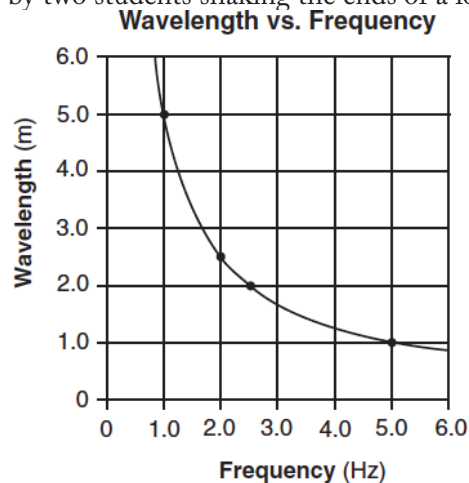Name: _____          Period: _____

# Waves-Wave Characteristics

1. What is the wavelength of a 256-hertz sound wave in air at STP?
   1. $1.17 \times 10^6$ m
   2. 1.29 m
   3. 0.773 m
   4. $8.53 \times 10^{-7}$ m

2. The graph below represents the relationship between wavelength and frequency of waves created by two students shaking the ends of a loose spring.

   

   Calculate the speed of the waves generated in the spring. [Show all work, including the equation and substitution with units.]

3. What is the period of a water wave if 4 complete waves pass a fixed point in 10 seconds?
   1. 0.25 s
   2. 0.40 s
   3. 2.5 s
   4. 4.0 s

4. If the frequency of a periodic wave is doubled, the period of the wave will be
   1. halved
   2. doubled
   3. quartered
   4. quadrupled

5. A 512-hertz sound wave travels 100 meters to an observer through air at STP. What is the wavelength of this sound wave?

6. The diagram below represents a periodic wave.
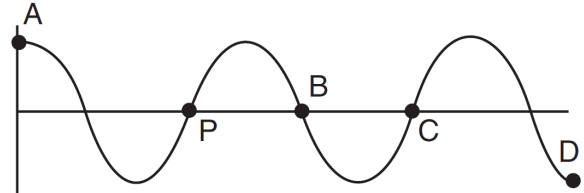
   

   Which point on the wave is in phase with point P?
   1. A
   2. B
   3. C
   4. D

7. A periodic wave having a frequency of 5.0 hertz and a speed of 10 meters per second has a wavelength of
   1. 0.50 m
   2. 2.0 m
   3. 5.0 m
   4. 50 m

8. A ringing bell is located in a chamber. When the air is removed from the chamber, why can the bell be seen vibrating but not be heard?
   1. Light waves can travel through a vacuum, but sound waves cannot.
   2. Sound waves have greater amplitude than light waves.
   3. Light waves travel slower than sound waves.
   4. Sound waves have higher frequencies than light waves.

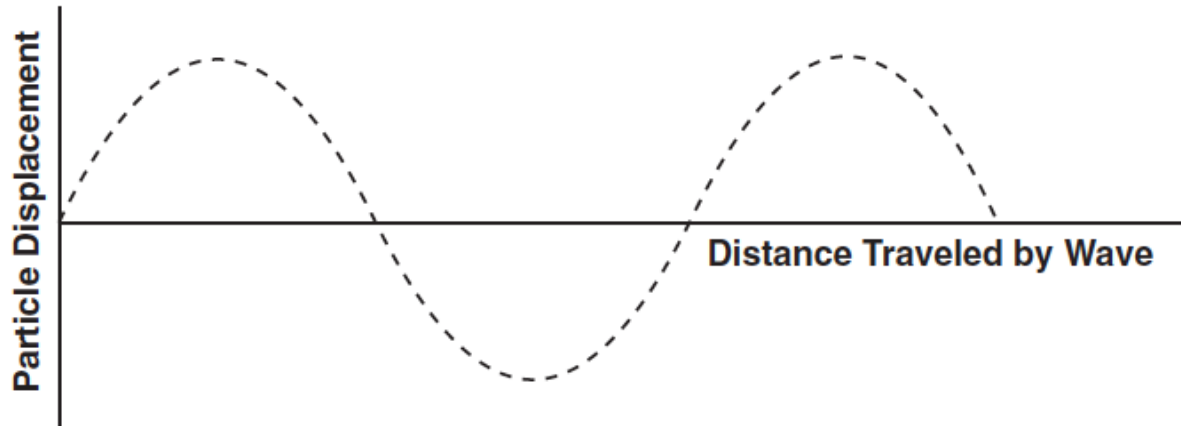9. The diagram below represents a transverse wave.
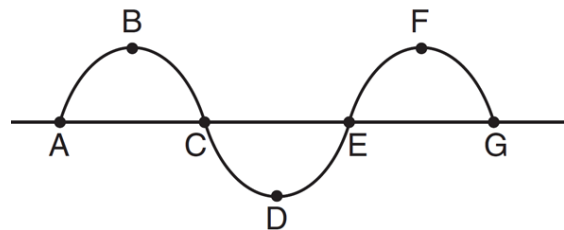
   

