Amy Knutson
Brittany Jones
Nicole Pagel

7. A record turntable turning at 33 revolutions per minute is switched over to 78 rpm. With a uniform angular acceleration, the turntable takes 5 seconds to make the speed change. The turntable has a radius of 15 cm.

a) What is the angular acceleration during the five seconds?

$\frac{33\ rev}{min} \times \frac{2\pi\ rad}{1\ rev} \times \frac{1\ min}{60\ sec.} = 3.46\ rad/s$

$\frac{78\ rev}{min} \times \frac{2\pi\ rad}{1\ rev} \times \frac{1\ min}{60\ s} = 8.17\ rad/s$

$\alpha = \frac{\Delta\omega}{\Delta t} = \frac{8.17\ rad/s - 3.46\ rad/s}{5} = \boxed{0.942\ rad/s^2}$

b) If a string had been attached to the edge of the turntable, how much string would have been wound up during the five seconds?

$\Delta\theta = \omega_0 t + \frac{1}{2}\alpha t^2$

$\Delta\theta = (3.46)(5) + (\frac{1}{2})(0.942\ rad/s^2)(5s^2)$

$\Delta\theta = 29.1$ radians

$29.1\ radians \times \frac{.15m}{1\ rad} = \boxed{4.37m}$

$\theta = \frac{s}{r}$

$29.1 = \frac{s}{0.15}$

$s = 4.37$

abbie Montko, John Duke, Erin Wissler

9150

Billy McCune
Gabe Amon
Ben Kuhr

Eye Quiz
Questions Right vs Wrong
卌 || |||

an minute i...

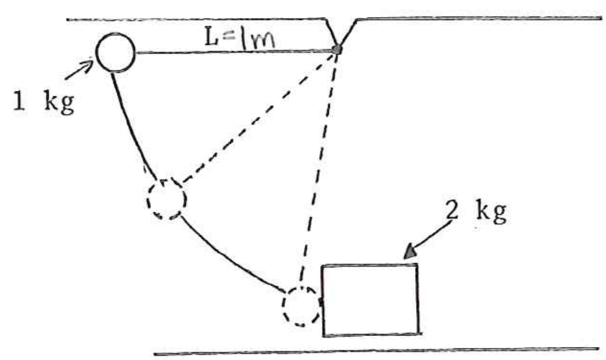
Garett Larson
Bridget Adelmann

Kaitlyn R. Tayler H. Kirsten

I QUIZ

9

6)



A 1 kg ball is attached to the end of a 1 m string and is released from a horizontal position, as shown above. It swings down and has an elastic collision with a 2 kg block resting on a frictionless surface. What was the velocity of the ball just before it hit the block? ✓
What was the velocity of the block just after the collision?
What was the velocity of the ball just after the collision?
What height does the ball reach after the collision?

$E_i = E_f$

$mgh = \frac{1}{2}mv^2 \quad v = \sqrt{2gh} = \boxed{4.43\,m/s}$

$v_{1i} - v_{2i} = v_{2f} - v_{1f}$ (with $v_{2i} = 0$)

