**Due Tues., Mar 27**

# 2011-12 PreAP Harmonic Motion 4

1. Remembering that 1000 g = 1 kg, what is the period of a spring that has a 400 g mass and a spring constant of 120 N/m?

2. * A spring-mass system has a period of 2.5 seconds and a spring constant that is 65 N/m. How much mass is attached?

*From the lab*:

3. Give two ways to change the period of a spring-mass system.

*Example: How long is a pendulum that has a period of 3.2 seconds?*

$$T = 2\pi\sqrt{\frac{\ell}{g}}$$

$$3.2 = 6.28\sqrt{\frac{\ell}{10}}$$

$$\frac{3.2}{6.28} = \frac{6.28}{6.28}\sqrt{\frac{\ell}{10}}$$

$$0.5096 = \sqrt{\frac{\ell}{10}}$$

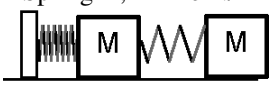
$$(0.5096)^2 = \frac{\ell}{10}$$

$$0.2597 = \frac{\ell}{10}$$

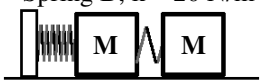
$$10(0.2597) = \ell$$

$$\ell = 2.597m = 259.7cm$$

Spring A; k = 40 N/m




Spring B; k = 20 N/m




Spring C; k = 20 N/m


Spring D; k = 20 N/m

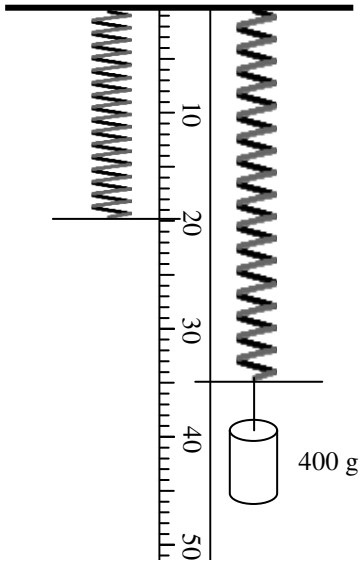

4. The spring-mass systems at the left are shown at their left and right-most positions.

   A. ____ Which spring has a faster period: A or B?
   B. ____ Which spring has a faster period: B or C?
   C. ____ Which spring has a faster period: C or D?
   D. ____ Which spring has a faster period: A or D?
   E. What is the amplitude of spring D?

   F. If spring C has a period of 0.33 seconds, calculate its frequency.

   G. If m = 1.5 kg, calculate the period of spring D.

   H. How far does Spring D travel in one full period?
   I. What is the displacement of Spring D after two full cycles?




5. A spring is unstretched to begin with, but the coils of the spring are not touching. Then a 400 g mass is attached and stretches the spring as shown. Remember that the spring constant has the units of N/m.

   A. Its original (relaxed) position is known as its equilibrium position. What is the spring's equilibrium position (in m)?

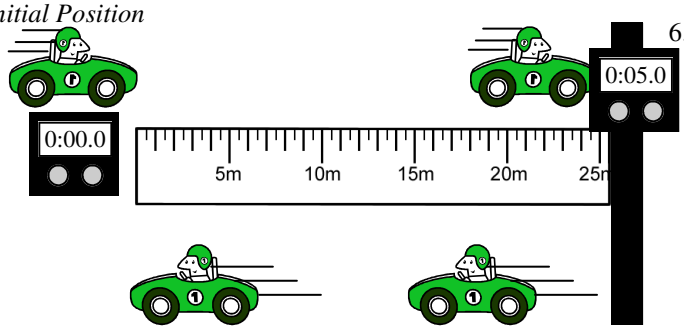
   B. * x is the displacement from this equilibrium position. In this case, what is x?

   C. * Calculate the force pulling down on the spring.

   D. * Given that F = −kx and that k is always a positive number (a constant), calculate the spring stiffness constant for the spring.

   E. Now that you have both m and k, calculate the period of the spring.

*Initial Position*




*Final Position*

6. A bumper car goes a certain distance, bumps off the wall and comes back to its initial position.

   A. * How far did it go in total (total **distance** there and back)?

   B. If it took 5 seconds to go to the wall and it stays at constant speed, how long did it take for the whole journey?

   C. Calculate the speed of the object.

2. 10.3kg
5B. 15 cm
5C = mg
5D 26.7 N/m
6A 50 m