   The wavelength of the wave is equal to the distance between points
   1. A and G
   2. B and F
   3. C and E
   4. D and F

# Waves-Wave Characteristics

10. The diagram below represents a periodic transverse wave traveling in a uniform medium.



On the diagram above, draw a wave having both a smaller amplitude and the same wavelength as the given wave.

---

Base your answers to questions 11 through 13 on the information and diagram below.

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.
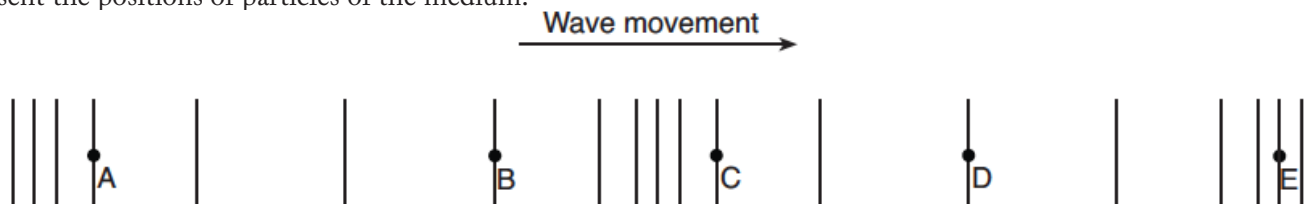


11. Which diagram best represents the motion of the particle at position C as the wave moves to the right?



   ( 1 )          ( 2 )          ( 3 )          ( 4 )
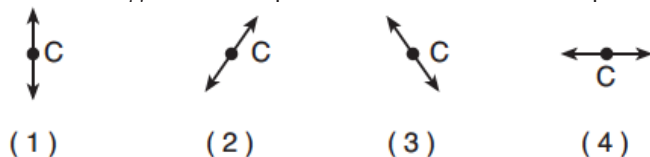
12. The wavelength of this wave is equal to the distance between points
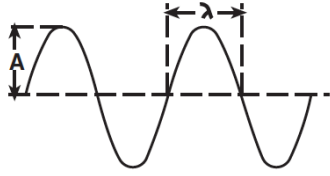    1.  A and B
    2.  B and C
    3.  A and C
    4.  B and E

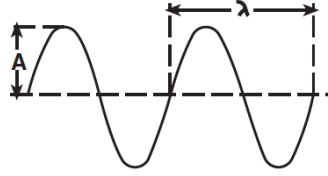13. The energy of this wave is related to its
    1.  amplitude
    2.  period
    3.  speed
    4.  wavelength
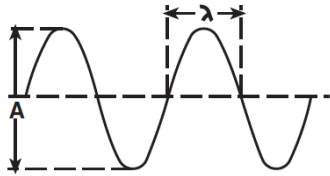
# Waves-Wave Characteristics

14. Which wave diagram has *both* wavelength ($\lambda$) and amplitude (A) labeled correctly?
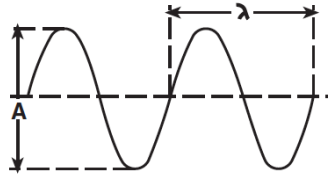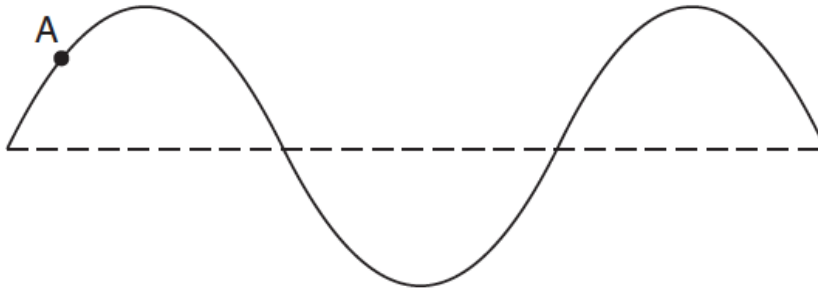
( 1 )          ( 3 )

( 2 )          ( 4 )

15. The diagram below represents a transverse wave moving on a uniform rope with point A labeled as shown. On the diagram, mark an X at the point on the wave that is 180° out of phase with point A.

