Oscillations Variables You know the drill... List ALL of the oscillations variables and constants that you can think of. Include their name, the letter that represents them, their units, and a defining equation for them (if applicable).

Variable Name	**Letter**	**SI Units**	**Defining Equation** (if applicable)
Period	T	s	$\frac{seconds}{oscillation}$
Angular Velocity	ω	$\frac{rad}{s}$	$2\pi f$ aka $\frac{2\pi}{T}$ aka $\sqrt{\frac{k}{m}}$
Frequency	f	$\frac{rev}{s}$ aka Hz	$\frac{oscillations}{second}$ aka $\frac{1}{T}$
Amplitude	A	depends on function type	
Mass	m	kg	
Spring Constant	k	$\frac{N}{m}$ aka $\frac{kg}{s^2}$	$\omega = \sqrt{\frac{k}{m}}$
Max position/displacement	x_{max}	m	$x(t) = \pm x_{max} \cdot {}^{sin}_{cos}(\omega t)$
Max velocity	v_{max}	$\frac{m}{s}$	$x_{max}\omega$
Max acceleration	a_{max}	$\frac{m}{s^2}$	
Time	t	s	
Spring Force	F^s	$N \cdot m$	$v_{max}\omega$ aka $x_{max}\omega^2$
Spring Potential Energy	U^s	J	$U^s = \frac{1}{2}kx^2$

Simple Harmonic Functions For each of the following situations write position as a function of time, x(t), for the resulting simple harmonic motion. A mass on a frictionless surface is connected to a spring. After being displaced, the spring completes 15 oscillations in the next 20 seconds.

Generic form of a SHO (Simple Harmonic Oscillator) $x(t) = \pm x_{max} \cdot {}^{sin}_{cos}(\omega t)$

Remember that $\omega = 2\pi f$ & $f = \frac{1}{T}$ & $T = \frac{seconds}{oscillations}$

$\implies T = \frac{20s}{30oscillations} = \frac{4}{3}s \implies f = \frac{3}{4}Hz \implies \omega = \frac{3\pi}{2}Hz$

a. It is pulled to the left 20 cm and released, from rest, at $t = 0$. $x(t) = -(20cm)cos(\frac{3\pi}{2}Hz \cdot t)$

b. It is not pulled at all and released, from rest, at $t = 0$. $x(t) = 0$

c. It is pulled to the right 30 cm and released, from rest, at $t = 0$. $x(t) = (30cm)cos(\frac{3\pi}{2}Hz \cdot t)$

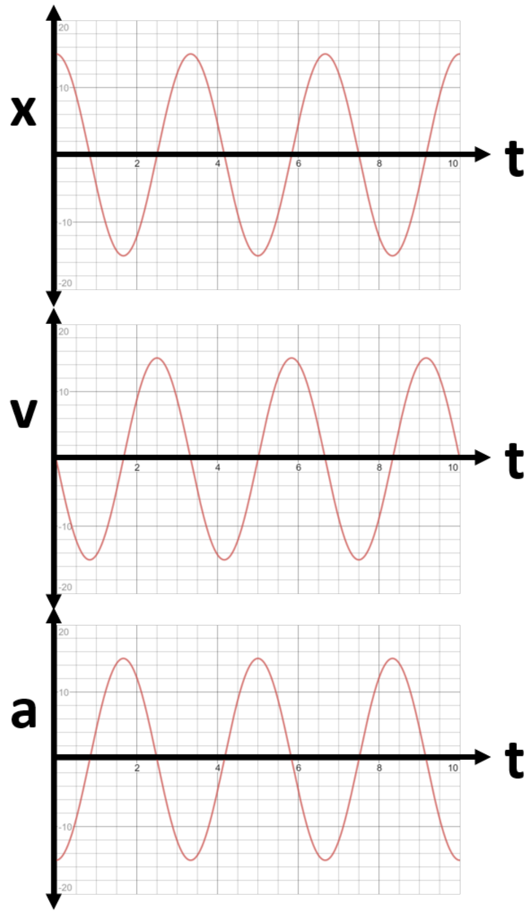
d. It is pulled to the left 25 cm and released, from rest, but the timer doesn't start until it is at the center. $x(t) = (25cm)sin(\frac{3\pi}{2}Hz \cdot t)$

e. It is not pulled at all and released, from rest, but the timer doesn't start until it is at the center. $x(t) = 0$

f. It is pulled to the right 5 cm and released, from rest, but the timer doesn't start until it is at the center. $x(t) = -(5cm)sin(\frac{3\pi}{2}Hz \cdot t)$

[0]Select problems may be modified from Walsh, Harrison, or the Internet.

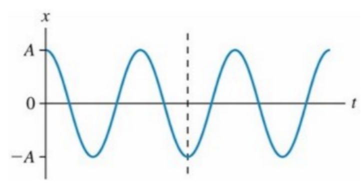
Graphing Oscillators A mass on a frictionless surface is connected to a spring and pulled to the right 15 cm. It is released from rest at $t = 0s$ and proceeds to make 3 oscillations in 10 s. Use the axes provided to graph the position, velocity, and acceleration as functions of time.
As a group, generate a conceptual story about what is happening in the physical situation for each of the graphs.



KC Multiple Choice Use the graphs you just generated to help you answer the KC multiple choice problem shown below.

Wave-Oscillations.SHO.**MS.KC.6:** The position graph of a mass connected to a horizontal spring is in the figure. Which of the following statements regrading the instant indicated by the dotted line are true.

(a) The mass is undergoing the largest acceleration that points in the positive direction.
(b) The mass is undergoing the largest acceleration that points in the negative direction.
(c) The mass is undergoing the smallest magnitude acceleration.
(d) The mass is moving in the positive direction.
(f) The mass is moving in the negative direction.
(e) The mass is at its equilibrium location.
(g) The mass + spring system has maximum potential energy
(h) The mass + spring system has maximum kinetic energy



A & G are true statements about the dotted line.
D would also be true if the question were asking where it was going to move next, at the maximum position points it is technically stationary ($v = 0$).