

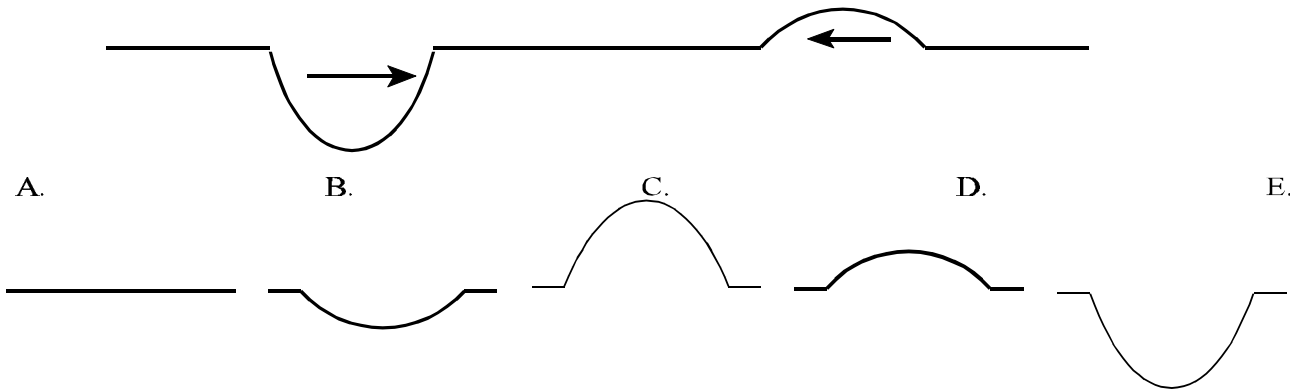
SIMPLE HARMONIC MOTION, WAVES AND SOUND

FOR EACH OF THE FOLLOWING SELECT THE BEST ANSWER AND PLACE THE APPROPRIATE LETTER IN THE SPACE PROVIDED. [OR SCANTRON SHEET] USE CAPITAL, BLOCK LETTERS.

- ___ 1. The linear distance between corresponding points on consecutive waves;
A. amplitude B. frequency C. pulse D. period E. wavelength
- ___ 2. The ability of waves to bend around corners when the length of the wave is large compared to the dimensions of the corner;
A. polarization B. refraction C. diffraction D. reflection E. interference
- ___ 3. The process whereby the vibrations of a transverse wave are limited to a single plane;
A. interference B. refraction C. reflection D. polarization E. diffraction
- ___ 4. As a wave moves from one medium to another each of the following characteristics may change except;
A. wavelength B. wave speed C. period D. amplitude E. phase
- ___ 5. A wave in which the displacement of the medium is at parallel to the direction of motion of the wave is called;
A. polarized B. reflected C. inverted D. longitudinal E. transverse
- ___ 6. To increase the information carrying capability of a wave you should decrease the wave's;
A. wave speed B. amplitude C. period D. phase E. medium
- ___ 7. A wave is moving through a medium when it encounters a barrier. Upon reflection from the barrier the reflected wave will have the same phase if;
A. the barrier is flexible. B. the barrier is larger than the wavelength.
C. the barrier has a higher impedance than the incident medium.
D. the barrier has a lower temperature than the incident medium.
E. the barrier is made of plexiglass.
- ___ 8. According to Huygen's Theorem;
A. a long, straight wave is made up of many small, circular waves called wavelets.
B. the amplitude of a wave gradually decreases with time.
C. the direction of motion of a wave is always parallel to the wavefront.
D. a large wave will generate a large number of smaller waves when it reflects.
E. a small series of waves will join together upon refraction.
- ___ 9. A wave is moving through a medium when it encounters a barrier. The angle between the incoming wave and the normal to the barrier is 52° . The angle between the reflected wave and the normal will be;
A. greater than 52° B. less than 52° C. exactly equal to 52° D. exactly equal to 38° .
E. there is insufficient information to tell.
- ___ 10. Changing this wave characteristic will change the energy content of a wave;
A. phase B. amplitude C. polarization D. all of these E. none of these
- ___ 11. The point on a longitudinal wave where the medium is more dense than the equilibrium density;
A. amplitude B. trough C. reduction D. compression E. rarefaction

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- __12. Which of the following waves must be longitudinal?
 A. waves at the beach B. sound waves moving through water C. earthquake waves
 D. sound waves moving through concrete E. vibrations moving through a sheet of steel
- __13. Two wave are moving through a spring in opposite directions as shown below. When these two waves meet the newly formed wave will most closely resemble?