A

Base your answers to questions 16 through 18 on the information and diagram below.

Three waves, A, B, and C, travel 12 meters in 2.0 seconds through the same medium as shown in the diagram below.

A     B

C

4.0 m

12 m
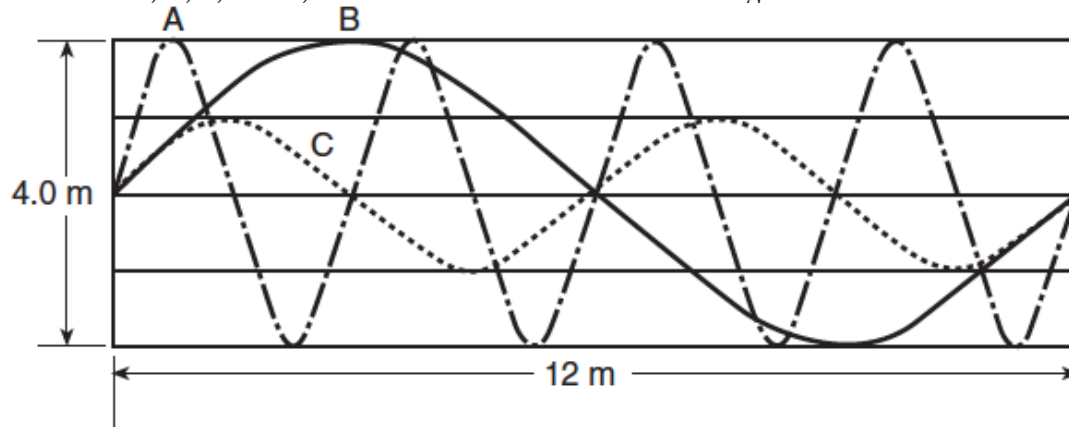
16. What is the amplitude of wave C?

17. What is the period of wave A?

18. What is the speed of wave B?

# Waves-Wave Characteristics

Base your answers to questions 19 through 21 on the information below. [Show all work, including the equation and substitution with units.]

A stationary submarine uses sonar to send a $1.18 \times 10^3$-hertz sound wave down through the ocean water. The reflected sound wave from the flat ocean bottom 324 meters below the sub is detected 0.425 seconds after it was sent from the submarine.
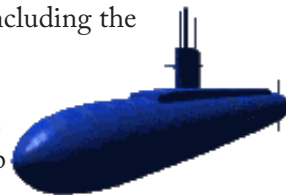
19. Calculate the speed of the sound wave in the ocean water.

20. Calculate the wavelength of the sound wave in the ocean water.

21. Determine the period of the sound wave in the ocean water.

---

22. A motor is used to produce 4.0 waves each second in a string. What is the frequency of the waves?
    1. 0.25 Hz
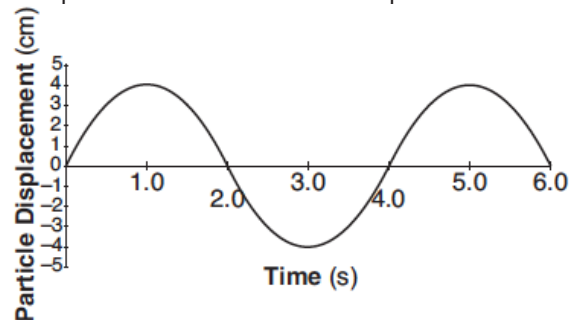    2. 15 Hz
    3. 25 Hz
    4. 4.0 Hz

23. If the amplitude of a wave is increased, the frequency of the wave will
    1. decrease
    2. increase
    3. remain the same

24. The time required for a wave to complete one full cycle is called the wave's
    1. frequency
    2. period
    3. velocity
    4. wavelength

25. The graph below represents the displacement of a particle in a medium over a period of time.
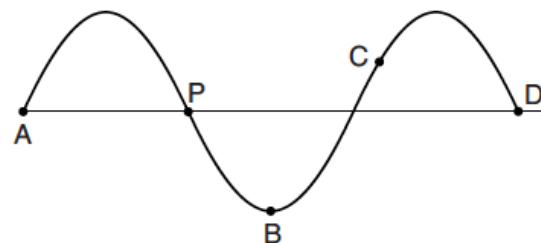


