Name: ______________________ Class: _________________ Date: _________ ID: A

Cp physics Test Ch 12 Waves

Multiple Choice

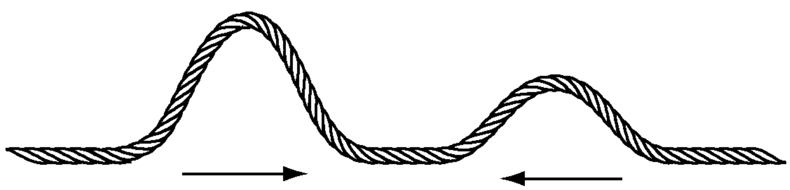
Identify the choice that best completes the statement or answers the question.

____ 1. A mass attached to a spring vibrates back and forth. At maximum displacement, the spring force and the
- a. velocity reach a maximum.
- b. velocity reach zero.
- c. acceleration reach a maximum.
- d. acceleration reach zero.

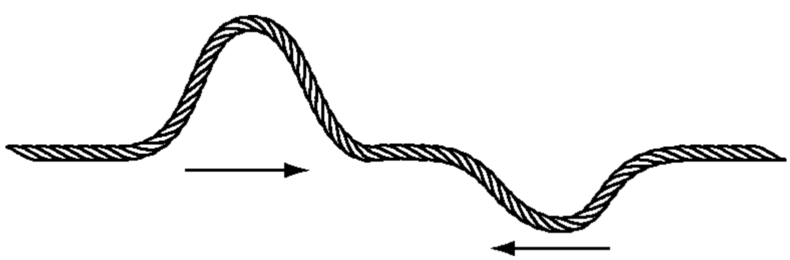
____ 2. A simple pendulum swings in simple harmonic motion. At maximum displacement,
- a. the acceleration reaches a maximum.
- b. the velocity reaches a maximum.
- c. the acceleration reaches zero.
- d. the restoring force reaches zero.

____ 3. If a pendulum is adjusted so that its frequency changes from 10 Hz to 20 Hz, its period will change from n seconds to
- a. $n/4$ seconds.
- b. $n/2$ seconds.
- c. $2n$ seconds.
- d. $4n$ seconds.

____ 4. Two mechanical waves that have positive displacements from the equilibrium position meet and coincide. What kind of interference occurs?
- a. constructive
- b. destructive
- c. complete destructive
- d. none



____ 5. Which of the following types of interference will occur when the pulses in the figure above meet?
- a. no interference
- b. constructive interference
- c. destructive interference
- d. total interference



____ 6. Which of the following types of interference will occur when the pulses in the figure above meet?
- a. no interference
- b. constructive interference
- c. destructive interference
- d. total interference

____ 7. Waves arriving at a free boundary are
- a. neither reflected nor inverted.
- b. reflected but not inverted.
- c. reflected and inverted.
- d. inverted but not reflected.

____ 8. For a mass hanging from a spring, the maximum displacement the spring is stretched or compressed from its equilibrium position is the system's

a. amplitude.	c. frequency.
b. period.	d. acceleration.

____ 9. A pendulum swings through a total of 28°. If the displacement is equal on each side of the equilibrium position, what is the amplitude of this vibration? (Disregard frictional forces acting on the pendulum.)

a. 28°	c. 56°
b. 14°	d. 7.0°

____ 10. Which of the following features of a given pendulum changes when the pendulum is moved from Earth's surface to the moon?

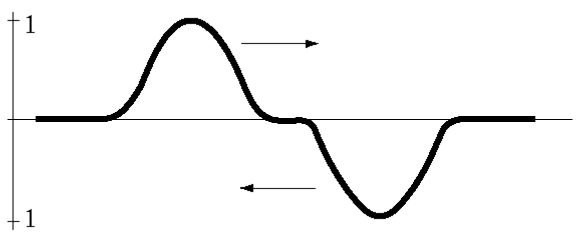
a. the mass	c. the equilibrium position
b. the length	d. the restoring force

____ 11. Which of the following is a single nonperiodic disturbance?

a. pulse wave	c. sine wave
b. periodic wave	d. transverse wave

____ 12. One end of a taut rope is fixed to a post. What type of wave is produced if the free end is quickly raised and lowered one time?

a. pulse wave	c. sine wave
b. periodic wave	d. longitudinal wave



____ 13. Which of the following types of interference will occur when the pulses in the figure above meet?

a. no interference	c. partial interference
b. complete constructive interference	d. complete destructive interference

____ 14. Consider two identical wave pulses on a rope having a fixed end. Suppose the first pulse reaches the end of the rope, is reflected back, and then meets the second pulse. When the two pulses overlap exactly, what will be the amplitude of the resultant pulse?

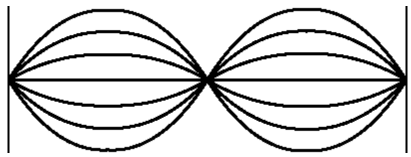
a. zero
b. same as the original pulses
c. double the amplitude of the original pulses
d. half the amplitude of the original pulses

____ 15. A student sends a pulse traveling on a taut rope with one end attached to a post. What will the student observe?

a. The pulse will not be reflected if the rope is free to slide up and down on the post.
b. The pulse will be reflected and inverted if the rope is free to slide up and down on the post.
c. The pulse will be reflected and inverted if the rope is fixed to the post.
d. The pulse will not be inverted if the rope is fixed to the post.

