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? Help

HW #4: Circular and rotational dynamics

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HW #4: Circular and rotational dynamics

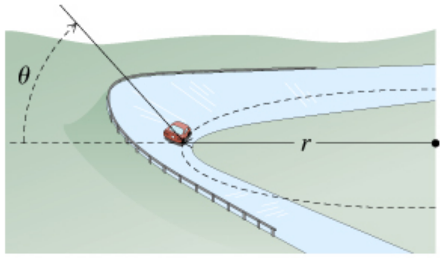
Due: 11:59pm on Wednesday, October 9, 2024

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

± Banked Frictionless Curve, and Flat Curve with Friction

Description: ± Includes Math Remediation. Examine the motion of a car under two different circumstances--a banked zero-friction road and a flat road with friction.

A car of mass M = 1500 kg traveling at 40.0 $\mathrm{km/hour}$ enters a banked turn covered with ice. The road is banked at an angle θ, and there is no friction between the road and the car's tires as shown in . Use g = 9.80 $\mathrm{m/s^2}$ throughout this problem.



Part A

What is the radius r of the turn if θ = 20.0 $^\circ$ (assuming the car continues in uniform circular motion around the turn)?

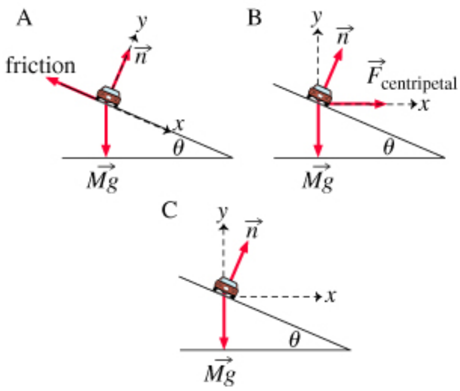
Express your answer in meters.

Hint 1. How to approach the problem

You need to apply Newton's 2nd law to the car. Because you do not want the car to slip as it goes around the curve, the car needs to have a net acceleration of magnitude v^2/r pointing radially inward (toward the center of the curve).

Hint 2. Identify the free-body diagram and coordinate system

Which of the following diagrams represents the forces acting on the car and the most appropriate choice of coordinate axes?



ANSWER:

- ○ Figure A
- ○ Figure B
- ◉ Figure C

The choice of coordinate system shown in this free-body diagram is the most appropriate for this problem. The car must have a net acceleration toward the center of the curve to maintain its motion and not slip. This implies that the net force must be along the *x* axis.

Hint 3. Calculate the normal force

Find n, the magnitude of the normal force between the car and the road. Take the positive *x* axis to point horizontally toward the center of the curve and the positive *y* axis to point vertically upward.

Express your answer in newtons.

Hint 1. Consider the net force

The only forces acting on the car are the normal force and gravity. There must be a net acceleration in the horizontal direction, but because the car does not slip, the net acceleration in the *vertical* direction must be zero. Use this fact to find n.

Hint 2. Apply Newton's 2nd law to the car in the *y* direction

Which equation accurately describes the equation for the net force acting on the car in the *y* direction?

ANSWER:

- ○ $\sum F_y = n\cos\theta + Mg$
- ○ $\sum F_y = n\sin\theta + Mg$
- ◉ $\sum F_y = n\cos\theta - Mg$
- ○ $\sum F_y = n\sin\theta - Mg$

ANSWER:

$n = \frac{Mg}{\cos(\theta)}$ = 1.56×10^4 N

Hint 4. Determine the acceleration in the horizontal plane

Take the *y* axis to be vertical and let the *x* axis point horizontally toward the center of the curve. By applying $\sum F_x = Ma_x$ in the horizontal direction, determine a, the magnitude of the acceleration, using your result for the normal force.

Express your answer in meters per second squared.

Hint 1. Apply Newton's 2nd law to the car in the *x* direction

Which equation accurately describes the equation for the net force acting on the car in the *x* direction?