The amplitude of the wave is
    1. 4.0 s
    2. 6.0 s
    3. 8 cm
    4. 4 cm

26. A periodic wave is produced by a vibrating tuning fork. The amplitude of the wave would be greater if the tuning fork were
    1. struck more softly
    2. struck harder
    3. replaced by a lower frequency tuning fork
    4. replaced by a higher frequency tuning fork

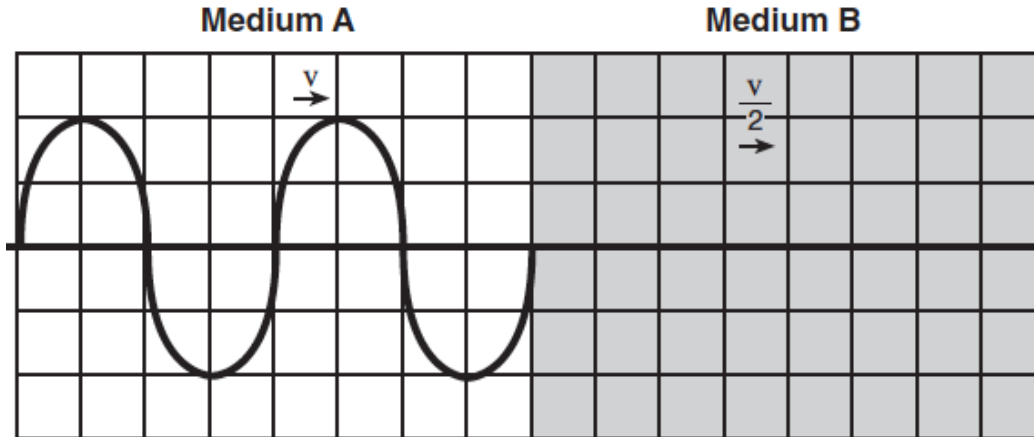27. The diagram below represents a periodic wave.



Which point on the wave is 90° out of phase with point P?
    1. A
    2. B
    3. C
    4. D

# Waves-Wave Characteristics

28. A periodic wave travels at speed v through medium A. The wave passes with all its energy into medium B. The speed of the wave through medium B is v/2. On the diagram below, draw the wave as it travels through medium B. Show at least one full wave.

**Medium A**      **Medium B**

29. The energy of a water wave is closely related to its
    1. frequency
    2. wavelength
    3. period
    4. amplitude

30. The diagram below represents a transverse wave.
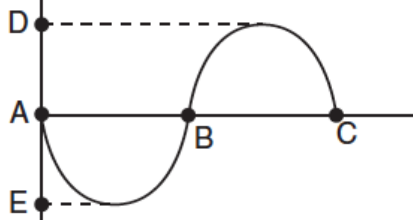
    The distance between which two points identifies the amplitude of the wave?
    1. A and B
    2. A and C
    3. A and E
    4. D and E

31. If the amplitude of a wave traveling in a rope is doubled, the speed of the wave in the rope will
    1. decrease
    2. increase
    3. remain the same

32. Increasing the amplitude of a sound wave produces a sound with
    1. lower speed
    2. higher pitch
    3. shorter wavelength
    4. greater loudness

33. The energy of a sound wave is closely related to its
    1. period
    2. amplitude
    3. frequency
    4. wavelength

34. The diagram below shows a periodic wave.
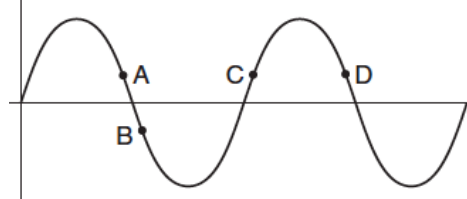
    Which points are in phase with each other?
    1. A and C
    2. A and D
    3. B and C
    4. C and D

35. Which unit is equivalent to meters per second?
    1. Hz·s
    2. Hz·m
    3. s/Hz
    4. m/Hz

36. The sound wave produced by a trumpet has a frequency of 440 hertz. What is the distance between successive compressions in this sound wave as it travels through air at STP?
    1. $1.5 \times 10^{-6}$ m
    2. 0.75 m
    3. 1.3 m
    4. $6.8 \times 10^5$ m

# Waves-Wave Characteristics

Base your answers to questions 37 and 38 on the information and diagram below.

