

Ch 10 HW Assignment: Answers & HW Hints (Pt. 1)

Part 1: Rotational Basics

Pg. 266-267 #2-4, 6, 8-10, 14, 16, 22a, 20,
21ab, 24, 27

Answers

2a. 0.105 rad/s

b. 0.0017 rad/s

c. 0.00015 rad/s

3. 10.98 rad/s

4a. 4 rad/s

b. 24 rad/s

c. 10 rad/s²

d. 6 rad/s²

e. 18 rad/s²

6a. 2 rad

b. 0 rad/s

c. 128 rad/s

d. 32 rad/s²

e. No, because...

8a. $1.2t^5 - 1.33t^3 + 2$

b. $0.2t^6 - 0.33t^4 + 2t + 1$

9a. 30s

b. 1800 rad

Continued on next page

More Answers

10a. 9000 rev/min²

b. 420rad

14a. 4.09s

b. 1.70s

16a. 1.04 rev/s²

b. 4.81s

c. 9.62s

d. 48.1 rev

22a. 314.2m/s

20a. 3.0 rad/s

b. 30m/s

c. 6.0m/s²

d. 90m/s²

21a. 20.94 rad/s

b. 12.56m/s

24a. 0.064m/s²

b. 0.026m/s²

27a. 3774 rad/s

b. 188.7m/s

Ch 10 #3

To calculate ω , you've got to know the time interval during which the angular displacement occurs. So begin this problem by finding the amount of time for the diver to fall down the 10m, using free-fall kinematics.

Ch 10 #16

Just make sure for parts C and D that you realize you can use the same α value that you used for parts A and B.

Ch 10 #24

Hopefully it's apparent to you that you need to do a couple of derivatives to start this problem. But in case you don't remember how to do this one, here's a reminder...

The derivative of $e^{f(x)}$ equals $(ef(x))(df/dx)$.

Then you'll need to evaluate your expressions for $t=0$ s. And in case you didn't know it (or know how to put it in your calculator), $e^0=1$.

Ch 10 #27

Start by finding the amount of time it takes the light beam to travel from the wheel to the mirror and back, using basic $v=d/t$ ideas. Also calculate the angular displacement the wheel must undergo in that same amount of time (since it must go through $1/500$ of one complete rotation). Then put these two ideas together to find $\omega=\theta/t$.

Part B shouldn't be too rough once you're done with part A.

Ch 10 HW Assignment: Answers & HW Hints (Pt. 2)

Part 2: Rotational Inertia

Pg. 268 #35-37, 39-41

Answers

35. 0.097 kgm^2

36a. 7.1%

b. 64.3%

37a. 1078.6J

b. 9707.5J

39a. 0.0234 kgm^2

b. 0.0011J

40a. 2 kgm^2

b. 6 kgm^2

c. 2 kgm^2

41. 0.00047 kgm^2

Ch 10 #36

Finding the rotational inertia isn't difficult, but it might be a little confusing how to find this "percent decrease". All you have to do for each case is divide the amount the rotational inertia changes by (from initial to final) by the initial amount.

Ch 10 #39

When thinking of the rotational inertia of this object, just find the inertia values of the individual parts (the two rods and the two masses), and add them all up to find the total. To make it even a little bit easier, just think of the rod as one long rod, with the axis shifted to its end.

Ch 10 HW Assignment: Answers & HW Hints (Pt.3)

Part 3: Torque & Newton's 2nd Law

Pg. 269 #45-47, 50-52, 54, 57

Answers

45. 4.59Nm

46a. 8.44Nm

b. 16.87Nm

c. 0Nm

47. 3.85Nm CW

50. 1.28kgm²

51. 0.14N

52a. 1.73m/s²

b. 6.92m/s²

54a. 9.72 rad/s²

b. CCW

57a. 420 rad/s²

b. 495 rad/s

Ch 10 #52

There's no mass value given, which means that you can't really calculate the rotational inertia or the torque. But since there are m 's in each of those values, they cancel when using them both in Newton's 2nd Law.

Ch 10 #57

For part A, you can just plug in $t=3\text{s}$ to calculate the exact force at that time, which means you can directly solve for the torque and therefore the angular acceleration at that moment. For part B, the angular speed is the integral of the angular acceleration. So you must use the force function to find an expression for the angular acceleration, and then you must integrate that expression. Once you integrate, evaluate your final expression at $t=3\text{s}$ to find the angular speed.

Ch 10 HW Assignment: Answers & HW Hints (Pt.4)

Part 4: Energy Conservation w/Rotation

Pg. 270 #58, 59a, 60a, 63, 66

Answers

58a. 0.63J

b. 0.153m

59a. -19,809J

60a. 1.4m/s

63. 5.42m/s

66. 1.42m/s

Ch 10 #59

When they ask you for the work needed, just remember the old energy idea that work will equal a change in kinetic energy. In this case, however, it's a change in *rotation* kinetic energy.

Ch 10 #63

Just remember that the initial potential energy should be based on the initial location of the *center of mass* of the object. Then it shouldn't be too rough to set up the energy-conservation equation with potential energy converting into rotational kinetic, as long as you're careful with your rotational inertia value.

Ch 10 #66

This is an energy conservation problem, with the only 'complexity' being that there are three objects to consider in the system. So set up your conservation equation, realizing that there's not motion at all initially. But for the final energy terms you should have three different KE terms for the motions of the three objects.