ANSWER:

- ○ $\sum F_x = n\cos\theta$
- ◉ $\sum F_x = n\sin\theta$
- ○ $\sum F_x = n\cos\theta + \frac{Mv^2}{r}$
- ○ $\sum F_x = n\cos\theta - \frac{Mv^2}{r}$

ANSWER:

$a = g\tan(\theta)$ = 3.57 $\mathrm{m/s^2}$

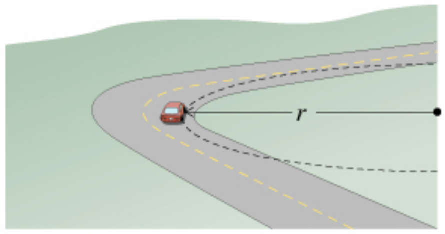
Now use this result and the fact that $a = v^2/r$ to solve for r.

ANSWER:

$r = \frac{v_c^2}{g\tan(\theta)}$ = 34.6 m

Part B

Now, suppose that the curve is level ($\theta = 0$) and that the ice has melted, so that there is a coefficient of static friction μ between the road and the car's tires as shown in . What is $\mu_{\rm min}$, the minimum value of the coefficient of static friction between the tires and the road required to prevent the car from slipping? Assume that the car's speed is still 40.0 $\mathrm{km/hour}$ and that the radius of the curve is 34.6 m .



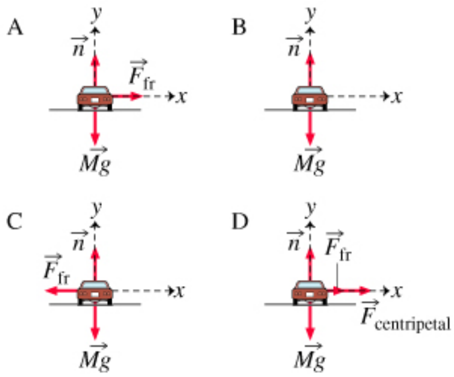
Express your answer numerically.

Hint 1. How to approach the problem

You need to apply Newton's 2nd law to the car. Because you do not want the car to slip as it goes around the curve, the car needs to have a net acceleration of magnitude v^2/r pointing radially inward (toward the center of the curve).

Hint 2. Identify the correct free-body diagram

Which of the following diagrams represents the forces acting on the car as it goes around the curve? $F_{\rm fr}$ represents the friction



force.

ANSWER:

- Figure A
- Figure B
- Figure C
- Figure D

This diagram indicates that the net force acting on the car in the *x* direction is equal to the force of friction.

Hint 3. Calculate the net force

What is the net force $F_{\rm net}$ that acts on the car?

Express your answer in newtons.

Hint 1. How to determine the net force

Newton's 2nd law tells you that

$$\sum \vec{F} = m\vec{a}.$$

Because you do not want the car to slip as it goes around the curve, the car needs to have a net acceleration of magnitude v^2/r pointing radially inward (toward the center of the curve).

ANSWER:

$F_{\rm net}$ = $\frac{Mv_c^2}{r}$ = 5350 N

Hint 4. Calculate the friction force

If the coefficient of friction were equal to $\mu_{\rm min}$, what would be $F_{\rm fr}$, the magnitude of the force provided by friction? Let m be the mass of the car and g be the acceleration due to gravity.

Hint 1. Equation for the force of friction

The force of friction is given by

$$F_{\rm fr} = \mu n.$$

Hint 2. Find the normal force

What is the normal force n acting on the car?

Enter your answer in newtons.

Hint 1. Acceleration in the *y* direction

Because the car is neither sinking into the road nor levitating, you can conclude that $a_y = 0$.

ANSWER:

n = Mg = 1.47×10^4 N

ANSWER:

- ○ $F_{\rm fr} = \frac{\mu_{\rm min}}{Mg}$
- ◉ $F_{\rm fr} = \mu_{\rm min} Mg$

ANSWER:

$\mu_{\rm min}$ = $\frac{\frac{v_c^2}{r}}{g}$ = 0.364

Problem 8.25 - Enhanced - with Video Solution

Description: [[Video Tutor Solution]] A ## g ball swings in a vertical circle at the end of a 1.5-m-long string. When the ball is at the bottom of the circle, the tension in the string is ## N. For help with math skills, you may want to review: Mathematical...

A 400 $\rm g$ ball swings in a vertical circle at the end of a 1.5-$\rm m$-long string. When the ball is at the bottom of the circle, the tension in the string is 15 $\rm N$.

For help with math skills, you may want to review: Mathematical Expressions Involving Squares

For general problem-solving tips and strategies for this topic, you may want to view a Video Tutor Solution of Vertical circle.

Part A

What is the speed of the ball at that point?

Express your answer with the appropriate units.

