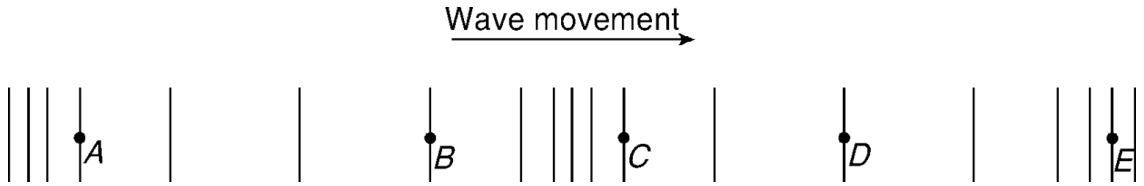
Name: _____ Date: _____ Period: _____

Simple Harmonic Motion and Waves Test Review

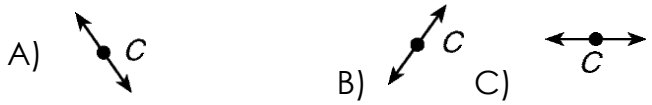
Directions: Choose the best answer choice of the ones provided for each problem. Be sure to clearly mark your answer on the answer document provided. Problems answered in the test document only will not be scored.

Use the following information and diagram to answer questions 1 and 2:

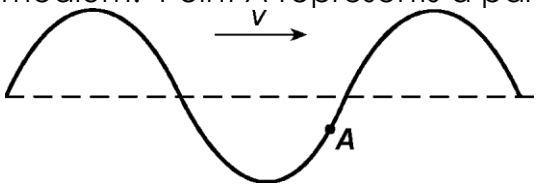
A longitudinal wave moves to the right through a uniform medium, as shown below. Points *A*, *B*, *C*, *D*, and *E* represent the positions of particles of the medium.



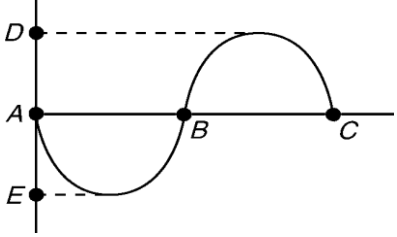
1. Which diagram *best* represents the motion of the particle at position *C* as the given wave moves to the right?



2. The wavelength of the given wave above is equal to the distance between points:
   a) A and B b) A and C c) B and C d) B and E
3. The energy of the given wave is related to it:
   a) Amplitude b) period c) speed d) wavelength
4. As a transverse wave travels through a medium, the individual particles of the medium move:
   a) In ellipses b) in circles c) parallel to direction of wave travel
   d) perpendicular to direction of wave travel
5. The diagram below represents a transverse wave traveling to the right through a medium. Point *A* represents a particle in the medium.



In which direction will particle *A* move in the next instant of time?
a) Up b) down c) left d) right



6. The diagram to the right represents a transverse wave.

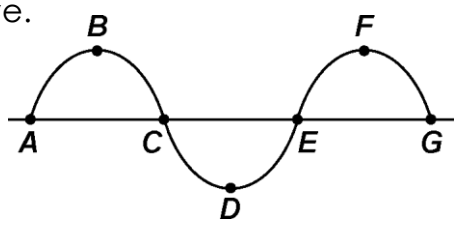
   The distance between which two points identifies the amplitude of the wave?

   a) A & B b) A and C c) A and E d) D and E
7. If the amplitude of a wave traveling in a rope is doubled, the speed of the wave in the rope will:

   a) Remain the same, b) increase, c)decrease, d) cannot determine
8. Increasing the amplitude of a sound wave produces a sound with:

   a) A higher pitch, b) greater loudness, c) a lower speed, d) a shorter λ
9. A periodic wave is produced by a vibrating tuning fork. The amplitude of the wave would be greater if the tuning fork were:

   a) Struck harder, b)struck more softly, c)replaces by a higher frequency tuning fork, d) replaced by a lower frequency tuning fork
10. The diagram to the right represents a transverse wave. The wavelength of the wave is equal to the distance between points:



    a) A and G, b) B and F, c)C and E, d) D and F
11. What is the wavelength of a periodic wave having a frequency of 5.0 Hertz and a speed of 10 m/s?

    a) 0.50 m b) 2.0 m c) 5.0 m d) 50 m
12. The product of a wave's frequency and its period is:

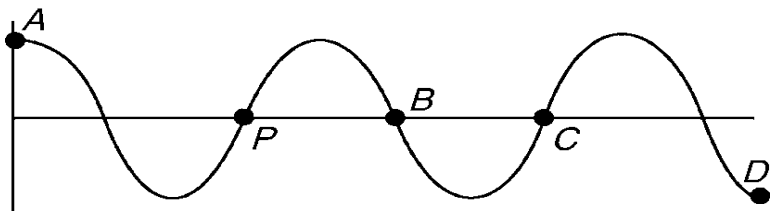
    a) Its wavelength, b) Planck's constant, c)one (1), d) its velocity
13. If the amplitude of a wave is increased, the frequency of the wave will:

    a) Remain the same, b) increase, c)decrease, d) cannot determine
14. The sound wave produced by a trumpet has a frequency of 440 Hz. What is the distance between compressions in this sound wave as it travels through the air? (The speed of sound through air at STP is v_s = 340 m/s)

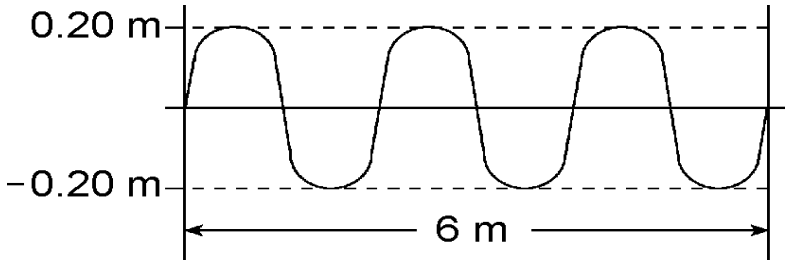
    a) 1.5×10^{-6} m, b) 0.77 m, c) 1.3 m, d) 6.8×10^{5} m

    b)
15. The time required for a wave to complete on full cycle is the called the wave's:

    a) Frequency, b) period, c) velocity, d) wavelength
16. The diagram below represents a periodic wave. Which point on the wave is in phase with point *P*? A, B, C, D, P

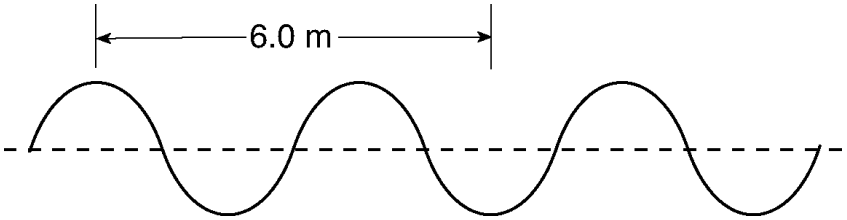


17. The diagram to the right represents a wave.



What is the speed of the wave if its frequency is 8.0 Hertz?
a) 1.6 m/s b) 3.2 m/s c) 16 m/s d) 32 m/s

18. The diagram below represents a periodic wave traveling through a uniform medium.



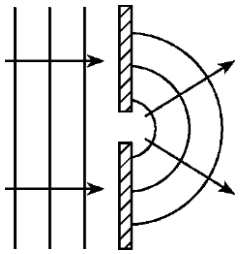
If the frequency of the wave is 2.0 Hz, what is the speed of the wave?
a) 2.0 m/s b) 4.0 m/s c) 6.0 m/s d) 8.0 m/s

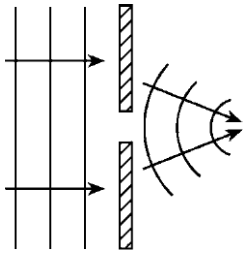
19. At an outdoor physics demonstration, a delay of 0.50 seconds was observed between the time the sound waves left a loudspeaker and the time these sound waves reached a student through the air. If the air is at STP, how far was the student from the speaker?
a) 1.5×10^{-3} m, b) 1.7×10^{2} m, c) 6.6×10^{2} m, d) 1.5×10^{8} m

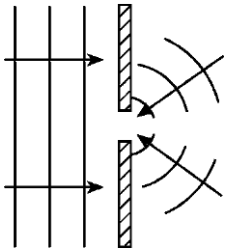
20. A student sees a train that is moving away from and sounding its whistle at a constant frequency. Compared to the sound produced by the whistle, the sound observed by the student is:
a) Higher in pitch, b) lower in pitch, c) greater in amplitude, d) a transverse wave rather than a longitudinal wave

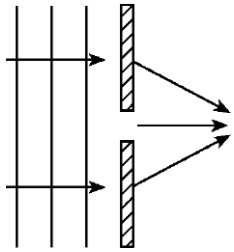
21. A car's horn produces a sound wave of constant frequency. As the car speeds up going away from a stationary spectator, the sound wave detected by the spectator:
a) increases in amplitude and increases in frequency
b) decreases in amplitude and decreases in frequency
c) increases in amplitude and decreases in frequency
d) decreases in amplitude and increases in frequency

22. Which diagram *best* represents the shape and direction of a series of wave fronts after they have passed through a small opening in a barrier?

