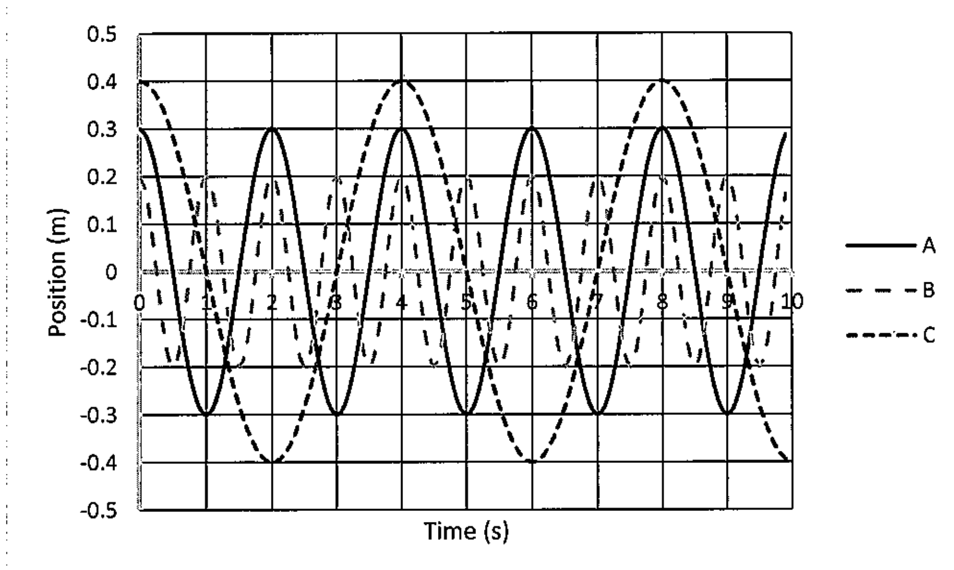
Simple Harmonic Motion Practice 2 Name ________________

1. The graphs below represent masses oscillating on the ends of springs.




a. Which spring had the largest amplitude? Explain.
b. Which had the longest period? Explain.
c. Assuming all of the masses were the same, which had the largest spring constant? Explain.
d. Assuming all of the spring constants were the same, which had the largest mass? Explain.
e. Assuming all of the spring constants were the same, what is the ratio of mass A to mass B? Show your work.
f. If mass C is 200 grams, what is the spring constant for C?
g. Write an equation for the position of mass C as a function of time.
h. Use the equation to find the position of spring C at t = 6 seconds. Show all work.

a) C - It had the farthest distance from equilibrium. (Amp of C = 0.4m)

b) C - It took longest to repeat ($T_c = 4s$)

c) $T_s = 2\pi\sqrt{\frac{m}{K}}$ as K ↑, T ↓. Since $T_B$ is the smallest its "K" is largest.

d) $T_s = 2\pi\sqrt{\frac{m}{K}}$ as m ↑, T ↑. Since $T_c$ is greatest, $m_c$ is greatest.

e) $\frac{T_A}{T_B} = \frac{2\pi\sqrt{\frac{m_A}{K_A}}}{2\pi\sqrt{\frac{m_B}{K_B}}} \rightarrow \frac{T_A}{T_B} = \sqrt{\frac{m_A}{m_B}} \rightarrow \left(\frac{2}{1}\right)^2 = \sqrt{\frac{m_A}{m_B}}^2$

$4 = \frac{m_A}{m_B}$

f) $T_s = 2\pi\sqrt{\frac{m}{k}}$

$4 = 2\pi\sqrt{\frac{.2}{K}}$

$(.636)^2 = \left(\sqrt{\frac{.2}{K}}\right)^2$

$.405 = \frac{.2}{K}$

$K = .49\ N/m$

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

$x = .4\cos(2\pi(\frac{1}{4})t)$

$x = .4\cos(\frac{\pi}{2}t)$

h) $x = .4\cos(\frac{\pi}{2} \cdot 6)$

$x = -0.4m$

2. The equation for the position of a mass oscillating on the end of a spring is

$x(t) = 0.4\cos(1/4\pi t)$

a. What is the amplitude of the oscillation?
b. What is the frequency of the oscillation?
c. What is the period of the oscillation?
d. If the mass is 0.5 kg, what is the spring constant of the spring?
e. What effect would each of the following changes have on the *frequency* of oscillation of the mass? Explain your answers. (Math can count as an explanation.)
   i. Doubling the spring constant?
   ii. Quadrupling the mass?
   iii. Doubling the amplitude?

a) Amp = .4 m

b) $2\pi f = \frac{1}{4}\pi$

$f = \frac{1}{8}\ \frac{\text{cycles}}{\text{sec}}$.

c) $T = \frac{1}{f} = 8$ sec/cycle.

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

$8 = 2\pi\sqrt{\frac{0.5}{K}}$

$1.27 = \sqrt{\frac{.5}{K}}$

$1.62 = \frac{.5}{K}$

$K = .308$ N/m

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

$f = \frac{1}{T} = \frac{1}{2\pi}\sqrt{\frac{K}{m}}$

$f = \frac{1}{2\pi}\sqrt{\frac{K}{m}}$

i if K doubles, f is $\sqrt{2}\times$ as large.

ii if m quadruples, f is $\sqrt{\frac{1}{4}} = \frac{1}{2}$ as large

iii. No effect – f does not depend on amplitude