ANSWER:

v = $\sqrt{\frac{\left(F - \frac{9.8m}{1000}\right) \cdot 1.5 \cdot 1000}{m}}$ = 6.4 $\frac{\rm m}{\rm s}$

Problem 8.26 - Enhanced - with Expanded Hints

Description: [[Enhanced item has hints walking students through the problem-solving steps. All parts and hints contain wrong answer feedback, with a worked solution available upon completing the part.]] A heavy ball with a weight of ## N(m=## kg) is hung from the...

A heavy ball with a weight of 150 N (m = 15.3 kg) is hung from the ceiling of a lecture hall on a 5.0-m-long rope. The ball is pulled to one side and released to swing as a pendulum, reaching a speed of 5.9 $\mathrm{m/s}$ as it passes through the lowest point.

For help with math skills, you may want to review: Solutions of Systems of Equations

Part A

What is the tension in the rope at that point?

Express your answer with the appropriate units.

Hint 1. How to approach the problem

Start by choosing a coordinate system and drawing a free-body diagram indicating the forces acting on the ball when it is at its lowest point, making sure to note the direction of the acceleration. Apply Newton's second law to the ball at its lowest point and the fact that the ball's acceleration only has a radial component at this point to solve for the tension.

Hint 2. Simplify: Newton's second law

Choose the correct equation for the radial component of Newton's second law.

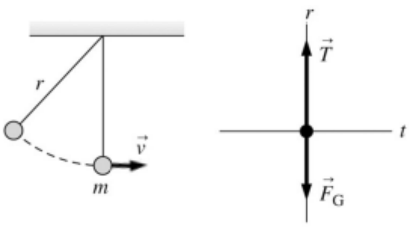
ANSWER:

- ○ $T = \frac{mv^2}{r}$
- ◉ $T - mg = \frac{mv^2}{r}$
- ○ $T = mv^2r$
- ○ $T + mg = mv^2r$

ANSWER:

T = $w+\frac{\frac{v^2}{l}w}{9.8}$ = 260N

MODEL: The ball is a particle on a massless rope in circular motion about the point where the rope is attached to the ceiling.



Bottom of swing

Known: r = 5.0 m, m = 15.3 kg, v = 5.9 $\mathrm{m/s}$

Find: T

SOLVE: Newton's second law in the radial direction is

$$\left(\sum F_r\right) = T - F_{\mathrm{G}} = T - mg = \frac{mv^2}{r}$$

Solving for the tension in the rope and evaluating,

$$T = m\left(g + \frac{v^2}{r}\right) = (15.3\ \mathrm{kg})\left(9.8\ \mathrm{m/s^2} + \frac{(5.9\ \mathrm{m/s})^2}{5.0\ \mathrm{m}}\right) = 260\ \mathrm{N}$$

REVIEW: The tension in the rope is greater than the gravitational force on the ball in order to keep the ball moving in a circle.

Problem 8.49

Description: The ultracentrifuge is an important tool for separating and analyzing proteins. Because of the enormous centripetal accelerations, the centrifuge must be carefully balanced, with each sample matched by a sample of identical mass on the opposite side...

The ultracentrifuge is an important tool for separating and analyzing proteins. Because of the enormous centripetal accelerations, the centrifuge must be carefully balanced, with each sample matched by a sample of identical mass on the opposite side. Any difference in the masses of opposing samples creates a net force on the shaft of the rotor, potentially leading to a catastrophic failure of the apparatus. Suppose a scientist makes a slight error in sample preparation and one sample has a mass 10 mg larger than the opposing sample.

Part A

If the samples are 12 cm from the axis of the rotor and the ultracentrifuge spins at 70000 rpm , what is the magnitude of the net force on the rotor due to the unbalanced samples?

Express your answer with the appropriate units.

ANSWER:

$$F_{\mathrm{net}} = 0.12 \cdot 10^{-5} \left(\frac{w \cdot 2\pi}{60}\right)^2 = 64\,\mathrm{N}$$

Problem 8.61

Description: A m car starts from rest and drives around a flat d-m-diameter circular track. The forward force provided by the car's drive wheels is a constant f. (a) What is the magnitude of the car's acceleration at t=ts? (b) What is the direction of the...

A 1600 kg car starts from rest and drives around a flat 59-m-diameter circular track. The forward force provided by the car's drive wheels is a constant 1100 N .