$\times m_1$ $\qquad$ $\times m_2$

$m_1v_1 = m_1v_{1f} + m_2v_{2f}$

$+\ m_1v_1 = m_1v_{2f} - m_1v_{1f}$

$2m_1v_1 = m_1v_{2f} + m_2v_{2f} = v_{2f}(m_1+m_2)$

$v_{2f} = \frac{2m_1v_1}{v_{2f}(m_1+m_2)}$

$\boxed{v_{2f} = 2.95\,m/s}$

$m_1v_1 = m_1v_f + m_2v_{2f}$

$-\ m_2v_1 = m_2v_{2f} - m_2v_{1f}$

$(m_1-m_2)v_1 = (m_1+m_2)v_{1f}$

$v_{1f} = \frac{(m_1-m_2)v_1}{(m_1+m_2)}$

$\boxed{v_{1f} = -1.48\,m/s}$

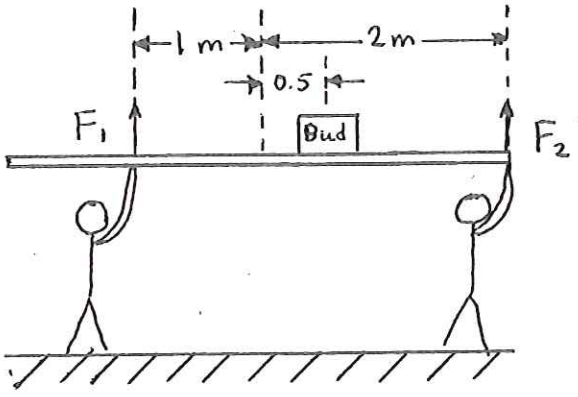
$h = \frac{v^2}{2g} = \boxed{0.111\,m}$

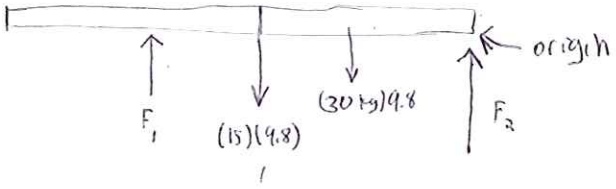
Rachel Stretch
Megan Murphy
Katelynn Strolow
Sam
Bailey
Rick
also
Kailyn Shortevand
John Hubbard
Sami Watson

2 wrong on Epic Quiz

Chris Lawson
Joe Fink

(3) Two people are carrying a board with a case of beer located 0.5 m from the center of the board. The board has a mass of 15 kg, with the center of gravity at the center of the board. If the mass of the beer is 30 kg, and the forces are applied as shown, what are F_1 and F_2 (assuming an equilibrium situation)?





$\sum F_x : 0$

$\sum F_y : +F_1 + 147 - 294 + F_2 = 0$

$F_2 = 196\ N$

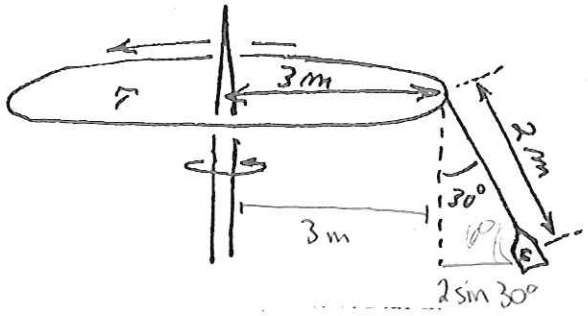
$\sum \tau : -F_1 + 147 + 294$
$(3m) \quad (2) \quad (1.5)$ } $F \times r_\perp$

$F_1 = 245\ N$

I-quiz: ||||-||||-||||

Stephen
Josh
Sam

3. A merry-go-round car C is suspended by a 2m cable from the turntable (radius 3m), as shown. If the car swings out by an angle of 30° with the vertical, as shown, :



(a) What is the radius of the circle in which the car C moves?

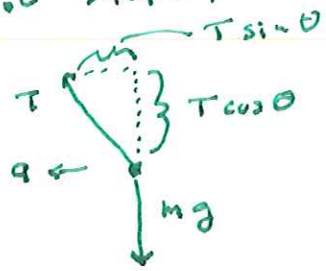
$r = 3 + 2\sin 30 = \boxed{4\ m}$

(b) How fast is the merry-go-round turning (number of rotations per minute)?

r of C = 3m when $\omega = 0$ rad/s

r of C = 4m when $\omega = ?$ rad/s

show steps!



