Welcome back, Bill Wiecking

>>Working in AP Physics B (SC651)

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ch 10 problems

Chapter 10: Rotational Kinematics

Conceptual problems

10.C.1 (5.00) Is it possible for a rotating object to have increasing angular speed and negative angular acceleration? Explain your answer.

◯ Yes ◯ No

10.C.2 (5.00) Order these three cities from smallest to largest tangential velocity due to the rotation of the Earth: Washington, DC, USA; Havana, Cuba; Ottawa, Canada.

smallest:
middle:
largest:

10.C.3 (5.00) Which of the following rotational quantities are the same for all points on a rotating disk? Check all that apply, and explain your selections.

☐ Angular velocity
☐ Tangential velocity
☐ Angular acceleration
☐ Tangential acceleration
☐ Centripetal acceleration

10.C.4 (5.00) Does the angular velocity vector of the Earth point north or south along its axis of rotation?

◯ North ◯ South

Section 0: Introduction

10.0.1 **(5.00)** Use the simulation in the interactive problem in Section 10.0 to answer the following questions. (a) If you increase the period, will the angular velocity increase, decrease or stay the same? (b) If you increase the period, will the linear speed increase, decrease or stay the same? (c) If you increase the distance from the center, will the angular velocity increase, decrease or stay the same? (d) If you increase the distance from the center, will the linear speed increase, decrease or stay the same?

(a)
(b)
(c)
(d)

Section 1: Angular position

10.1.1 **(5.00)** Two cars are traveling around a circular track. The angle between them, from the center of the circle, is 55° and the track has a radius of *r* m. How far apart are the two cars, as measured around the curve of the track?

m

Section 2: Angular displacement

10.2.1 **(5.00)** A dancer completes *N* revolutions in a pirouette. What is her angular displacement?

rad

Section 3: Angular velocity

10.3.1 **(5.00)** A hamster runs in its wheel for *t* hours every night. If the wheel has a 6.8 cm radius and its average angular velocity is 3.0 radians per second, how far does the hamster run in one night?

m

Section 4: Angular acceleration

10.4.1 **(5.00)** The blades of a fan rotate clockwise at −225 rad/s at medium speed, and −355 rad/s at high speed. If it takes *t* seconds to get from medium to high speed, what is the average angular acceleration of the fan blades during this time?

rad/s^2

Section 7: Equations for rotational motion with constant acceleration

10.7.1 A merry-go-round is at rest before a child pushes it so that it rotates with a

(5.00) constant angular acceleration for *t* s. When the child stops pushing, the merry-go-round is rotating at 1.20 rad/s. How many revolutions did the child make around the merry-go-round while he was pushing it?

rev

10.7.2 **(5.00)** A CD is rotating counterclockwise at 31 rad/s. What angular acceleration will bring it to a stop in 28 rad?

rad/s^2

Section 11: Tangential velocity

10.11.1 **(5.00)** How might a magician make the Statue of Liberty disappear? Imagine that you are sitting with some spectators on a circular platform that, unknown to all of you, can rotate very slowly. It is evening, and you can see the Statue of Liberty a short distance away between two tall brightly lit columns at the rim of the platform. A large curtain can be drawn between the columns to temporarily hide the statue. The magician closes the curtain, then rotates the platform through an angle of just 0.170 radians so the statue is hidden behind one of the columns when the curtain is opened. (a) If the platform rotation takes 24.0 seconds, what is the average angular speed required? (b) You are sitting 4.00 m from the center of rotation while the platform is rotating. What is the centripetal acceleration required to move you along the circular arc? (c) Calculate the centripetal acceleration as a fraction of *g*. You could be unaware of the rotation, especially if you were distracted.

(a) rad/s

(b) m/s^2

(c) *g*

10.11.2 **(5.00)** An old-fashioned LP record rotates at 33 1/3 rpm (revolutions per minute) and is 12 inches in diameter. A "single" rotates at 45 rpm and is 7.0 inches in diameter. If a fly sits on the edge of an LP and then on the edge of a single, on which will the fly experience the greater tangential speed?

On the LP On the 45

Section 12: Tangential acceleration

10.12.1 **(5.00)** A whirling device is launched spinning counterclockwise at 35 rad/s. It slows down with a constant angular acceleration and stops after 16 seconds. If the radius of the device is 0.038 m, what is the magnitude of the tangential acceleration of a point on the edge of the device?

m/s^2

Additional problems

10.A.2 **(5.00)** You are designing an uninhabited combat air vehicle (UCAV) that will be capable of making a 20 "gee" turn. That is, the magnitude of the centripetal acceleration during the turn can be as great as 20.0 times 9.80 m/s^2. Assume that your UCAV flies at a speed of 331 m/s ("Mach 1") and that its mass is 5.00×10^3 kg. (a) What is the minimum radius of a horizontal turn that your UCAV can make? (b) What is the force ("thrust") in the horizontal direction that must be provided to make that turn?

(a) _____ m

(b) _____ N

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