A student standing on a dock observes a piece of wood floating on the water as shown below. As a water wave passes, the wood moves up and down, rising to the top of a wave crest every 5.0 seconds.
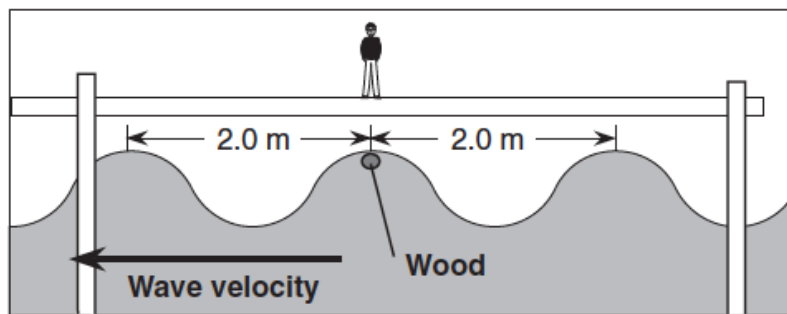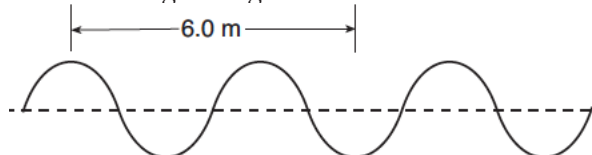


(Not drawn to scale)

37. Calculate the frequency of the passing water waves. [Show all work, including the equation and substitution with units.]

38. Calculate the speed of the water waves. [Show all work, including the equation and substitution with units.]

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



If the frequency of the wave is 2.0 hertz, the speed of the wave is
1. 6.0 m/s
2. 2.0 m/s
3. 8.0 m/s
4. 4.0 m/s

40. 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 superimposed waves is
1. 0°
2. 90°
3. 180°
4. 270°

41. A surfacing whale in an aquarium produces water wave crests every 0.40 seconds. If the water wave travels at 4.5 meters per second, the wavelength of the wave is
1. 1.8 m
2. 2.4 m
3. 3.0 m
4. 11 m

42. The diagram below represents a transverse wave moving along a string.
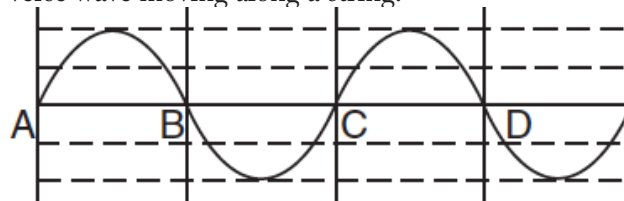


On the diagram above, draw a transverse wave that would produce complete destructive interference when superimposed with the original wave.

43. The product of a wave's frequency and its period is
1. one
2. its velocity
3. its wavelength
4. Planck's constant

# Waves-Wave Characteristics

Base your answers to questions 44 and 45 on the information below.

A student plucks a guitar string and the vibrations produce a sound wave with a frequency of 650 hertz.

44. The sound wave produced can best be described as a
    1. transverse wave of constant amplitude
    2. longitudinal wave of constant frequency
    3. mechanical wave of varying frequency
    4. electromagnetic wave of varying wavelengths

45. Calculate the wavelength of the sound wave in air at STP. [Show all work, including the equation and substitution with units.]

Base your answers to questions 46 and 47 on the information below.

A transverse wave with an amplitude of 0.20 meters and wavelength of 3.0 meters travels toward the right in a medium with a speed of 4.0 meters per second.

46. On the diagram below, place an X at each of *two* points that are in phase with each other.
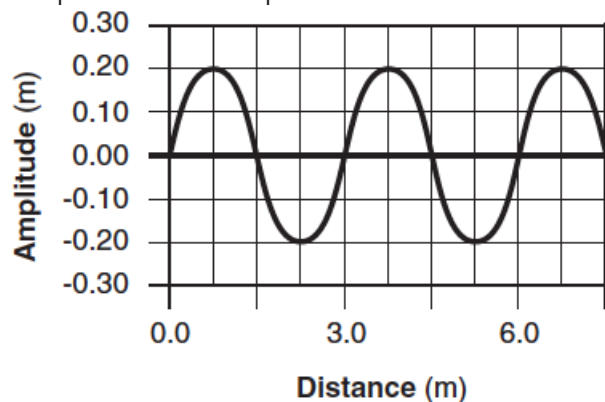


47. Calculate the period of the wave. [Show all work, including the equation and substitution with units.]