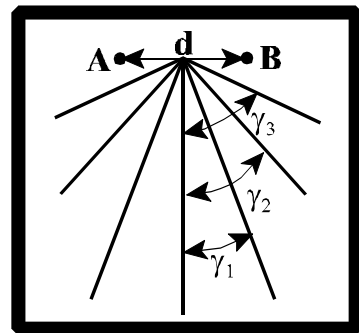


- __14. The resistance of a medium to the passage of a wave is called?
 A. polarization B. resistance C. refraction D. interference E. impedance
- __15. The point on a standing wave where two waves completely cancel each other out?
 A. barrier B. incident C. node D. loop E. antinode
- __16. After two waves undergo interference;
 A. each wave returns to the other side of the medium. B. each wave reflects off of the nearest interface.
 C. it is impossible to tell that interference has ever occurred.
 D. each wave decreases in amplitude. E. each wave slows down.
- __17. According to the Law of Refraction;
 A. the speed of the refracted wave will equal the speed of the incident wave.
 B. the angle of refraction will equal the angle of incidence.
 C. the direction of motion of a wave will usually change as it moves from one medium into another.
 D. the ratio of the wavelengths before and after refraction will be less than 1.0
 E. refracted waves will gain amplitude from a flexible barrier.
- __18. A standing wave is set up in a musical instrument such that resonance occurs at the following frequencies; 90 Hz., 180 Hz., 270 Hz., etc. Which of the following boundary conditions must apply to this instrument?
 A. both ends are fixed B. both ends are free
 C. the center of the instrument is fixed while the ends are both free
 D. the center of the instrument is free and both ends are fixed
 E. all of these are possible.
- __19. Which of the following factors will affect the period of a pendulum?
 A. the acceleration of gravity. B. the maximum speed of the bob.
 C. the mass of the bob. D. the arc length of the bob E. the density of the bob.

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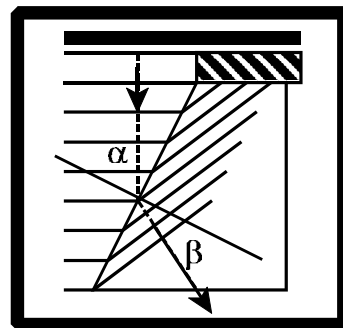
- ___20. You are listening to music coming from two loudspeakers sitting in front of you. When you move either slightly to the right or slightly to the left you notice that the sound level seems to get much louder. What wave characteristic would BEST explain what has happened?
A. reflection B. interference C. polarization D. refraction E. phase
- ___21. The gradual decrease in the amplitude of a wave as a function of time is called;
A. phase change B. damping C. interference D. attenuation E. damping
- ___22. The lowest frequency at which something will vibrate naturally is called the;
A. harmonic B. damping level C. constructive limit D. fundamental E. low effort level
- ___23. A wave is moving through a medium when it reflects off of a terminating barrier. As a result of this reflection the incident and reflected waves interfere with one another in a pattern of alternating nodes and antinodes. This system has formed a/an;
A. standing wave pattern. B. harmonic interlude. C. formal loop pattern.
D. phase formation. E. diffraction pattern.
- ___24. Which of the following could account for the poor transmission of sound through a glass bell jar?
A. The impedance of glass is greater than the impedance of air.
B. The impedance of glass is less than the impedance of air.
C. The speed of sound is greater in air than in glass.
D. The speed of sound is less in air than in glass.
E. The impedance of air is different from the impedance of glass.

Two point sources are generating waves simultaneously as shown in the diagram to the right. The second antinode occurs at an angle of $\theta_2 = 33.0^\circ$ and the distance between the two sources is $d = 12.0$ cm as shown.



- ___25. What is the wavelength of the waves in this pattern?
A. 1.54 cm B. 3.08 cm C. 3.27 cm D. 4.02 cm E. 4.44 cm
- ___26. What will be the maximum order n of the antinodes that these two sources can generate?
A. 4 B. 3 C. 2 D. 1 E. 0

A wave, which has a wavelength of $\lambda_1 = 4.30$ cm, is moving through a medium at a speed of $s_1 = 17.5$ cm/sec when it encounters an interface into a second medium at an angle of $\alpha = 38.0^\circ$ relative to the normal. In the second medium the speed of this wave is reduced to $s_2 = 12.8$ cm/sec.



