Ch 11 HW Assignment: Answers & HW Hints (Pt. 1)

Part 1: Rolling

Pg. 297-298 #7, 4a, 10, and 5, 8a, 11, 15

Answers

7a. -4N i

b. 0.6 kgm^2

4a. 8.05^o

10. $7.2x10^{-4}$ kgm^2

5. -3.15J

8a. 0.378m

11. 4.78m

15. 0.502

Ch 11 #10

To solve for the rotational inertia of the object, you've got to know how quickly it accelerates down the incline. Luckily, you were given a graph of velocity versus time, and you of course remember that the *slope* of this type of graph is the acceleration. (I found it to be $a=3.5m/s^2$.) So use this value to do the same type of steps you did on #4.

Ch 11 #8a

Since it's asking about the moment that the ball reaches the top of the circular loop, you should be thinking in terms of circular motion ideas. At the top of the loop, F_g and F_N would both be pushing downward on the ball to cause its centripetal acceleration. This leads you to the equation $F_g + F_N = mv^2/r$. But since you're told that it's on the verge of leaving the track, you can assume that F_N is basically equal to 0, and solve for v. Then use energy conservation ideas (w/rolling) to solve for the initial height.

Ch 11 #11

Hopefully you see right away that you can use energy-conservation ideas (w/rolling) to find the ball's launch speed. But here are some projectile reminders:

1. You can treat the horizontal and vertical parts of its motion independently.
2. In the vertical direction, it's accelerating at $-9.8 m/s^2$, so use kinematics. (But remember that its initial vertical velocity is zero.)
3. In the horizontal direction, its motion is constant, so use $v=x/t$.

Ch 11 #15

At the lowest point, F_N is pushing up on the ball while F_g is pulling down, and they combine to cause its upward centripetal acceleration. This leads to the equation $F_N - F_g = mv^2/r$. You should be able to use this to solve for its speed at this lowest point, and then you can use energy conservation ideas to solve for the rotational inertia, in terms of m and r. Since they told you that the general form of the inertia will be $I=\beta mr^2$, you should see that β is just your coefficient of your inertia expression.

Ch 11 HW Assignment: Answers & HW Hints (Pt. 2)

Part 2: Angular Momentum

Pg. 299-300 #27, 36, 37ab, 39, 41

Answers

27a. 9.8 kgm^2/s

36a. 0.53 kgm^2/s

b. 440 rad/s

37a. 1.47Nm

b. 20 rad

39a. 0.0046 kgm^2

b. 0.0011 kgm^2/s

c. 0.0039 kgm^2/s

41a. 1.58 kgm^2

b. 3.97 kgm^2/s

Ch 11 #41

Part A could be a little tricky, but just remember that the rotational inertia of a complex object can be found by adding the individual inertia values of its components. The hoop is fairly easy (as long as you remember the axis has shifted from center). For the square, the side along the axis has zero rotational inertia. The left side might as well be a point mass, so its inertia is just MR^2. The two sides perpendicular to the axis can both be thought of as thin rods, but with their axes shifted from their centers.

Ch 11 HW Assignment: Answers & HW Hints (Pt. 3)

Part 3: Conservation of Angular Momentum

Pg. 300-302 #43, 45a, 44, 50a, 53, 56, 61, 66

Answers

43a. 3.6 rev/s

b. 3

c. The man did work to pull the bricks in.

45a. 266.7 rev/min

44. 500 rev

50a. 4.19 rad/s

53. 3.36 rad/s

55. 1286m/s

61. 1.5 rad/s

66. 31.8^{o}

Ch 11 #44

This one might feel weird because it's asking about an angle rather than a rotational speed. But if you think about it…

$$I_1\omega_1 = I_2\omega_2$$

$$I_1(\theta_1/t) = I_2(\theta_2/t)$$

$$I_1(\theta_1) = I_2(\theta_2)$$

(Because the times are the same for both objects.)

Ch 11 #50

There are three things you might need to consider on this one… First, during the ‘initial’ portion of the problem, recognize that the cockroach and record are rotating in opposite directions. Second, when it says that the cockroach stops, it of course means it stops relative to the record. And third, this means that the rotational inertia during the ‘final’ portion of the problem has to be the combined inertias of both objects.

Ch 11 #66

Hello there, big hard problem! It's got to be done in several parts…

1. **Use conservation of energy to find the speed of the sliding object right before it hits the rod.**
2. **Use conservation of angular momentum to find the initial swinging speed (right after the collision).**

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Ch 11 #66

3. Use conservation of energy to find the max height reached by the swinging object(s). On this part, there's a weird twist, though. The potential energy applies to the change in height of the *center of mass* of the object(s). So you could either figure out the center of the 2-mass system, or you could just do the easier thing and treat it as if there are 2 different mgh terms at the end, one for each object. (And the rod's COM only raises by h/2.)
4. $h = L - L\cos\theta$