Part A

What is the magnitude of the car's acceleration at $t = 13\mathrm{s}$?

Express your answer with the appropriate units.

ANSWER:

$$a = \frac{\sqrt{\left(1 + \frac{4f^2ts^4}{m^2d^2}\right)}f}{m} = 2.8\,\frac{\mathrm{m}}{\mathrm{s}^2}$$

Part B

What is the direction of the car's acceleration at $t = 13\mathrm{s}$? Give the direction as an angle from the *r*-axis.

Express your answer in degrees.

ANSWER:

$$\theta = 90 - \frac{\operatorname{atan}\left(\frac{\frac{2fts^2}{m}}{d}\right) \cdot 180}{\pi} = 14\ \circ$$

Also accepted: $90 + \frac{\operatorname{atan}\left(\frac{\frac{2fts^2}{m}}{d}\right) \cdot 180}{\pi}$ = 170, $-90 - \frac{\operatorname{atan}\left(\frac{\frac{2fts^2}{m}}{d}\right) \cdot 180}{\pi}$ = -170, $90 - \frac{\operatorname{atan}\left(\frac{\frac{2fts^2}{m}}{d}\right) \cdot 180}{\pi}$ = 14

Part C

If the car has rubber tires and the track is concrete, at what time does the car begin to slide out of the circle?

Express your answer with the appropriate units.

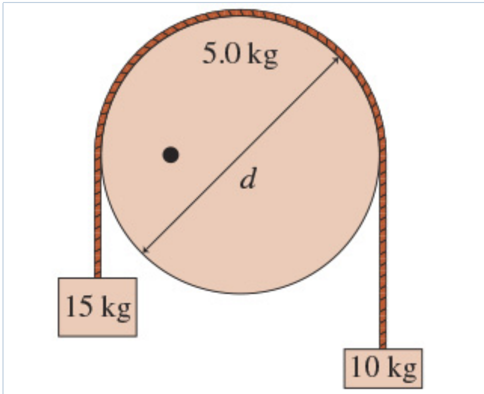
ANSWER:

$$t = \sqrt{\frac{\frac{md}{2}}{f}}\left(\left(\frac{m\cdot 9.8}{f}\right)^2-1\right)^{0.25} = 25\mathrm{s}$$

Problem 12.20 - Enhanced - with Expanded Hints

Description: [[Enhanced item has hints walking students through the problem-solving steps. All parts and hints contain wrong answer feedback, with a worked solution available upon completing the part.]] The axle in is half the distance from the center to the rim. ...

The axle in is half the distance from the center to the rim. Suppose d = 35 cm.



Part A

What is the torque that the axle must apply to prevent the disk from rotating?

Express your answer in newton-meters. Enter positive value for the counterclockwise torque and negative value for the clockwise torque.

Hint 1. How to approach the problem

You need to determine the directions of torques and forces. Then use the expression for the torque to find the total magnitude for all the torques.

Hint 2. Simplify: torques direction

Choose the correct number and direction of the torques.

ANSWER:

- (selected) There are three torques: two clockwise and one counterclockwise.
- There are three torques: one clockwise and two counterclockwise.
- There are four torques: two clockwise and two counterclockwise.
- There are two torques: one clockwise and one counterclockwise.

ANSWER:

$$\tau = \frac{-d}{100\cdot 4}\cdot 15\cdot 9.8+\frac{d}{100\cdot 4}\cdot 5\cdot 9.8+\frac{d\cdot 3}{100\cdot 4}\cdot 9.8\cdot 10 = 17 \ \mathrm{N\cdot m}$$

Also accepted: $\frac{-d}{100\cdot 4}\cdot 15\cdot 9.81+\frac{d}{100\cdot 4}\cdot 5\cdot 9.81+\frac{d\cdot 3}{100\cdot 4}\cdot 9.81\cdot 10$ = 17.2, $\frac{-d}{100\cdot 4}\cdot 15\cdot 9.8+\frac{d}{100\cdot 4}\cdot 5\cdot 9.8+\frac{d\cdot 3}{100\cdot 4}\cdot 9.8\cdot 10$ = 17.2, $\frac{-d}{100\cdot 4}\cdot 15\cdot 9.8+\frac{d}{100\cdot 4}\cdot 5\cdot 9.8+\frac{d\cdot 3}{100\cdot 4}\cdot 9.8\cdot 10$ = 17

The pulley acts as if all of its mass were concentrated at its center of mass.

