1. A 0.02 kg mass is attached to a massless spring as shown to the right and vibrates with simple harmonic motion with an amplitude of 5.0 cm. The spring constant is 300 N/m. What is the speed of the mass when it is 2.0 cm from its equilibrium position?
   a. 2.1 m/s
   b. 3.2 m/s
   c. 4.8 m/s
   d. 5.6 m/s
   e. 6.8 m/s

2. A 2.0 kg mass on the end of a horizontal spring is vibrating with simple harmonic motion and can be described by the equation \( x = 0.3 \cos(3.0) t \). What is the period of the vibration?
   a. 3 s
   b. 1.2 s
   c. 2.8 s
   d. 4.2 s
   e. 5.0 s

3. A plot of height vs time for a sinusoidal sound wave traveling in air is shown in the figure to the right. What is the wavelength of this wave?
   a. 14 cm
   b. 18 cm
   c. 16.7 cm
   d. 34 cm
   e. 40 cm

4. Sound waves are ___ and generally travel ___ as the density of the medium through which the sound wave travels increases.
   a. transverse, faster
   b. longitudinal, faster
   c. transverse, slower
   d. longitudinal, slower

5. A guitar string has a length of 80 cm and a mass of 5.0 grams. The player tunes the string so that the second harmonic produces sound with a frequency of 600 Hz. What is the required tension in that guitar string?
   a. 8.8 \times 10^{-3} N
   b. 1.03 \times 10^{-3} N
   c. 1.25 \times 10^{-3} N
   d. 1.44 \times 10^{-3} N
   e. 2.6 \times 10^{-3} N

6. An organ pipe closed at one end is sounding its third harmonic at a frequency of 900 Hz. How long is the pipe?
   a. 9.5 cm
   b. 19 cm
7. As you wait at a railroad crossing an approaching train blows its whistle. At that moment the engineer in the train hears a whistle frequency of 800 Hz while you hear a frequency of 900 Hz. What is the speed of the approaching train?

a. 28 m/s
b. 32 m/s
c. 38 m/s
d. 43 m/s
e. 46 m/s

8. A flat piece of wood of density $0.80 \times 10^{-3} \text{ kg/m}^3$ and volume 2.0 m$^3$ is floating in a lake. What mass of iron must be placed on top to just submerge the log?

a. 400 kg
b. 800 kg
c. 1200 kg
d. 1600 kg
e. 2000 kg

9. A piece of iron is thrown into a bucket of water. After the iron is completely submerged, it sinks to the bottom of the bucket. And ______

a. no buoyant force acts on it
b. the buoyant force is approximately constant with depth
c. the buoyant force increases with depth
d. the buoyant force decreases with depth
e. the buoyant force becomes zero after the iron hits the bottom

10. Bernoulli's equation is a statement of conservation of ______ for fluids of constant density.

a. Energy
b. Momentum
c. Angular Momentum
d. Mass
e. Pressure

11. Water is flowing in a cylindrical pipe as shown in the figure to the right. If the pressure and velocity of the water at point 1 are 6 kPa and 0.5 m/s, respectively, what is the the pressure at point 2? Hint: First determine the velocity at point 2.

a. 1.2 kPa
b. 1.8 kPa
c. 2.8 kPa
d. 4.4 kPa
e. 6.0 kPa

12. A pitcher throws a baseball and causes it to spin as shown in the figure a person to the right. The view is of the person whose eyes are at the same vertical level as the ball, neglecting the effects of gravity the ball will ______

a. Curve to the right
b. Curve to the left
c. Curve up relative to the ground
13. At what temperature is the value on the Fahrenheit and Celsius scales the same?
   a. -10
   b. -20
   c. -30
   d. -40
   e. -50

   \[
   \frac{a}{5}x + 32 = x
   \]

14. A 50 kg child swings on a swing suspended by ropes that are 4.0 m long. How long does it take for the child to go from the highest to the lowest point of her swing? Consider the ropes as massless.
   a. .44 sec
   b. 1 sec
   c. 2 sec
   d. 3 sec
   e. 4 sec

   \[
   T = 2\pi\sqrt{\frac{L}{g}}
   \]
   \[
   T = 2\pi\sqrt{\frac{4}{9.81}} = 4.8 \text{ sec}
   \]

15. A large tank is filled with water to a depth of 15 meters. A spout is located 10 meters above the bottom of the tank is then opened. With what speed will the water emerge from the spout?
   a. 7.3 m/s
   b. 8.3 m/s
   c. 9.9 m/s
   d. 10.4 m/s
   e. 11.5 m/s

   \[
   v = \sqrt{2gh}
   \]
   \[
   v = \sqrt{2(9.81)(5)}
   \]
   \[
   v = \sqrt{98.1}(5) = \text{?}
   \]

   \[
   \begin{align*}
   T &= \text{?} \\
   \frac{1}{4}T &= \text{?} \\
   \frac{2}{4}T &= \text{?} \\
   \frac{3}{4}T &= \text{?}
   \end{align*}
   \]