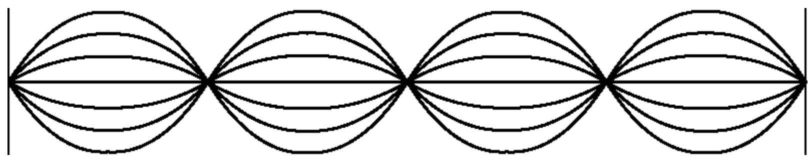
____ 16. A 2.0 m long stretched rope is fixed at both ends. Which wavelength would *not* produce standing waves on this rope?

a. 2.0 m
b. 3.0 m
c. 4.0 m
d. 6.0 m



____ 17. How many nodes and antinodes are shown in the standing wave above?

a. two nodes and three antinodes
b. one node and two antinodes
c. one-third node and one antinode
d. three nodes and two antinodes



____ 18. How many nodes and antinodes are shown in the standing wave above?

a. four nodes and four antinodes
b. four nodes and three antinodes
c. four nodes and five antinodes
d. five nodes and four antinodes

Problem

19. A mass on a spring that has been compressed 0.1 m has a restoring force of 20 N. What is the spring constant?

20. A mass on a spring vibrates in simple harmonic motion at an amplitude of 8.0 cm. If the mass of the object is 0.20 kg and the spring constant is 130 N/m, what is the frequency?

21. If a force of 50 N stretches a spring 0.10 m, what is the spring constant?

22. Imagine that you could transport a simple pendulum from Earth to the moon, where the free-fall acceleration is one-sixth that on Earth. By what factor would the pendulum's frequency be changed? Express the answer with one significant figure.

23. On the planet Xenos, an astronaut observes that a 1.00 m long pendulum has a period of 1.50 s. What is the free-fall acceleration on Xenos?

24. A student wishes to construct a mass-spring system that will oscillate with the same frequency as a swinging pendulum with a period of 3.45 s. The student has a spring with a spring constant of 72.0 N/m. What mass should the student use to construct the mass-spring system?

25. A periodic wave has a wavelength of 0.50 m and a speed of 20 m/s. What is the wave frequency?

Cp physics Test Ch 12 Waves
Answer Section

MULTIPLE CHOICE

1. C
2. A
3. B
4. A
5. B
6. C
7. B
8. A
9. B
10. D
11. A
12. A
13. D
14. A
15. C
16. B
17. D
18. D

PROBLEM

19. 200 N/m

Given
$x = -0.1$ m
$F_{elastic} = 20$ N

Solution
$F_{elastic} = -kx$

$$k = -\frac{F_{elastic}}{x} = -\frac{20\ \text{N}}{-0.1\ \text{m}}$$

$k = 200$ N/m

20. 4.0 Hz

    Given
    $x = 8.0$ cm (This value is not relevant to the problem.)
    $m = 0.20$ kg
    $k = 130$ N/m

    Solution

    $T = 2\pi\sqrt{\dfrac{m}{k}}$ and $f = \dfrac{1}{T}$, so

    $$f = \frac{1}{2\pi\sqrt{\dfrac{m}{k}}} = \frac{1}{2\pi}\sqrt{\frac{k}{m}} = \frac{1}{2\pi}\sqrt{\frac{130\ \text{N/m}}{0.20\ \text{kg}}} = 4.1\ \text{Hz}$$

21. 500 N/M

    Given
    $F_{elastic} = 50$ N
    $x = -0.10$ m

    Solution
    $F_{elastic} = -kx$

    $$k = \frac{-F_{elastic}}{x} = \frac{-50\ \text{N}}{-0.10\ \text{m}}$$

    $k = 500$ N/m

22. 0.4

Given
$a_g = \frac{1}{6}g$

Solution
$T = 2\pi\sqrt{\frac{L}{a_g}}$

Because L and 2π remain constant when the pendulum is moved to the moon, $T_{moon} \propto \sqrt{\frac{1}{a_g}}$, where a_g is the gravitational acceleration of the moon.

$$\frac{T_{moon}}{T_{earth}} = \frac{\sqrt{\frac{1}{a_g}}}{\sqrt{\frac{1}{g}}} = \sqrt{\frac{g}{a_g}}$$

$f = \frac{1}{T}$, so $\frac{f_{moon}}{f_{earth}} = \sqrt{\frac{a_g}{g}} = \sqrt{\frac{1}{6}} = 0.4$

23. 17.6 m/s^2

Given
$L = 1.00$ m
$T = 1.50$ s

Solution
$T = 2\pi\sqrt{\frac{L}{a_g}}$, so $T^2 = 4\pi^2\left(\frac{L}{a_g}\right)$

$$a_g = \frac{4\pi^2 L}{T^2} = 4\pi^2\left(\frac{1.00 \text{ m}}{(1.50 \text{ s})^2}\right) = 17.6 \text{ m/s}^2$$

24. 21.7 kg

Given
$T_{pendulum} = 3.45$ s
$k = 72.0$ N/m

Solution
If both systems have the same frequency, they will also have the same period.
Therefore, the given period may be substituted into the equation for a mass-spring system.

$$T = 2\pi\sqrt{\frac{m}{k}}$$

$$T^2 = 4\pi^2\left(\frac{m}{k}\right)$$

$$m = \frac{T^2 k}{4\pi^2} = \frac{(3.45\text{ s})^2(72.0\text{ N/m})}{4\pi^2} = 21.7\text{ kg}$$

25. 40 Hz

Given
$v = 20$ m/s
$\lambda = 0.50$ m

Solution
$v = f\lambda$

$$f = \frac{v}{\lambda} = \frac{20\text{ m/s}}{0.50\text{ m}} = 40\text{ Hz}$$