There are three torques: two clockwise and one counterclockwise. All of the forces that produce torques act straight down.

So,

$$\sum\tau = r_1F_1 + r_2F_2 + r_3F_3 = (0.088\ \mathrm{m})(15\ \mathrm{kg})(9.8\ \mathrm{m/s^2}) - (0.088\ \mathrm{m})(5.0\ \mathrm{kg})(9.8\ \mathrm{m/s^2}) - (0.263\ \mathrm{m})(10\ \mathrm{kg})(9.8\ \mathrm{m/s^2}) = -17.2\ \mathrm{N\cdot m}$$

The net torque is negative because the clockwise torques are greater than the counterclockwise torques. The answer must be positive in order to prevent rotation.

Problem 12.26 - Enhanced - with Expanded Hints

Description: [[Enhanced item has hints walking students through the problem-solving steps. All parts and hints contain wrong answer feedback, with a worked solution available upon completing the part.]] A 1.0 kg ball and a 2.0 kg ball are connected by a ##-m-long...

A 1.0 kg ball and a 2.0 kg ball are connected by a 0.90-m-long rigid, massless rod. The rod is rotating cw about its center of mass at 16 rpm.

Part A

What torque will bring the balls to a halt in 5.8 s ?

Express your answer in newton-meters.

Hint 1. How to approach the problem

Determine the coordinate system and origin. Recall how to determine the moment of inertia using the center of mass. Then recall how moment of inertia is related to torque.

Hint 2. Simplify: moment of inertia

What is the moment of inertia of the system?

Express your answer in kilogram-square meters to three significant figures.

ANSWER:

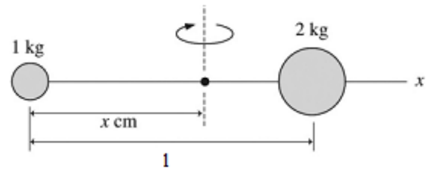
$I = \left(\frac{2L}{3}\right)^2 + 2\left(\frac{L}{3}\right)^2$ = 0.540 $\mathrm{kg\cdot m^2}$

ANSWER:

$\tau = \left|\frac{\frac{2L^2}{3}(2\pi w)}{60t}\right|$ = 0.16 $\mathrm{N\cdot m}$

Also accepted: $\left|\frac{\frac{2L^2}{3}(2\pi w)}{60t}\right|$ = 0.156, $\left|\frac{\frac{2L^2}{3}(2\pi w)}{60t}\right|$ = 0.16

Two balls connected by a rigid, massless rod are a rigid body rotating about an axis through the center of mass. Assume that the size of the balls is small compared to 0.90 m .



We have placed the origin of the coordinate system on the 1.0 kg ball.

The center of mass and the moment of inertia are

$$x_{\mathrm{cm}} = \frac{(1.0\ \mathrm{kg})(0\ \mathrm{m}) + (2.0\ \mathrm{kg})(0.90\ \mathrm{m})}{1.0\ \mathrm{kg} + 2.0\ \mathrm{kg}} = 0.600\ \mathrm{m} \text{ and } y_{\mathrm{cm}} = 0\ \mathrm{m}$$

$I_{\text{about cm}} = \sum m_i {r_i}^2 = (1.0\ \mathrm{kg})(0.600\ \mathrm{m})^2 + (2.0\ \mathrm{kg})(0.300\ \mathrm{m})^2 = 0.540\ \mathrm{kg \cdot m^2}$

We have $\omega_{\mathrm{f}} = 0\ \mathrm{rad/s}$, $t_{\mathrm{f}} - t_{\mathrm{i}} = 5.8\ \mathrm{s}$, and $\omega_{\mathrm{i}} = -16\ \mathrm{rpm} = -16\ \mathrm{rpm}(2\pi\ \mathrm{rad}/60 \cdot \mathrm{s}) = -0.53\pi\ \mathrm{rad/s}$, so $\omega_{\mathrm{f}} = \omega_{\mathrm{i}} + \alpha(t_{\mathrm{f}} - t_{\mathrm{i}})$ becomes

$$0\ \mathrm{rad/s} = (-0.53\pi\ \mathrm{rad/s}) + \alpha(5.8\ \mathrm{s}) \Rightarrow \alpha = 0.09\pi\ \mathrm{rad/s^2}$$