- ___27. What is the frequency of the incident wave?
A. 3.3 Hz B. 4.7 Hz C. 2.2 Hz D. 4.1 Hz E. 20 Hz
- ___28. What will be the frequency of this wave in the second medium?
A. 3.3 Hz B. 4.7 Hz C. 2.2 Hz D. 4.1 Hz E. 20 Hz

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___29. What will be the direction of motion of this wave in the second medium?

- A. 26.8° B. 14.2° C. 31.5° D. 9.95° E. 61.1°

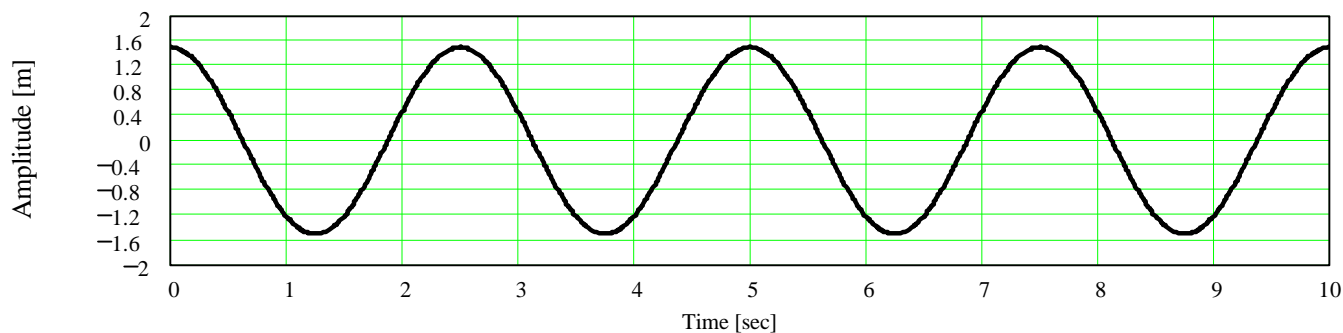
___30. What will be the wavelength of the wave in the second medium?

- A. 3.15 cm B. 1.11 cm C. 5.90 cm D. 3.88 cm E. 2.35 cm

___31. Two waves which are moving in the same direction and which have corresponding crests and troughs are said to be;

- A. synchronized. B. polarized. C. refracted. D. in phase. E. correlated.

EACH OF THE FOLLOWING QUESTIONS REFERS TO THE DIAGRAM BELOW WHICH PLOTS THE POSITION OF A SIMPLE HARMONIC OSCILLATOR AS A FUNCTION OF TIME.



___32. What is the period of this oscillator?

- A. 4.4 seconds B. 3.0 seconds C. 1.2 seconds D. 2.5 seconds E. 4.0 seconds

___33. What is the frequency of this oscillator?

- A. 0.40 Hz B. 0.33 Hz C. 0.83 Hz D. 0.52 Hz E. 0.25 Hz

___34. What is the angular velocity of this oscillator?

- A. 1.61 rad/sec B. 3.30 rad/sec C. 1.44 rad/sec D. 4.00 rad/sec E. 2.51 rad/sec

___35. What is the maximum amplitude of this oscillator?

- A. 0.80 meters B. 4.4 meters C. 0.40 meters D. 0.25 meters E. 1.5 meters

___36. Which of the following equations will best represent the position of this oscillator as a function of time?

- A. $A = 0.5 \cos(3.3 t)$ B. $0.4 \cos(1.1 t)$ C. $1.5 \cos(2.51 t)$ D. $0.4 \sin(2.6 t)$ E. $-0.4 \sin(1.6 t)$

___37. What will be the amplitude of this pendulum when $t = 20.0$ seconds?

- A. 0.37 meters B. -0.31 meters C. -0.37 meters D. 1.5 meters E. 0.25 meters

___38. What will be the maximum velocity of this oscillator?

- A. 1.05 m/s B. 3.77 m/s C. 0.640 m/s D. 2.25 m/s E. 6.18 m/s

___39. The place where two different mediums come together is called the

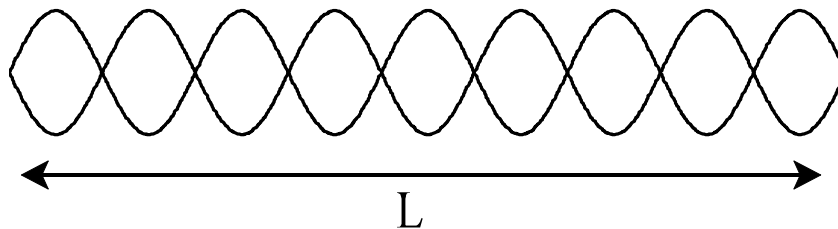
- A. barrier B. plane edge C. matter margin D. interface E. terminal margin

