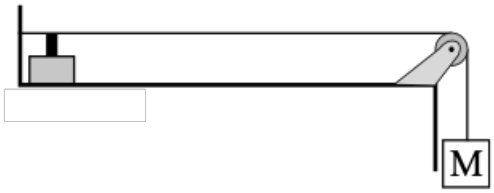
Daily Check 42

1. Say that a string with linear mass density of 3 g/m is connected to a mechanical oscillator on the left end and sent over a pulley on the right, as shown. A mass of 0.50 kg is hung from the string, and the mass remains stationary. The distance between the oscillator and the pulley, which can both be treated as fixed ends, is 2.0 m. /2

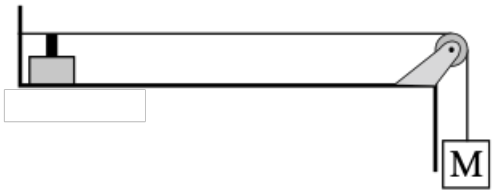
   What is the wavelength of the fundamental mode?



   - ◯ 1 m
   - ◯ 2 m
   - ◯ 4 m
   - ◯ 8 m

2. Say that a string with linear mass density of 3 g/m is connected to a mechanical oscillator on the left end and sent over a pulley on the right, as shown. A mass of 0.50 kg is hung from the string, and the mass remains stationary. The distance between the oscillator and the pulley, which can both be treated as fixed ends, is 2.0 m. /2

   Which of the following is closest to the frequency of the fundamental mode?



   - ◯ 5 Hz
   - ◯ 10 Hz
   - ◯ 20 Hz
   - ◯ 30 Hz
   - ◯ 40 Hz

3. Nodes in a standing wave are points of... /2

- ◯ Zero amplitude
- ◯ Maximum amplitude
- ◯ Average amplitude

4. A transverse traveling wave on a string is given by the following equation: /2

$y(x,t) = (0.2\,m)\,\cos\,(4\,rad/m\;\;x\;+2\,rad/s\,t\;+0.3\,rad)$

What is the maximum transverse speed of a particle in this wave?

- ◯ 0.8 m/s
- ◯ 0.4 m/s
- ◯ 0.5 m/s
- ◯ 0.2 m/s
- ◯ None of the above

5. A transverse traveling wave on a string is given by the following equation in SI units: /2

$y(x,t) = 0.2\,\cos\,(\,0.4\,x+\;2\,t+0.3)$

What is the speed of this wave?

- ◯ 8 m/s
- ◯ 4 m/s
- ◯ 5 m/s
- ◯ 2 m/s
- ◯ None of the above

6. A transverse traveling wave on a string is given by the following equation in SI units: /2

$y(x,t) = 0.2\,\cos\,(\,0.4\,x+\;2\,t+0.3)$

What is the wavelength of this wave?

- ◯ 0.4 m
- ◯ 4.0 m
- ◯ 15.7 m
- ◯ 3.1 m
- ◯ 2.5 m

7. A single particle in a transverse wave oscillates with simple harmonic motion given by: /2

$y(t) = 0.5\,m\,\cos\,(\,30\,rad/s\,t)$

The speed of the wave is found to be 10 m/s. What is the wavelength of this wave?

- ◯ $\pi/6$
- ◯ $\pi/3$
- ◯ 6π
- ◯ $2\pi/3$
- ◯ None of the above

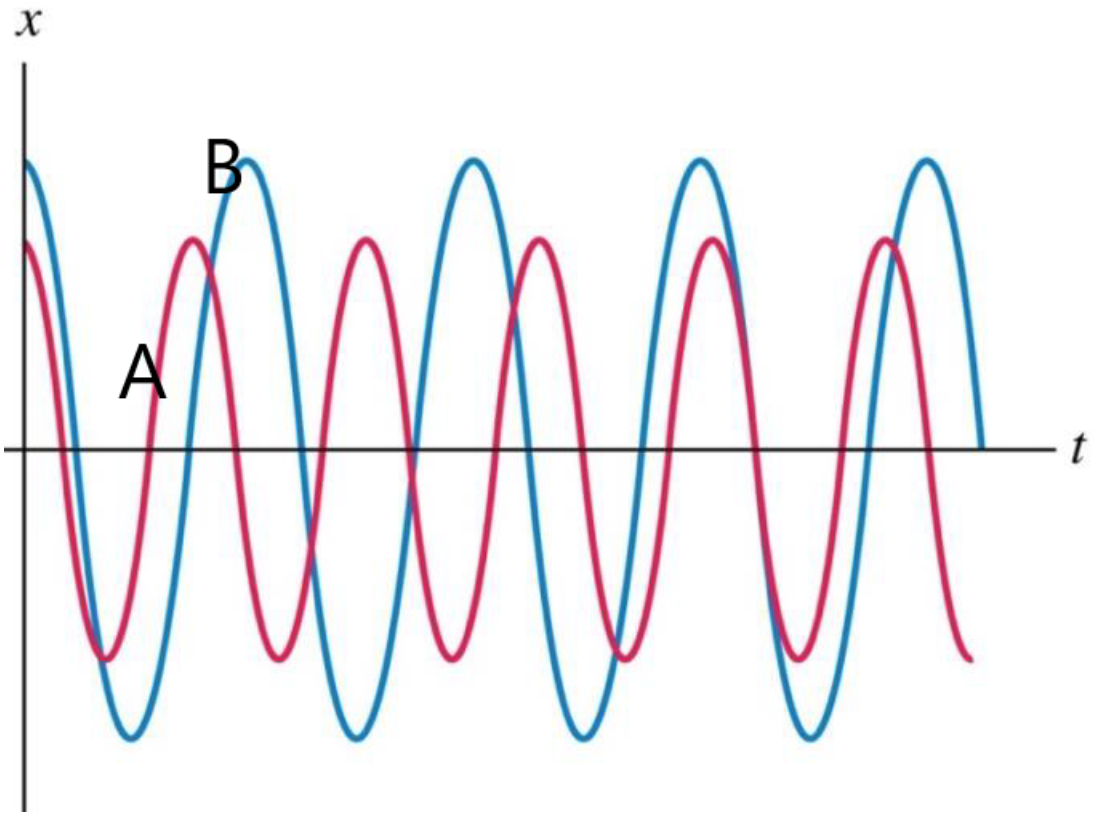
8. Consider the wavefunction $y(\,x,t) = A\,\cos\,(kx + \omega t + \varphi)$. In which direction does the wave travel? /2