Having found I and α, we can now find the torque τ that will bring the balls to a halt in 5.8 s:

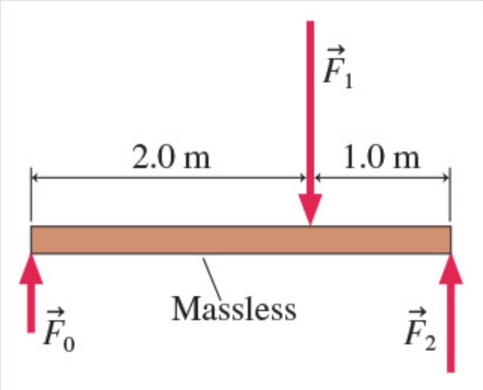
$$\tau = I_{\text{about cm}}\alpha = (0.540\ \mathrm{kg \cdot m^2})(0.09\pi\ \mathrm{rad/s^2}) = 0.16\ \mathrm{N \cdot m}$$

The magnitude of the torque is 0.16 $\mathrm{N \cdot m}$, applied in the counterclockwise direction.

Problem 12.29

Description: The object shown in is in equilibrium. Suppose |(F_vec_0)| = F_0 N. (a) What is the magnitude of F_vec_1? (b) What is the magnitude of F_vec_2?

The object shown in is in equilibrium. Suppose $|\vec{F}_0|$ = 10 N.



Part A

What is the magnitude of $\vec{F}_1$?

Express your answer with the appropriate units.

ANSWER:

$|\vec{F}_1|$ = $3F_0$ = 30N

Also accepted: $3F_0$ = 30.0N, $3F_0$ = 30N

Part B

What is the magnitude of $\vec{F}_2$?

Express your answer with the appropriate units.

ANSWER:

$|\vec{F}_2|$ = $2F_0$ = 20N

Also accepted: $2F_0$ = 20.0N, $2F_0$ = 20N

Problem 12.58

Description: A person's center of mass is easily found by having the person lie on a reaction board. A horizontal, ##-m-long, ## kg reaction board is supported only at the ends, with one end resting on a scale and the other on a pivot. A ## kg woman lies on the...

A person's center of mass is easily found by having the person lie on a *reaction board.* A horizontal, 3.0-m-long, 5.6 kg reaction board is supported only at the ends, with one end resting on a scale and the other on a pivot. A 60 kg woman lies on the reaction board with her feet over the pivot. The scale reads 24 kg .

Part A

What is the distance from the woman's feet to her center of mass?

Express your answer with the appropriate units.

ANSWER:

d = $\frac{L\left(m_2-\frac{1}{2}m_1\right)}{m}$ = 1.1m

Problem 12.67 - Enhanced - with Expanded Hints

Description: [[Enhanced item has hints walking students through the problem-solving steps. All parts and hints contain wrong answer feedback, with a worked solution available upon completing the part.]] A 30-cm-diameter, ## kg solid turntable rotates on a...

A 30-cm-diameter, 1.2 kg solid turntable rotates on a 1.0-cm-diameter, 450 g shaft at a constant 33 rpm. When you hit the stop switch, a brake pad presses against the shaft and brings the turntable to a halt in 15 seconds.

Part A

How much friction force does the brake pad apply to the shaft?

Express your answer with the appropriate units.

Hint 1. How to approach the problem

The solid turntable and the shaft are rotating at a constant angular speed. When the stop switch is hit, a brake pad presses against the shaft, and a friction force slows down the turntable. Recall that the change in a system's angular momentum over time equals the net torque applied to the system. Express the torque using the friction force and the radius of the shaft and set it equal to the change in the system's angular momentum over the time when the stop switch is hit, till the turntable comes to a halt. Solve the equation for the friction force and insert numerical values.

Hint 2. Simplify: angular momentum of the system

Until the stop switch is hit, the turntable and shaft are rotating at a constant angular speed and have constant angular momentum. Recall how angular momentum depends on the moment of inertia and angular speed. Treat the turntable and the shaft as a disk and a cylinder and calculate the initial total angular momentum of the system.

Express your answer with the appropriate units.