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- ___40. Which of the following could be the distance between nodes in a standing wave pattern?
A. 1/4 wavelength B. 1/8 wavelength C. 1.5 wavelengths D. 3/4 wavelengths E. 5/4 wavelength
- ___41. Which of the following statements about sound is false?
A. Sound can bend around the corners of doorways.
B. The speed of sound waves through air depends on the temperature.
C. Sound waves can destructively interfere with one another.
D. Sound waves can be polarized upon passing through a narrow window.
E. The pitch of a sound depends on the speed of the source relative to the observer.
- ___42. On the Earth's moon the speed of sound would be;
A. less than on the earth because of the weaker gravity.
B. more than on the earth because of the weaker gravity.
C. the same as on the earth because the speed of sound is not affected by gravity.
D. faster than that of light because of the environment.
E. non existent because there isn't any air on the moon.
- ___43. The pitch of a sound depends on the sound's
A. amplitude B. period C. medium D. loudness E. speed
- ___44. This electronics device can be used to convert sound into a visible signal that looks like a wave.
A. oscillator B. amplifier C. oscilloscope D. microscope E. oxidizer
- ___45. A sound, which has a frequency of 175 Hz will resonate over a tube which is closed at one end. Assuming that this frequency is the fundamental frequency for this tube, the next higher frequency that will also resonate in this tube will have a frequency of ?
A. 125 Hz B. 350 Hz C. 525 Hz D. 450 Hz E. 675 Hz.
- ___46. You are listening to two sounds which differ only slightly in pitch and you notice the that loudness of the two sounds seems to increase and decrease over time. Assuming that this variation occurs six times each second, and that one of the sounds has a frequency of 512 Hz., then the other sound may have a frequency of?
A. 502 Hz B. 512 Hz C. 518 Hz D. 85 Hz E. 588
- ___47. The speed of sound at room temperature [25 °C] is given to be 346 m/s. What will be the speed of sound at -5 °C?
A. 334 m/s B. 328 m/s C. 346 m/s D. 348 m/s E. 358 m/s
- ___48. A point source of sound generates 3.5 watts of sound power. When you measure the intensity of the sound it is 8.20×10^{-6} Watts/m². How far are you from this point source?
A. 3.6 m B. 55.2 m C. 152 m D. 184 m E. 552 m
- ___49. A sound is measured to have an intensity of 7.1×10^{-9} W/m². What will be the intensity of this sound in decibels?
A. 6.0 db B. 14.4 db C. 38.5 db D. 51 db E. 86 db
- ___50. You are listening to your stereo when you walk into another room. Given that the normal range of human hearing goes from 20 Hz to 20,000 Hz, which of the following frequencies would you most likely hear ?
A. 10 Hz B. 40 Hz C. 1200 Hz D. 4000 Hz E. 15,000 Hz

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Each of the following questions below refers to the diagram to the right which pictures a string which is vibrating with a standing wave pattern. The frequency of this vibration is 72 Hz and the distance [L] between the ends of the string is 45.0 cm.



