

Physics 102 Homework #2

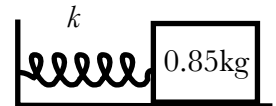
first draft due Wednesday, February 1st
final draft due Sunday, February 5th

1. What is the period of a pendulum with a 5kg bob and a 0.7m-long string?

$$T = 2\pi\sqrt{\frac{L}{g}} = 2\pi\sqrt{\frac{0.7}{9.8}} = \mathbf{1.7s}.$$

2. A 0.85kg block on a spring is oscillating with an amplitude of $A = 0.42\text{m}$ and a frequency of $f = 3.5\text{Hz}$.

- a. What is the spring constant of the spring?



$$f = \frac{1}{2\pi}\sqrt{\frac{k}{m}} \implies k = (2\pi f)^2 m = (2\pi)^2 (3.5)^2 (0.85) = \mathbf{411\text{N/m}}.$$

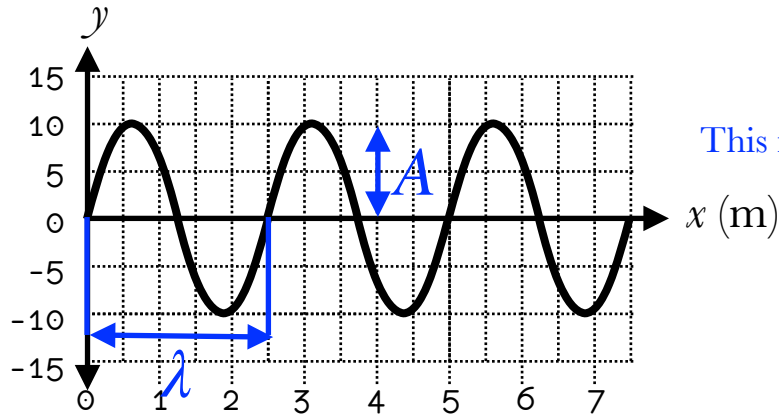
- b. What is the fastest speed the block attains, and when does it attain it?

$$v_{\max} = 2\pi A f = (2\pi)(0.42)(3.5) = \mathbf{9.2\text{m/s}}. \text{ It moves its fastest at the } \mathbf{\text{equilibrium point}}.$$

- c. What is the total energy of the block during its oscillation?

$$E_{\text{tot}} = \frac{1}{2}kA^2 = \frac{1}{2}(411)(0.42)^2 = \mathbf{36.3\text{J}}.$$

3. This is a graph of a wave moving with 7.2m/s at time $t = 0$.



This is a snapshot graph.

a. What is the amplitude of the wave?

$$A = 10$$

b. What is the wavelength of the wave?

$$\lambda = 2.5\text{m}$$

This is a snapshot graph, so we can read the wavelength right off the graph.

c. What is the period of the wave?

$$v = \frac{\lambda}{T} \implies T = \frac{\lambda}{v} = \frac{2.5}{7.2} = 0.35\text{s.}$$

d. What is the frequency of the wave?

$$v = \lambda f \implies f = \frac{v}{\lambda} = \frac{7.2}{2.5} = 2.9\text{Hz.} \quad \text{or } f = \frac{1}{T} = \frac{1}{0.35} = 2.9\text{Hz.}$$

4. Suppose these two pulses overlap in a medium.

Note that this is a snapshot graph with x on the horizontal axis.

- Fill in the table with the total displacement y_T at $x=0,1,\dots,8$. (I've filled in a few.)
- In the next column, write a **C** if there is constructive interference going on, **D** if destructive, and **N** if neither.
- Use the numbers from the table to draw the superposition of the two pulses in the blank graph below.

x	(a) y_T	(b) C/D Interference?
0	0	N
1	-1	D
2	0	D
3	-1	D
4	0	D
5	3	D
6	4	C
7	2	N
8	0	N

