Name: _____ **Class:** _____ **Date:** _____ **ID: A**

AP physics B - Webreview ch 13 Waves

Multiple Choice

Identify the choice that best completes the statement or answers the question.

____ 1. A large spring requires a force of 150 N to compress it only 0.010 m. What is the spring constant of the spring?
a. 125 000 N/m
b. 15 000 N/m
c. 15 N/m
d. 1.5 N/m
e. 1.0 N/m

____ 2. A 0.20-kg object is attached to a spring with spring constant $k = 10$ N/m and moves with simple harmonic motion over a horizontal frictionless surface. At the instant that it is displaced from equilibrium by −0.050 m, what is its acceleration?
a. 1 000 m/s^2
b. −40 m/s^2
c. 0.1 m/s^2
d. 2.5 m/s^2
e. 1.5 m/s^2

____ 3. Tripling the displacement from equilibrium of an object in simple harmonic motion will bring about a change in the magnitude of the object's acceleration by what factor?
a. 0.33
b. 1.0
c. 3.0
d. 9.0
e. 12

____ 4. A mass of 0.40 kg, attached to a spring with a spring constant of 80 N/m, is set into simple harmonic motion. What is the magnitude of the acceleration of the mass when at its maximum displacement of 0.10 m from the equilibrium position?
a. zero
b. 5 m/s^2
c. 10 m/s^2
d. 20 m/s^2
e. 23 m/s^2

____ 5. A mass of 4.0 kg, resting on a horizontal frictionless surface, is attached on the right to a horizontal spring with spring constant 20 N/m and on the left to a horizontal spring with spring constant 50 N/m. If this system is moved from equilibrium, what is the effective spring constant?
a. 30 N/m
b. -30 N/m
c. 70 N/m
d. 14 N/m
e. -14 N/m

____ 6. Suppose there is an object for which $F = +kx$. What will happen if the object is moved away from equilibrium ($x = 0$) and released?
   a. It will return to the equilibrium position.
   b. It will move further away with constant velocity.
   c. It will move further away with constant acceleration.
   d. It will move further away with increasing acceleration.
   e. None of the above.

____ 7. Which is not an example of approximate simple harmonic motion?
   a. A ball bouncing on the floor.
   b. A child swinging on a swing.
   c. A piano string that has been struck.
   d. A car's radio antenna as it waves back and forth.
   e. Both choices A and D are valid.

____ 8. If it takes 4.0 N to stretch a spring 6.0 cm and if the spring is then cut in half, what force does it take to stretch one of the halves 3.0 cm?
   a. 2.0 N
   b. 4.0 N
   c. 8.0 N
   d. 16 N
   e. 18 N

____ 9. Three identical springs each have the same spring constant k. If these three springs are attached end to end forming a spring three times the length of one of the original springs, what will be the spring constant of the combination?
   a. k
   b. 3 k
   c. $k/3$
   d. 1.73 k
   e. 9 k

____ 10. A 0.20-kg object is oscillating on a spring with a spring constant of $k = 15$ N/m. What is the potential energy of the system when the object displacement is 0.040 m, exactly half the maximum amplitude?
   a. zero
   b. 0.006 0 J
   c. 0.012 J
   d. 2.5 J
   e. 3.4 J

____ 11. A 0.20 kg object, attached to a spring with spring constant $k = 10$ N/m, is moving on a horizontal frictionless surface in simple harmonic motion of amplitude of 0.080 m. What is its speed at the instant when its displacement is 0.040 m? (Hint: Use conservation of energy.)
   a. 9.8 m/s
   b. 4.9 m/s
   c. 49 cm/s
   d. 24.5 cm/s
   e. 53 cm/s

____ 12. A mass of 0.40 kg, hanging from a spring with a spring constant of 80 N/m, is set into an up-and-down simple harmonic motion. What is the speed of the mass when moving through the equilibrium point? The starting displacement from equilibrium is 0.10 m.
a. zero
b. 1.4 m/s
c. 2.0 m/s
d. 3.4 m/s
e. 4.2 m/s

