Worksheet simple harmonic motion solutions

**1.** Name two types of potential energy.

Two types of potential energy are gravitational potential energy, and elastic potential energy.

**2.** In Hooke's law, the x represents a displacement, which is the change in position. A change between what two positions?

The x in Hooke's law represents a displacement between the equilibrium position and some strained position.

**3.** Write a one word answer for the following two questions.

**(a)** If you're counting the number of cycles that occur during a set amount of time, what are you measuring?

Frequency

**(b)** If you're counting the amount of time that occurs during a set cycle, what are you measuring?

Period

**4.** Starting at a compressed amplitude, a chunk of copper oscillates on a string with a frequency of 15Hz and an amplitude of 0.2m .

**(a)** What is the copper's period?

$$T=\frac{1}{f}=\frac{1}{15Hz}=0.07s$$

**(b)** What is the copper's angular speed?

$$ω=2πf=2\left(π\right)\left(15Hz\right)=30π\frac{rad}{s}=94.25\frac{rad}{s}$$

**(c)** What is the copper's maximum velocity?

$$v\_{max}=Aω=\left(0.2m\right)\left(30π\frac{rad}{s}\right)=6π\frac{m}{s}=18.85\frac{m}{s}$$

**(d)** What is the copper's maximum acceleration?

$$a\_{max}=Aω^{2}=\left(0.2m\right)\left(30π\frac{rad}{s}\right)^{2}=180π^{2}\frac{m}{s^{2}}=1.78x10^{3}\frac{m}{s^{2}}$$

**(e)** After 8s have passed, what is the copper's velocity?

$$v=\frac{dx}{dt}=-Aω\sin(\left(ωt+φ\right))=-\left(0.2m\right)\left(30π\frac{rad}{s}\right)sin\left(\left(30π\frac{rad}{s}\right)\left(8s\right)-\frac{π}{2}\right)=-18.85\frac{m}{s}$$

**(f)** After 8s have passed, what is the copper's acceleration?

$$a=\frac{d^{2}x}{dt^{2}}=-Aω^{2}\cos(\left(ωt+φ\right))=-\left(0.2m\right)\left(30π\frac{rad}{s}\right)^{2}\cos(\left(\left(30π\frac{rad}{s}\right)\left(8s\right)+π\right)=1.78x10^{3}\frac{m}{s^{2}})$$

**(g)** After 8s have passed, how far from equilibrium is the copper?

$$x=Acos\left(ωt+φ\right)=\left(0.2m\right)\cos(\left(\left(30π\frac{rad}{s}\right)\left(8s\right)+π\right)=-0.2m)⁡$$