B-Day: Due Wed., Jan 24 (Assigned: 1/22)
A-Day: Due Thurs., Jan 25 (Assigned: 1/23)

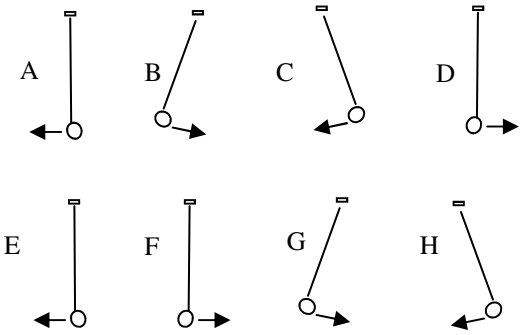
Harmonic Motion 3

1. (Y or N) Which of the following affects the period of a pendulum?
   A. ____ Mass of the bob (mass at end of pendulum)?
   B. ____ Length of string?
   C. ____ Amplitude?

   Phase. In-phase means at the same point in the cycle. 1 cycle = 360°. Out-of-phase is any time they are not in-phase. Perfectly out-of-phase is 180°, or 1/2 cycle away. A crest (top of a wave) is 180° out-of-phase with a trough (bottom of a wave). More help is available in the study helps under Harmonic Motion.

2. Using the pendulums at the right answer the following:
   A. Using only letters A—D, give me the correct sequence for one complete cycle: B ___ ___ ___

   B. Which one is 180° out-of-phase with E? ____
   C. Which one is 180° out-of-phase with H? ____
   D. Which one is 90° out-of phase with F?____
   E. Which one is 90° out-of phase with G? ____
   F. Which one is in-phase with D? ___
   G. Which one is in-phase with H? ___



3. Drawing Harmonic Motion (Make all differences OBVIOUS):

A. 2 Pendulums: Pendulum 1 has a greater amplitude.	B. 2 Pendulums: Pendulum 1 has a 1faster period.	C. 2 Hanging Spring-Mass Systems Spring 1 has a smaller amplitude.

4. Using the graph on the right, complete the following:
   A) Mark 1 cycle on the graph (trough to trough):
   B) What is the period of the motion on the graph?

   C) What is the frequency of the graph?

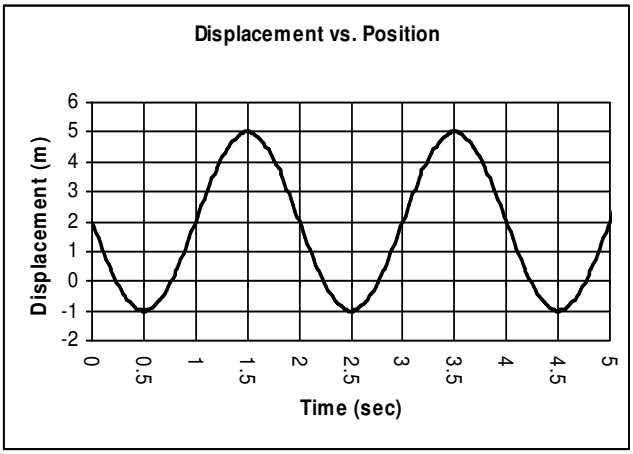
   D) What is the amplitude of the graph?

   E) What is the equilibrium position of the graph?

   F) How many cycles does the graph show?

   G) What is 1/2 cycle after 1.5 sec.

   H) Label a Crest and Trough



5. A pendulum is 60 cm long. Find its period.

6. A 25 m/s wave has a period of 6 seconds. Find its wavelength. (*Use speed of a wave formula.)*

7. A pendulum completes 3.5 cycles in 8.2 seconds. Find its period. (*Use the definition of frequency, first.)*

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Hey Phil, let's learn a little about springs.

8. Positive or negative displacement (x):
   A) If a spring is compressed, the spring is shorter, so x is:
   B) If a spring is stretched, the spring is longer, so x is:
   C) If we pull on a spring, it stretches, so x is:
   D) If we push on a spring, it compresses, so x is:
   E) So, if we hang a mass on a spring it will stretch, so x is:

OK, that explains the positive and negative displacement (x). Let's explain the force thing.

9. Is the F in F = -kx the spring or something pulling on a spring?
10. If I pull on a spring with 20 N, then the spring pulls back with how much force?
11. A 5 kg object is hanging on a spring. How much force is pulling on the spring?
12. How much force is the spring resisting with?

13. A spring is *compressed* 6 cm (k = 35 N/m). Find the force that caused it. (*Notice the units for k. The units for x, must has to use same units of length.)*

OK, now, let's understand the spring constant (k), which changes with each spring. Also, I want to show you how to understand a formula by doing an algebra experiment (of sorts).

14. Spring A has a spring constant of 10 N/m (Newtons per meter). Spring B's k = 20 N/m.
   A) How many Newtons are necessary to stretch Spring A 1 meter?
   B) How many Newtons are necessary to stretch Spring B 1 meter?
   C) If you pull on (stretch) Spring A with 10 N, how far does Spring A stretch?

   D) If you stretch Spring B with 10 N, how far does Spring B stretch?

   E) So, which Spring has the higher spring constant?
   F) Which Spring stretches farther with the same 10 N force?

15. Now, let's use a 10 kg mass with the same two springs above.
   A) Find the period of Spring A (*use the period of a mass-spring system on the notes*).

   B) Find the period of Spring B.

   C) Which one has the faster period?
   D) So, a higher spring constant means a faster or slower period?

16. In the hallway, did amplitude affect how fast the pulses moved on the slinky?

17. As we stretched the slinky, did the speed of the pulse go faster or slower?

18. Would energy (waves) travel faster in solids or liquids?

19. Transverse or Longitudinal wave?
   A. When I pushed the slinky.
   B. When I moved the slinky side to side?

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