51. What is the wavelength of this wave?
 A. 10.0 cm B. 20.0 cm C. 15.0 cm D. 30.0 cm E. 50.0 cm
52. What will be the speed of the waves traveling in this string?
 A. 375 m/s B. 75 m/s C. 45 m/s D. 7.2 m/s E. 4.5 m/s
53. What will be the frequency of the fundamental which will vibrate in this string?
 A. 30 Hz B. 6.0 Hz C. 90 Hz D. 8.0 Hz E. 150 Hz
54. What will be the frequency of the third harmonic which will vibrate in this string?
 A. 30 Hz B. 60 Hz C. 90 Hz D. 24 Hz E. 150 Hz
55. Given that this string has a mass of 18.0 grams, how much tension must be applied to this string to generate these wave patterns?
 A. 0.48 N B. 72 N C. 4.80 N D. 2.07 N E. 22.5 N
56. Assume that initially this string is vibrating with a frequency 150 Hz. You then increase the tension in the string until it is 9x the original tension. What will be the new frequency of vibration?
 A. 150 Hz B. 175 Hz C. 300 Hz D. 450 Hz E. 600 Hz
-
57. A long, vertical tube is filled with water to the top. A tuning fork is held over the mouth of the tube and the water is slowly lowered. When the water is 18 cm below the top of the tube the volume of the sound suddenly gets significantly louder. You continue lowering the water level in the tube until the sound again gets significantly louder. What is the **approximate** water level in the tube now?
 A. 22 cm. B. 44 cm. C. 66 cm. D. 54 cm. E. 110 cm.
58. A long, vertical tube [which has an inner diameter of 1.5 cm] is filled with water to the top. A tuning fork is held over the mouth of the tube and the water is slowly lowered. When the water is 18 cm below the top of the tube the volume of the sound suddenly gets significantly louder. What is the wavelength of the sound being generated by the tuning fork?
 A. 32 cm. B. 74 cm. C. 66 cm. D. 79 cm. E. 92 cm.
59. A long, vertical tube [which has an inner diameter of 1.5 cm] is filled with water to the top. A tuning fork is held over the mouth of the tube and the water is slowly lowered. When the water is 18 cm below the top of the tube the volume of the sound suddenly gets significantly louder. What is the frequency of this tuning fork? [Assume 25 °C]
 A. 786 Hz. B. 524 Hz. C. 376 Hz. D. 465 Hz E. 220 Hz

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- __60. You are a passenger in a car moving toward a fire station while its siren is blaring. The sound that you hear is
- A. louder than if you were at rest.
 - B. quieter than if you were at rest.
 - C. higher in pitch than if you were at rest.
 - D. decreasing in intensity as you move closer to the station.
 - E. slowly damping out due to the speed of your car.

You are 182 meters [± 3 m] from the C-wing of the school when you hit two blocks of wood together and then listen for the echo. You measure the time for the return of the echo to average $t = 1.11$ sec [$\pm .08$ sec].

- __61. According to these data what is the speed of sound on this particular day?
- A. 168 m/sec
 - B. 337 m/sec
 - C. 328 m/sec
 - D. 355 m/sec
 - E. 331 m/sec
- __62. What would be a reasonable value for the error on this speed?
- A. ± 31 m/sec
 - B. ± 5.08 m/sec
 - C. ± 5.8 m/sec
 - D. ± 22 m/sec
 - E. 26 m/sec
- __63. What is the air temperature on this day?
- A. -5°C
 - B. 15°C
 - C. 22°C
 - D. -8°C
 - E. 10°C
-
- __64. Consumer Reports measures the sound intensities in various automobiles as part of its recommendations to new car buyers. One year when measuring the noise intensity level in several off road vehicles they measured one such vehicle to have a noise intensity level of 79 db. A typical passenger car, however, has a noise intensity level of about 70 db. How much greater is the intensity level I_1 in the off road vehicle than in the typical passenger car I_2 ?
- A. $I_1 = 9 I_2$
 - B. $I_2 = 15 I_1$
 - C. $I_1 = 8 I_2$
 - D. $I_1 = 84 I_2$
 - E. $I_1 = 32 I_2$
- __65. An organ pipe is open at both ends, has a length of 1.65 meters and an inner diameter of 4.5 cm. Assuming a temperature of 20°C , what will be the fundamental frequency that is produced by this pipe?
- A. 88 Hz.
 - B. 68 Hz.
 - C. 102 Hz.
 - D. 112 Hz.
 - E. 168 Hz.

THE END!

LAB PHYSICS TEST

100 PTS

1998-99 D

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1. E	16. C	31. D	46. C	61. C
2. C	17. C	32. D	47. B	62. A
3. D	18. E	33. A	48. D	63. A
4. E	19. A	34. E	49. C	64. C
5. D	20. B	35. E	50. B	65. C
6. C	21. E	36. C	51. A	
7. A	22. D	37. D	52. D	
8. A	23. A	38. B	53. D	
9. C	24. E	39. D	54. D	
10. B	25. C	40. C	55. D	
11. D	26. B	41. D	56. D	
12. B	27. D	42. E	57. D	
13. B	28. D	43. B	58. B	
14. E	29. A	44. C	59. D	
15. C	30. A	45. C	60. C	