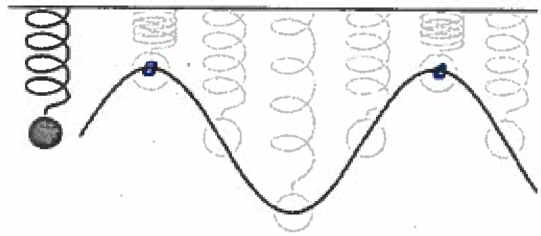
Who dat be? key Period:______

AP Physics 1: 9.4 Spring Periods

1. On the drawing below, label the cycle of one period from start to finish. Use the compressed spring to start the period.



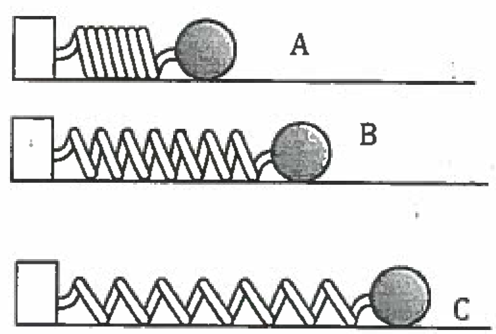
2. Find the formula for period of a spring on your formula chart and label all the variables in the formula.

Period → $T = 2\pi \sqrt{\frac{m}{k}}$ ← mass, ← spring constant.

3. Looking at the formula above and thinking of pendulums, if you pull a mass farther down when creating a spring period, would this effect the time to complete one period? Why? No, the change in strecth is not included in the formula therefore it would not change the period.

b. What if you used the spring on a different planet, would that change the period? Why? No, acceleration due to gravity is not included in the formula.

4. The drawing shows the harmonic motion of a mass on a spring at the extremes of its motion. Point A is where the spring is compressed and let go, point B is the midpoint of travel, and point C is the maximum amplitude before it begins coming back to its original position. Label on the drawing



(a) Point(s) of greatest velocity, with v_{max}
B

(b) Point(s) of least velocity, with v_{min}
C, A

(c) Point(s) of greatest acceleration, with a_{max}
C, A

(d) Point(s) of least acceleration, with a_{min}
B

(e) Point(s) with greatest potential energy, with PE
C, A

(f) Point(s) with greatest kinetic energy, with KE
B

(g) Point(s) with max amplitude, with A
C, A

Who dat be?______________________________ Period:______

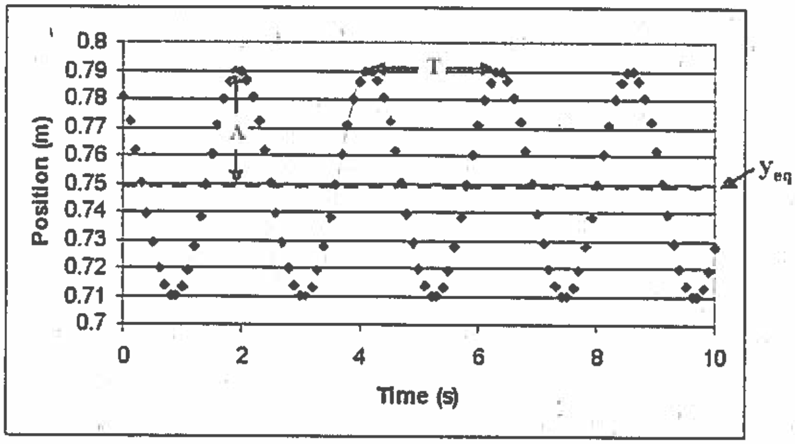
5. A 355 g mass is attached to a spring ($k = 435$ N/m). If the system is allowed to oscillate on a frictionless surface, what is the period and frequency of the motion? *(0.179 s & 5.57 Hz)*

$m = 355 = .355$ kg $\quad T = 2\pi\sqrt{\frac{m}{k}} \quad f = \frac{1}{T} =$ **5.58 Hz**

$k = 435$ N/m $\quad = 2\pi\sqrt{\frac{.355}{435}}$

$= $ **.179 s**

6. Below is a graph of a spring oscillating with the period, amplitude and equilibrium labeled.



a) About how much time does it take the spring above to complete one period?

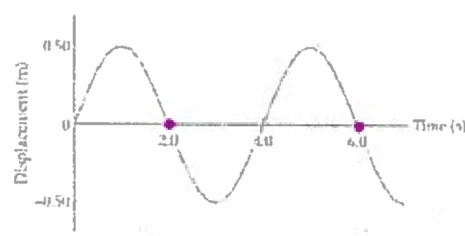
≈ 2. __ seconds.

b) How much was the spring compressed to create this bouncing spring? *(0.04 m)*

.79 − .75 = **.04m**

max Amp. resting length

7. Below is a graphical representation of a spring's period. Answer the questions below using the graph.



a) If the spring constant of the spring shown is 20 N/m, what is the mass hanging from the spring? *(8.106 kg)*

$k = 20$ N/m $\quad T = 2\pi\sqrt{\frac{m}{k}} \quad k\left(\frac{T}{2\pi}\right)^2 = m \rightarrow m = 20\left(\frac{4}{2\pi}\right)^2 =$ **8.106 kg**

$T = 4.0$ s

b) If you tripled the value of k, how would that affect the size of mass on the spring?

$T = 2\pi\sqrt{\frac{m}{3k}}$

$m = 24.31$

$m = 3k\left(\frac{T}{2\pi}\right)^2$ **mass triples.**

$m = 3(20)\left(\frac{4}{2\pi}\right)^2$