ANSWER:

$$L_i = \left(\frac{1}{2}m\,(0.15)^2 + \frac{1}{2}\cdot 0.45\left(\frac{d}{200}\right)^2\right)\cdot 3.46 = 4.7\times10^{-2}\,\frac{\mathrm{kg\cdot m^2}}{\mathrm{s}}$$

Also accepted: $\left(\frac{1}{2}m\,(0.15)^2 + \frac{1}{2}\cdot 0.45\left(\frac{d}{200}\right)^2\right)\cdot 3.46 = 4.67\times10^{-2}\,\frac{\mathrm{kg\cdot m^2}}{\mathrm{s}}$, $\left(\frac{1}{2}m\,(0.15)^2 + \frac{1}{2}\cdot 0.45\left(\frac{d}{200}\right)^2\right)\cdot 3.46 = 4.7\times10^{-2}\,\frac{\mathrm{kg\cdot m^2}}{\mathrm{s}}$

Hint 3. Simplify: expression for friction force

Recall that the change in a system's angular momentum over time equals the net torque applied to the system. Express the torque as a vector product of the friction force and the radius vector of the shaft, and set it equal to the change in the system's angular momentum.

Suppose that the initial angular momentum of the system is L_i, the radius of the shaft is r_{sh} and it takes Δt time to stop the turntable after the switch is hit. Which of the following expression is applicable for determining the friction force f_k?

ANSWER:

- ○ $f_k = r_{sh}\frac{L_i}{\Delta t}$
- ○ $f_k = \frac{L_i \Delta t}{r_{sh}}$
- ○ $f_k = \frac{r_{sh}\Delta t}{L_i}$
- ◉ $f_k = \frac{1}{r_{sh}}\frac{L_i}{\Delta t}$

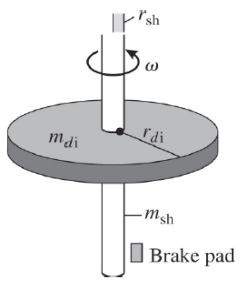
ANSWER:

$$f_k = \frac{\frac{200}{d}\left(0.5m\,(0.15)^2 + 0.5\cdot 0.45\left(\frac{d}{200}\right)^2\right)\cdot 3.46}{t} = 0.62\,\mathrm{N}$$

Also accepted: $\frac{\frac{200}{d}\left(0.5m\,(0.15)^2 + 0.5\cdot 0.45\left(\frac{d}{200}\right)^2\right)\cdot 3.46}{t} = 0.623\,\mathrm{N}$, $\frac{\frac{200}{d}\left(0.5m\,(0.15)^2 + 0.5\cdot 0.45\left(\frac{d}{200}\right)^2\right)\cdot 3.46}{t} = 0.62\,\mathrm{N}$

MODEL: Assume there are no other forces or torques other than the brake pad.

VISUALIZE: The friction force is tangent to the shaft. The initial angular momentum is $L_i = (I_{di} + I_{sh})\omega$.



Known: r_{di} = 0.15 m, r_{sh} = 0.005 m, m_{di} = 1.2 kg, m_{sh} = 0.45 kg, Δt = 15 s, ω = 33 rpm = 3.46 rad/s

Find: f_k

SOLVE:

$$\frac{\Delta\vec{L}}{\Delta t} = \vec{\tau} = \vec{r}\times\vec{F} = \vec{r}_{sh}\times\vec{f}_k$$

$$f_k = \left|\frac{1}{r_{sh}}\frac{\Delta L}{\Delta t}\right| = \frac{1}{r_{sh}}\frac{L_i}{\Delta t} = \frac{1}{r_{sh}}\frac{(I_{di}+I_{sh})\omega}{\Delta t} = \frac{1}{r_{sh}}\frac{\left(\frac{1}{2}m_{di}r_{di}^2 + \frac{1}{2}m_{sh}r_{sh}^2\right)\omega}{\Delta t}$$

$$f_k = \frac{1}{0.005\ \mathrm{m}}\frac{\left(\frac{1}{2}(1.2\ \mathrm{kg})(0.15\ \mathrm{m})^2 + \frac{1}{2}(0.45\ \mathrm{kg})(0.005\ \mathrm{m})^2\right)(3.46\ \mathrm{rad/s})}{15\ \mathrm{s}} = 0.62\ \mathrm{N}$$

REVIEW: This is not a large force, but it took 15 s to slow down the disk, so it is reasonable.

All Assignments

Physics for Scientists and Engineers with Modern Physics, 5e
Knight
amundson44156
Ends: 12/21/24