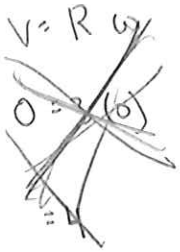
$T\cos\theta = mg \Rightarrow T = \frac{mg}{\cos\theta}$

$T\sin\theta = ma$

$\frac{mg\sin\theta}{\cos\theta} = ma$ ($a = v^2/R$)

$g\tan\theta = \frac{v^2}{R}$

$\sqrt{gR\tan\theta} = v$



$\omega^2 = \omega_0^2 + 2\alpha\Delta\theta$

$\alpha = \frac{a}{R}$

$a = \omega^2 R$

$\alpha = \omega^2$

$v^2 = Rg\tan\theta$

$v = \sqrt{4m(9.8m/s^2)(\tan 60°)}$ (60° = 30°)

$= 8.24\ m/s$

$\frac{v}{R} = \omega$

$= \frac{8.24\ m/s}{4m}$

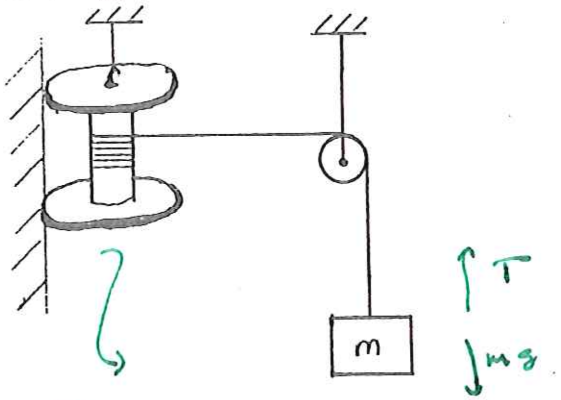
$= 2.06\ rad/s$

$2.06\ rad/s \cdot \left(\frac{1\ rev}{2\pi}\right) \cdot \left(\frac{60\ s}{1\ min}\right)$

$= 19.7\ rev/min.$

1. A spool has a large radius of 12 cm and a small radius of 6 cm. A string is wrapped around the small radius section, and is then connected to a mass of 5 kg via a massless, frictionless pulley. The large radius section is rubbing against a surface such that there is a total frictional force of 20 N on the spool. The spool's moment of inertia is 0.01 kg m . As the mass falls, what is the angular acceleration of the spool?

R r



$$mg - T = ma$$

$$Tr - fR = I\alpha = I\frac{a}{r} \Rightarrow T - f\frac{R}{r} = I\frac{a}{r^2}$$

$$mg - f\frac{R}{r} = \left(m + \frac{I}{r^2}\right)a$$

$$\frac{5\cdot 9.8 - 20\,\frac{12}{6}}{5 + \frac{.01}{(.06)^2}} = \frac{mg - f\frac{R}{r}}{m + I/r^2} = a$$

$$\approx 1.16\ m/s^2$$

$$\alpha = \frac{a}{r} = \frac{1.16}{.06} = 1.93\ \frac{rad}{s^2}$$

1. A 2 kg mass is attached to a spring with spring constant k = 100 n/m. A 1 kg mass moving at 1 m/s makes an elastic collision with the 2 kg mass. (All masses move horizontally on a frictionless surface).

initial $v_1 = v$

1 m/s

final velocities: v_1 & v_2

A. What is the velocity of the 2 kg mass right after the collision?

momentum: $m_1 v = m_1 v_1 + m_2 v_2$

energy: $v = v_2 - v_1 \quad \times m_1$

elastic collision

$m_1 v = m_1 v_1 + m_2 v_2$

$m_1 v = m_1 v_2 - m_1 v_1$

$2m_1 v = (m_1 + m_2) v_2$

$\frac{2m_1}{(m_1+m_2)} v = v_2$

$\frac{2 \cdot 1}{1+2} 1 = \frac{2}{3}$ m/s

B. How far to the left does the 2 kg mass move?

energy conservation

initial energy = KE + PE = $\frac{1}{2} m_2 v^2 + 0$

final energy = KE + PE = $0 + \frac{1}{2} k x^2$ ← equal

$\frac{1}{2} m_2 v^2 = \frac{1}{2} k x^2$

$\sqrt{\frac{m_2}{k}} v = x \Rightarrow \sqrt{\frac{2}{100}} \frac{2}{3} = .0942$ m