____ 13. A mass of 0.40 kg, hanging from a spring with a spring constant of 80 N/m, is set into an up-and-down simple harmonic motion. What is the speed of the mass when moving through a point at 0.05 m displacement? The starting displacement of the mass is 0.10 m from its equilibrium position.
a. zero
b. 1.4 m/s
c. 1.7 m/s
d. 1.2 m/s
e. 1.0 m/s

____ 14. A runaway railroad car, with mass 30×10^4 kg, coasts across a level track at 2.0 m/s when it collides with a spring-loaded bumper at the end of the track. If the spring constant of the bumper is 2.0×10^6 N/m, what is the maximum compression of the spring during the collision? (Assume the collision is elastic.)
a. 0.77 m
b. 0.58 m
c. 0.34 m
d. 1.07 m
e. 1.23 m

____ 15. A 0.20-kg mass is oscillating on a spring over a horizontal frictionless surface. When it is at a displacement of 2.6 cm for equilibrium it has a kinetic energy of 1.4 J and a spring potential energy of 2.2 J. What is the maximum speed of the mass during its oscillation?
a. 3.7 m/s
b. 4.7 m/s
c. 6.0 m/s
d. 6.3 m/s
e. 7.8 m/s

____ 16. Suppose a 0.3-kg mass on a spring that has been compressed 0.10 m has elastic potential energy of 1 J. What is the spring constant?
a. 10 N/m
b. 20 N/m
c. 200 N/m
d. 300 N/m
e. 400 N/m

____ 17. Suppose a 0.3-kg mass on a spring that has been compressed 0.10 m has elastic potential energy of 1.0 J. How much further must the spring be compressed to triple the elastic potential energy?
a. 0.30 m
b. 0.20 m
c. 0.17 m
d. 0.07 m
e. 0.05 m

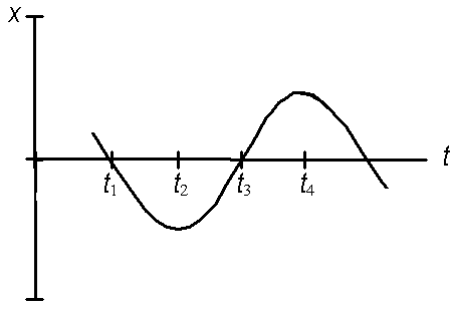
____ 18. Suppose a 0.30-kg mass on a spring-loaded gun that has been compressed 0.10 m has elastic potential energy of 1.0 J. How high above the spring's equilibrium point can the gun fire the mass if the gun is fired straight up?
a. 0.10 m
b. 0.34 m
c. 0.24 m
d. 3.6 m
e. 10 m

____ 19. An object is attached to a spring and its frequency of oscillation is measured. Then another object is connected to the first object, and the resulting mass is four times the original value. By what factor is the frequency of oscillation changed?
a. 1/4
b. 1/2
c. 1/16
d. 2
e. 4

____ 20. For a mass suspended on a spring in the vertical direction, the time for one complete oscillation will depend on:
a. the value for g (the acceleration due to gravity).
b. the distance the mass was originally pulled down.
c. the maximum speed of the oscillating mass.
d. the time doesn't depend on any of the above.
e. both choices A and C are valid.

____ 21. A mass on a spring vibrates in simple harmonic motion at a frequency of 4.0 Hz and an amplitude of 8.0 cm. If a timer is started when its displacement is a maximum (hence $x = 8$ cm when $t = 0$), what is the displacement of the mass when $t = 3.7$ s?
a. zero
b. 0.025 m
c. 0.036 m
d. 0.080 m
e. 0.095 m

____ 22. Consider the curve $x = A \sin(kt)$, with $A > 0$. At which point on the graph is it possible that $t = 0$?



a. Point t_1
b. Point t_2
c. Point t_3
d. Point t_4
e. Both choices A and C are valid.

____ 23. For a wave on the ocean, the amplitude is:
a. the distance between crests.
b. the height difference between a crest and a trough.
c. one half the height difference between a crest and a trough.
d. how far the wave goes up on the beach.
e. one half the distance between crests.

____ 24. As a gust of wind blows across a field of grain, a wave can be seen to move across the field as the tops of the plants sway back and forth. This wave is a:
a. transverse wave.
b. longitudinal wave.
c. polarized wave.
d. interference of waves.
e. both choices B and C are valid.

