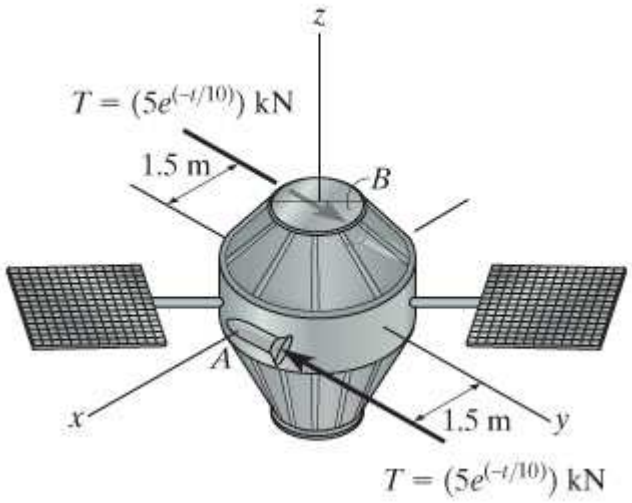
Express your answer with the appropriate units.

v_G =377 $\frac{\text{m}}{\text{s}}$

Correct

6 Practice Problem 3.1

The 195 kg satellite has a radius of gyration about the centroidal z axis of k_z = 1.25 m. Initially it is rotating with a constant angular velocity of $\omega_0 = \{1500\,\mathbf{k}\}\ \mathrm{rev/min}$.



Part A

If the two jets A and B are fired simultaneously and produce a thrust of $T = (5e^{-0.1t})\ \mathrm{kN}$, where t is in seconds, determine the angular velocity of the satellite, five seconds after firing.

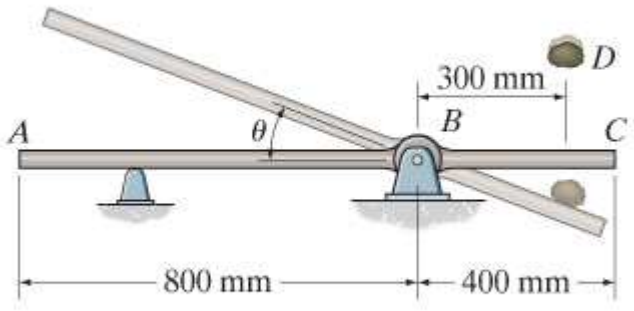
Enter the x, y, and z components of the angular velocity separated by commas.

$\omega_x,\ \omega_y,\ \omega_z$ = $\mathrm{rad/s}$

Try Again

SC6 Practice Problem 3.2

A 2 kg mass of putty D strikes the uniform 10 kg plank ABC with a velocity of 10 m/s.



Part A

If the putty remains attached to the plank, determine the maximum angle θ of swing before the plank momentarily stops. Neglect the size of the putty.

Express your answer with the appropriate units.

θ =47.4 °

Correct