Simple Harmonic Motion: Quiz Practice Name _____

1. How will each change affect the period of a pendulum? Justify your answers.
   a. Increasing the length of the pendulum.
   b. Increasing the mass at the end of the pendulum.

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

a) If $\ell\uparrow$, $T\uparrow$ - the ℓ is in the numerator, so increasing it increases T.

b) No effect - mass is not in the equation

2. How will each change affect the frequency of an oscillating spring/mass system? Justify your answers.
   a. Increasing the spring constant.
   b. Increasing the mass.

a) $T = 2\pi\sqrt{\frac{m}{K}}$ - increasing K causes T to decrease. Decreasing T increases f.

b) $T = 2\pi\sqrt{\frac{m}{K}}$ - increasing m causes T to increase, which causes f to decrease.

3. The period of a spring/mass system is 1.2 seconds.
   a. What will be its frequency?
   b. If the mass is replaced by a mass which is 3 times as large, what will be the new period of the system?

a) $f = \frac{1}{T} = \frac{1}{1.2} = 0.83\overline{3}$ cycle/sec

b) $T = 2\pi\sqrt{\frac{m}{K}}$ if m triples, T increases by a factor of $\sqrt{3}$

$\therefore T = (\sqrt{3})(1.2) = \boxed{2.08\text{s}}$

4. The position of an 0.2 kg mass on the end of a spring in SHM can be given by the equation x(t) = 0.5cos(4t).
   a. What is the frequency of the oscillation?
   b. What is the spring constant of the spring?

$x = .5\cos(4t)$

$x = A\cos(2\pi f t)$

$2\pi f = 4$

$f = 4/2\pi$

$\boxed{f = .637 \text{ cycle/sec}}$

b) $T = \frac{1}{f} = \frac{1}{.637} = 1.57$

$T = 2\pi\sqrt{\frac{m}{K}}$

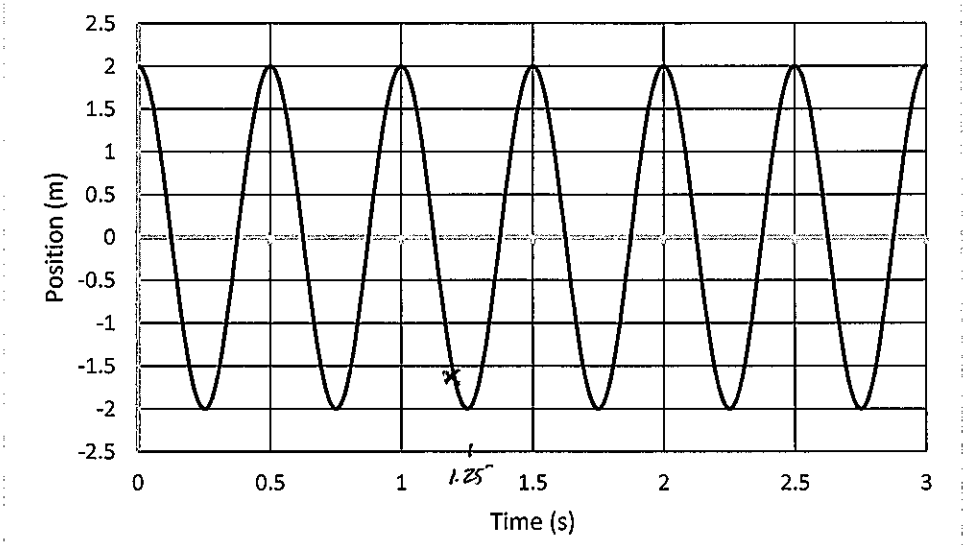
$1.57 = 2\pi\sqrt{\frac{.2}{K}}$

$.25 = \sqrt{\frac{.2}{K}}$

$.0625 = .2/K$

$\boxed{K = 3.2 \text{ N/m}}$

5. A graph of the motion of a mass in simple harmonic motion at the end of a spring is shown below:



a. What are the amplitude, period and frequency of the system?
b. Write an equation for the position of the mass as a function of time.
c. Use the equation to find the position of the mass at t = 1.2s. Does your value match the one shown on the graph?
d. What is the ratio of the mass of the object to the spring constant of the spring?

a) $A = 2m$
$T = 0.5s$
$f = 2$ cycles / second

b) $x = A\cos(2\pi f t)$
$x = 2\cos(2\pi(2)t)$

c) $x = 2\cos(2\pi(2)(1.2)) = 2\cos(15.08)$
$x = -1.61\,m$ yes.

d) $\frac{m}{k} = ?$ $\quad T = 2\pi\sqrt{\frac{m}{k}}$

$.5 = 2\pi\sqrt{\frac{m}{k}}$

$(.0795)^2 = \left(\sqrt{\frac{m}{k}}\right)^2$

$.00633\ \frac{kg}{N/m} = \frac{m}{k}$