- ◯ Positive x
- ◯ Positive y
- ◯ Negative x
- ◯ Negative y
- ◯ Positive z

9. If the frequency of an object increases, what happens to its period? /2

- ◯ Stays same
- ◯ increases
- ◯ decrease

10. Two identical blocks oscillate on different horizontal springs. The x(t) graph is shown below for each one. Which one has the larger **frequency** of oscillation? /2



- ◯ A
- ◯ B
- ◯ same

11. A mass oscillates with position as a function of time given by: /2

$$x(t) = (3.4mm)cos(20t + \pi)$$

What is the maximum velocity of the mass during this oscillation?

- ◯ 3.4 mm/sec
- ◯ 6.8 cm/sec
- ◯ 20 cm/sec
- ◯ πcm/sec
- ◯ 4 cm/sec

12. An object on the end of a spring is oscillating in simple harmonic motion given by /2

$$x(t) = Acos(\omega t + \phi)$$

If the amplitude of oscillation is doubled, how does this affect the oscillation period?

- ◯ T doubles.
- ◯ T remains the same.
- ◯ T is halved.
- ◯ T increases by a factor of $\sqrt{2}$

13. An object at the end of a spring is oscillating in simple harmonic motion. At what point during the motion does the mass have its maximum magnitude of the acceleration? /2

- ◯ When it passes through equilibrium.
- ◯ When halfway between equilibrium and its maximum amplitude.
- ◯ When at its maximum amplitude.
- ◯ Acceleration is constant.

14. The "k" used to describe wave motion is the same as the "k" used to determine the frequency of a spring. /1

- ◯ True
- ◯ False

15. An object on the end of a spring is oscillating in simple harmonic motion given by: /2

$$x(t) = (5.0\ \text{cm})\cos\left((2.0\ \text{rad/s})t + 0.7\ \text{rad}\right).$$

What is the **maximum speed** of this mass, and where in the motion does this occur?

- ◯ 10 cm/s, happens when it is at its maximum displacement from equilibrium.
- ◯ 2.0 cm/s, happens when it is at its maximum displacement from equilibrium.
- ◯ 2.5 cm/s, happens when it is at its maximum displacement from equilibrium.
- ◯ 10 cm/s, happens when it is passing through equilibrium.
- ◯ 2.0 cm/s, happens when it is passing through equilibrium.

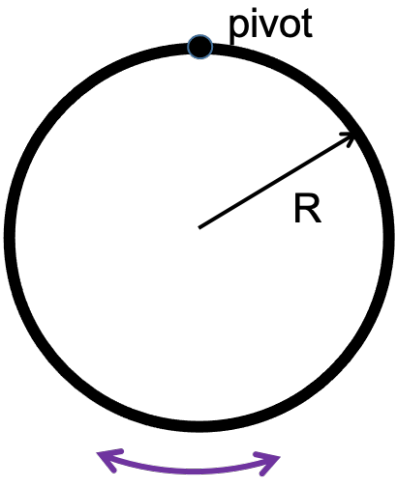
16. An object of mass 4.0 kg is on the end of a spring and is oscillating in simple harmonic motion given by: /2

$$x(t) = (5.0\ \text{cm})\cos\left((2.0\ \text{rad/s})t + 0.7\ \text{rad}\right).$$

What is the maximum elastic potential energy, in Joules, and where does this occur? Ignore damping.

- ◯ 0.02 J, and it happens when the mass passes through equilibrium
- ◯ 0.02 J, and it happens when the mass is farthest from equilibrium
- ◯ Not enough information
- ◯ 0.04 J, and it happens when the mass passes through equilibrium
- ◯ 0.04 J, and it happens when the mass is farthest from equilibrium

17. A uniform density hollow hoop is pivoted at a point on the rim, and it oscillates back and forth at small angles. The radius of the hoop is R. /2



What is the period of oscillation of this hoop?

- ◯ $2\pi\sqrt{\frac{R}{g}}$
- ◯ $2\pi\sqrt{\frac{2R}{g}}$
- ◯ $2\pi\sqrt{\frac{R}{2g}}$
- ◯ $2\pi\sqrt{\frac{R^2}{2g}}$