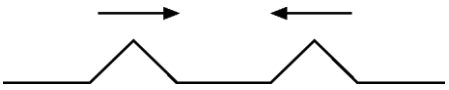
A) 

C) 

B) 

D) 

23. Two waves having the same frequency and amplitude are traveling in the same medium. Maximum constructive interference occurs at points where the phase difference between the two superposed waves is:
    a) 0^0 b) 90^0 c) 180^0 d) 270^0
24. Two waves having the same frequency and amplitude are traveling in the same medium. Maximum destructive interference occurs at points where the phase difference between the two superposed waves is:
    a) 0^0 b) 90^0 c) 180^0 d) 270^0
25. Two pulses traveling in the same uniform medium approach each other as show below.



Which diagram best represents the superposition of the two pulses?

A)

B) 

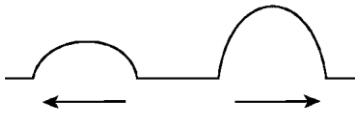
C) 

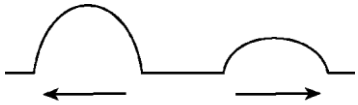
D) 

26. The diagram below represents two pluses approaching each other from opposite direction in the same medium.

Which diagram best represents the medium after the pulses have passed through each other?

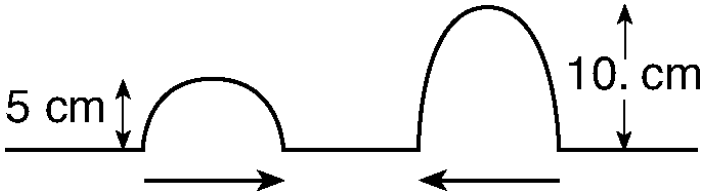
A) 

B) 

C) 

D) 

27. The diagram below show two pulses approaching each other in a uniform medium.

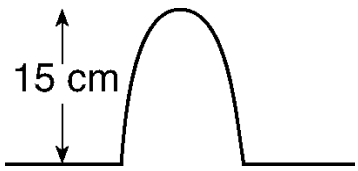


Which diagram best represents the superposition of the two pulses?

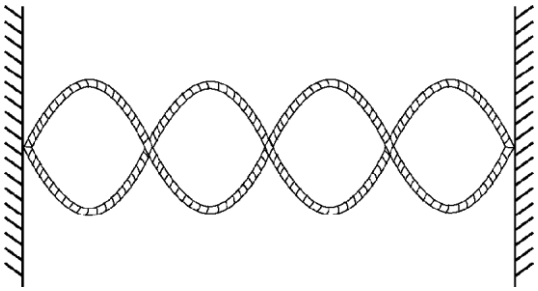
A) 

B) 

C) 

D) 

28. What is the total number of nodes and antinodes in the standing wave below?



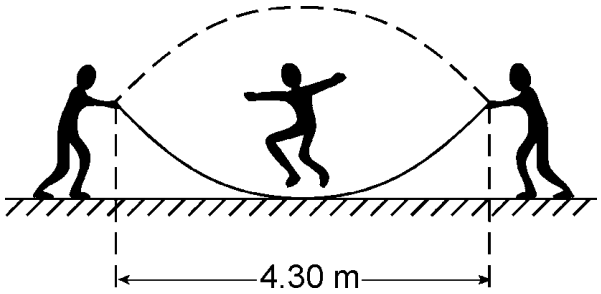
A) 2 nodes and 3 antinodes

B) 5 nodes and 4 antinodes

C) 3 nodes and 2 antinodes

D) 4 nodes and 5 antinodes

29. While playing, two children create a standing wave in a jump rope, as shown in the diagram below. A third child participates by jumping the rope.



What is the wavelength of this standing wave?

A) 2.15 m

B) 4.30 m

C) 6.45 m

D) 8.60 m

30. Wave *X* travels eastward with frequency *f* and amplitude *A*. Wave *Y*, traveling in the same medium, interacts with wave *X* and produces a standing wave. Which statement about wave *Y* is correct?

A) Wave *Y* must have a frequency of *f*, an amplitude of *A*, and be traveling westward.

B) Wave *Y* must have a frequency of *f*, an amplitude of *A*, and be traveling eastward.

C) Wave *Y* must have a frequency of 3*f*, an amplitude of 2*A*, and be traveling westward.

D) Wave *Y* must have a frequency of 2*f*, an amplitude of 3*A*, and be traveling eastward.

31. What type of wave phenomenon occurs when vibrations in one object causes vibrations in a second object?

A) Intensity

B) Reflection

C) Resonance

D) Tuning

32. A dampened fingertip rubbed around the rim of a crystal stemware glass causes the glass to vibrate and produce a musical note. This effect is due to:

A) reflection.

B) refraction.

C) rarefaction.

D) resonance.

33. Resonance occurs when one vibrating object transfers energy to a second object causing it to vibrate. The energy is transfer is most efficient when, compared to the first object, the second object has the same natural:

A) amplitude.

