Ch 15 HW Assignment: Answers & HW Hints (Pt. 1)

Part 1: Oscillation Basics

Startup Assignment from Online Reading/Problems (see Webpage)

Ch 15 HW Assignment: Answers & HW Hints (Pt. 2)

Part 2: Energy of SHM

Pg. 405-407 #13, 26-29, 31, 32, 35, 36

Answers

13. 39.6Hz

26. 18.23Hz

27. 0.037J

28a. 200N/m

b. 1.39kg

c. 1.91Hz

29a. ¾E

b. ¼E

c. $A/\sqrt{2}$

31a. 2.25Hz

b. 125J

c. 250J

d. 86.6cm

32. 833N/m

35a. 1.106m/s

b. 3.32cm

Ch 15 #13

The only weird thing about this one is the fact that you’ve got two springs. For this arrangement of springs, it should make sense that a displacement of 1 full meter would result in a net restoring force of (7580N)x2, since each spring would pull back with 7580N. So this results in an *effective* spring constant of 15,160N/m, which you can use as if it were just one spring with that value of k.

Ch 15 #26

So this is a different arrangement of two springs than in #13. This time, it's a little harder to think about, but it turns out that a certain weight will stretch the two-spring combo twice as far as the same weight hung from an individual spring. This means that you can use k=6430/2 as your effective spring constant.

Ch 15 #29

For part A, just think of plugging in to an E-conservation equation, but with variables instead of numbers. It should make sense to set it up like this… $\frac{1}{2}kA^2 = \frac{1}{2}k(A/2)^2 + KE$

Then find KE and determine how it compares to the total energy, which is $\frac{1}{2}kA^2$.

Part B should be really easy ocne part A is done.

Part C will be similar to A, except now you're solving for the x-position where KE is equal to $0.5(\frac{1}{2}kA^2)$.

Ch 15 #32

You should be able to set up an E-conservation equation, just like most of these problems, by paying attention to KE and ½kx^2 at two different locations along the spring's oscillation. Be wise and choose the two simplest places in its motion, though.

Ch 15 #35

Keep in mind for part A that it's not really asking you anything about an oscillation, but is instead dealing with a collision, and should therefore be solved with momentum conservation.

For part B, you can use your result from part A as an equilibrium maximum speed for the oscillating mass-spring.

Ch 15 HW Assignment: Answers & HW Hints (Pt. 3)

Part 3: SHM & Uniform Circular Motion

Pg. 405-409 #1, 3, 15, 65

Answers

1. $37.83 m/s^2$

3a. 1.0mm

b. 0.754m/s

c. $568 m/s^2$

15a. 5.58Hz

b. 0.325kg

65a. 1.21J

b. 50 times/sec

Ch 15 #15

On part A, it's pretty easy if you just remember the relationship between acceleration and position for an object in SHM: $a=-\omega^2x$.

Hopefully part B will be apparent to you, if you notice that mass isn't a part of any of the new ideas, but the new ideas have to do with frequency (which is period^{-1}), and that can be related to mass with a slightly older formula.

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Ch 15 #15 (cont.)

For part C, you can't use any of the new equations directly to find A, since you don't know t (and three values you have for x, v, and a aren't *maximum* values). But you should be able to use E-conservation ideas, since you know mass and speed at a certain moment (which can calculate KE at that moment), and you also know k and position (which can calculate PE at that moment). So you should be able to set up $KE + PE = \frac{1}{2}kA^2$ to solve for amplitude.

Ch 15 #65

There are a couple different ways you could approach this, but the way that has most to do with ideas from this assignment would be to use the cosine-shaped graph to help you figure out quantities like A and f from the circular-related equations from this section. You should be able to get that A=7cm and f=25Hz from the graph. Once you know these, you can calculate max speed using $v=-\omega A\sin(\omega t)$, which you can then turn into a max KE pretty easily.

For part B, you should realize that you've already found your answer during part A.

Ch 15 HW Assignment: Answers & HW Hints (Pt. 4)

Part 4: Pendulums

Pg. 407-408 #45, 44, 43, 46

Answers

45. 0.366 s

44. 0.056 m

43a. 0.205 kgm^2

b. 0.477 m

c. 1.50 s

46. 1.83 s

Ch 15 #44

The thing that makes this one a little bit difficult is that your T equation ends up containing 'd' in two different places. It shows up squared in the rotational inertia value, since it's the distance the axis is shifted from the center of the rod. It also shows up in the denominator, of course. So once you have your T equation set up, rearrange to get rid of the radical and fraction. Then you should see that you've got a quadratic that needs to be solved. (And one of your answers is longer than the meter stick, which doesn't make sense.)

Ch 15 #43

For part A, just remember how we used to calculated rotational of inertia for complex objects by adding up the different I-values for the different parts. So find the I-value for the disk (with its axis shifted pretty far from its center) and for the rod (with its axis shifted to its end), and then add em.

For part B you just use COM ideas reviewed in class, and for part C, you just put together parts A and B in the I formula.

Ch 15 #46

This one's pretty similar to #43, but they just didn't ask you for parts A and B. You still obviously have to do those steps, though, in order to find I and d to use in the T formula.