____ 25. Which of the following is an example of a longitudinal wave?
a. sound wave in air
b. wave traveling in a string
c. both a and b
d. neither a nor b
e. wave traveling in a rope

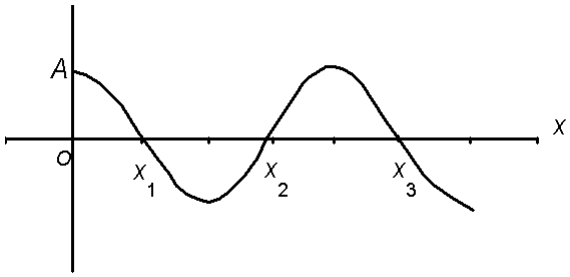
____ 26. If the frequency of a traveling wave train is increased by a factor of three in a medium where the speed is constant, which of the following is the result?
a. amplitude is one third as big
b. amplitude is tripled
c. wavelength is one third as big
d. wavelength is tripled
e. both choices A and C are valid.

____ 27. The wavelength of a traveling wave can be calculated if one knows the:
a. frequency.
b. speed and amplitude.
c. amplitude and frequency.
d. frequency and speed.
e. speed.

____ 28. A traveling wave train has wavelength 0.50 m, speed 20 m/s. Find the wave frequency.
a. 0.025 Hz
b. 20 Hz
c. 40 Hz
d. 10 Hz
e. 1.5 Hz

____ 29. A musical tone, sounded on a piano, has a frequency of 410 Hz and a wavelength in air of 0.800 m. What is the wave speed?
a. 170 m/s
b. 235 m/s
c. 328 m/s
d. 587 m/s
e. 673 m/s

____ 30. Consider the curve $f(x) = A\cos(2\pi x/\lambda)$. The wavelength of the wave will be:



a. the distance *0* to *A*.
b. twice the distance *0* to *A*.
c. the distance x_2 to x_3.
d. twice the distance x_2 to x_3.
e. the distance *0* to x_1.

____ 31. Bats can detect small objects such as insects that are of a size approximately that of one wavelength. If bats emit a chirp at a frequency of 60 kHz, and the speed of sound waves in air is 330 m/s, what is the smallest size insect they can detect?
a. 1.5 mm
b. 3.5 mm
c. 5.5 mm
d. 7.5 mm
e. 9.5 mm

____ 32. A long string is pulled so that the tension in it increases by a factor of three. If the change in length is negligible, by what factor does the wave speed change?
a. 3.0
b. 1.7
c. 0.58
d. 0.33
e. 0.21

____ 33. Tripling both the tension in a guitar string and its mass per unit length will result in changing the wave speed in the string by what factor?
a. 0.58
b. 1.00 (i.e., no change)
c. 1.73
d. 3.00
e. 9.00

____ 34. Tripling the mass per unit length of a guitar string will result in changing the wave speed in the string by what factor?
a. 0.58
b. 1.00 (i.e., no change)
c. 1.73
d. 3.00
e. 9.00

____ 35. A wave is traveling in a string at 60 m/s. When the tension is then increased 20%, what will be the resulting wave speed?
a. also 60 m/s
b. 66 m/s
c. 72 m/s
d. 55 m/s
e. 84 m/s

____ 36. A wave travels in a string at 60 m/s. A second string of 20% greater linear density has the same tension applied as in the first string. What will be the resulting wave speed in the second string?
a. also 60 m/s
b. 66 m/s
c. 72 m/s
d. 55 m/s
e. 84 m/s

____ 37. Equal wavelength waves of amplitude 0.25 m and 0.15 m interfere with one another. What is the resulting minimum amplitude that can result?
a. 0.15 m
b. 0.10 m
c. 0 m
d. -0.40 m
e. -0.60 m

____ 38. Consider two identical and symmetrical wave pulses on a string. Suppose the first pulse reaches the fixed end of the string and is reflected back and then meets the second pulse. When the two pulses overlap exactly, the superposition principle predicts that the amplitude of the resultant pulses, at that moment, will be what factor times the amplitude of one of the original pulses?
a. 0
b. 1
c. 2
d. 4
e. 8

AP physics B - Webreview ch 13 Waves
Answer Section

MULTIPLE CHOICE

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