B) frequency.

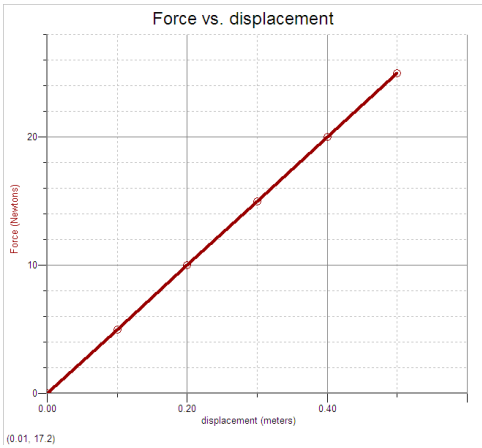
C) loudness.

D) beat.

1)C, 2)B, 3)A, 4)D, 5)B, 6)C, 7)A, 8)B, 9)A, 10)B, 11)B, 12)C, 13)A, 14)B, 15)B, 16)C, 17)C, 18)D, 19)B, 20)B, 21)B, 22)A, 23)A, 24)C, 25)D, 26)C, 27)D, 28)B, 29)D, 30)A, 31)C, 32)D, 33) B

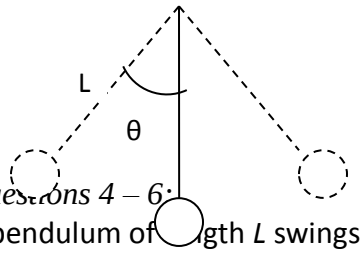
1. According to Hooke's law for an ideal spring, doubling the stretch distance will
(A) double the velocity of the mass.
(B) double the force that the spring exerts on the mass.
(C) quadruple the force the spring exerts on the mass.
(D) double the period.
(E) double the frequency.

Questions 2 – 3: Consider the *force vs displacement* graph shown for an ideal spring.



2. The work done in stretching the spring from 0.1 m to 0.5 m is
(A) 1 J (B) 4 J (C) 6 J (D) 12 J (E) 24 J

3. The spring constant *k* is equal to
(A) 5 N/m
(B) 10 N/m
(C) 20 N/m
(D) 25 N/m
(E) 50 N/m



Questions 4 – 6:
A pendulum of length *L* swings with an amplitude θ and a frequency *f* as shown above.

4. If the amplitude is increased and the pendulum is released from a greater angle,
(A) the period will decrease.
(B) the period will increase.
(C) the period will not change.
(D) the frequency will increase.
(E) the frequency will decrease.

5. If the mass and the length of the pendulum are both quadrupled, the frequency of vibration will be

(A) *f* (B) *2f* (C) *4f* (D)*(1/2) f* (E) *(1/4)f*

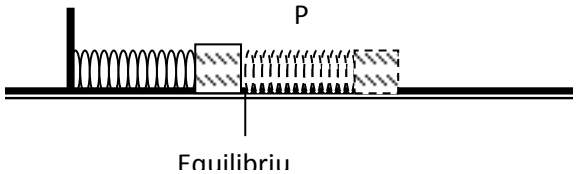
6. Which of the following statements is true about the swinging pendulum?

I. The greatest restoring force and the greatest velocity occur at the same point.

II. The greatest restoring force and the greatest acceleration occur at the same point.

III. The greatest acceleration and the greatest velocity occur at the same point.

(A) I only
(B) I and II only
(C) II only
(D) I and III only
(E) I, II, and III



Questions 7 – 9:

The equation which describes the motion of a mass oscillating on an ideal spring is

$$x = 6 \cos 3t$$

where *x* is in centimeters and *t* is in seconds.

7. The amplitude of the harmonic motion is

(A) 3 cm (B) 6 cm (C) 9 cm (D) 18 cm (E) 30 cm

8. The period of vibration for this mass on a spring is most nearly

(A) 1 s (B) 2 s (C) 3 s (D) 6 s (E) 9 s

9. The total distance traveled by the mass during one full oscillation is

(A) 3 cm (B) 6 cm (C) 12 cm (D) 18 cm (E) 24 cm

10. A mass vibrates on an ideal spring as shown above. The total energy of the spring is 100 J. What is the kinetic energy of the mass at point P, halfway between the equilibrium point and the amplitude?

(A) 25 J (B) 50 J (C) 75 J (D) 100 J (E) 200 J

1)B, 2)B, 3)E, 4)C, 5)D, 6) C, (7) B, (8)B, (9) B, (10) B

Open-ended:

1) Diagram SHM. At each time interval, describe the positon, velocity, and acceleration. Relate the quantities to each other at each time interval.

2) Give real-world examples of periodic motion. Give examples of simple harmonic motion.

3) Describe the potential and kinetic energies at the equilibrium point and at the maximum displacement for a block on a spring system.