



PHYSICS

BOOKS - PEARSON IIT JEE

FOUNDATION

WAVE MOTION AND SOUND

Example

1. Frequency of a sound wave produced by a vibrating body is 50 Hz. Find the wavelength of

the sound wave produced. ($V_{\text{air}} = 330\text{ms}^{-1}$)



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2. Frequency of a sound wave produced by a vibrating body is 50 Hz. Find the wavelength of the sound wave produced. ($V_{\text{air}} = 330\text{ms}^{-1}$)



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Very Short Answer Type Question

1. Define frequency



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2. Distinguish between music and noise.



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3. What is the relation between frequency and time period of a wave ?



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4. How are different musical notes produced in stringed instruments, in musical instruments having stretched membranes and in musical instruments of blow type ?



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5. What is sound ?



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6. The S.I. unit of frequency is _____



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7. Among solids, liquids and gases, in which medium is the velocity of sound the maximum and in which medium is the velocity of sound the minimum ?



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8. Compressions and rarefactions are formed in _____



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9. Name some musical instruments that produce sound by vibration of stretched strings, by vibration of stretched membranes and vibration of air columns



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10. In a transverse wave, the particles of the medium



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11. Define a wave



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12. Sound cannot travel in _____



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13. Define time period



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14. Assertion : For an oscillating simple pendulum, the tension in the string is maximum at the mean position and minimum at the extreme position. **It brgt Reason :** The velocity of oscillating bob in simple harmonic motion is maximum at the mean position.



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15. Transverse and Longitudinal Waves



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16. The time period of a pendulum is directly proportional to _____



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17. What is the general name of the waves consisting of:

(a) compressions and rarefactions?

(b) crests and troughs?



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18. The instrument that produces sound by a vibrating membrane is called _____



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19. Define amplitude of a vibrating body



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20. The positions of maximum displacement of a particle from the mean position of a transverse wave is called _____



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21. Define the wavelength of a transverse wave





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22. The propagation of a disturbance due to vibratory motion of the particles of a medium is



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23. Define the wavelength of a longitudinal wave



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24. If the time period in second for 20 oscillations noted down in an experiment are 38.6, 40.0, 41.5, 42.8, and 39.4, the average time period of a given simple pendulum is _____



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25. Define a compression and a rarefaction



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26. A liquid contained in a 'U' -tube, when disturbed, executes _____ motion



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27. State the laws of simple pendulum



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28. A loaded spring produces _____ waves



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29. How is sound propagated through a material medium ? What is wave motion ?



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30. The amplitude of the pendulum is measured from _____ position to _____ position



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Short Answer Type Question

1. Distinguish between transverse and longitudinal waves.



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2. If 5 waves are produced in half a second of time, what is the frequency of the wave ?



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3. The frequency of a wave is 200 Hz and its wave-length is 60m. Find its velocity



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4. Introduction, Transverse wave on string



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5. The distance between a crest and an immediate trough in a transverse wave is 20 m. find its wavelength



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6. Find the ratio of time periods of two pendula whose lengths are in the ratio 1 : 4



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7. Statement-1: Radio waves can be polarised.

Statement-2: Sound waves in air are longitudinal in nature.



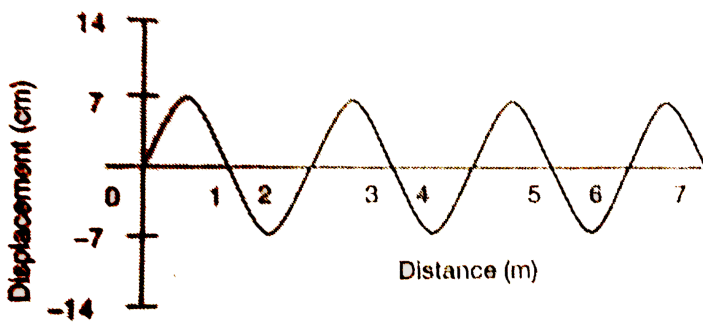
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8. The distance between the 1st crest and the 3rd crest in a transverse wave is 10 m. Find its wavelength



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9. The adjacent figure shows a displacement vs distance graph of a wave. If the velocity of the wave is 14ms^{-1} calculate its



(i) wavelength,

(ii) frequency and

(iii) amplitude of the wave



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10. Explain why the loudness of a sound note varies with the distance from the source of sound



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11. Describe briefly an experiment to prove the third law of simple pendulum



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12. The distance between the 2nd compression and the 3rd compression in a longitudinal wave is 200 cm. Find the wavelength of the wave





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13. A sound wave travels from kerosene to glass. What changes occur in the velocity, frequency and wavelength of the sound wave ?

Explain



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Essay Type Question

1. Explain the formation of longitudinal waves in a long spring



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2. (a) What is sound? What type of waves are sound waves in air?

(b) Describe an experiment to show that sound cannot pass through vacuum.



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3. Describe an experiment to prove that sound is produced by vibrating bodies.



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4. Explain through an example that velocity of sound is more in solids as compared to that in air.



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1. If the period of a simple pendulum is $2s$, then its frequency is $0.5Hz$



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2. The velocity of sound is the highest in gases



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3. If a pendulum clock loses time, then the length of the pendulum should be

appropriately decreased.



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4. In a transverse wave, the distance between two successive troughs is $\lambda/2$



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5. The distance between the point of suspension of the pendulum and the bottom of the bob is the length of a simple pendulum



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6. Answer true or false

If a pebble is thrown into the water the ripples on the surface of water are created due to translatory motion of the water particles.



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7. The speed of a periodic wave is the product of its



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8. If the time period of a wave is 1 millisecond, and the wave is 330ms^{-1} , then its wavelength is ____ cm



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9. The value of acceleration due to gravity increases as we move from equator to poles. For a given simple pendulum, a constant time

period can be achieved by _____ its length correspondingly.



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10. If the time periods of two pendulums are 2s and 4s, then the ratio of their lengths is _____



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11. The instruments that produce sound by vibrating strings are called _____



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12. A sound wave travels with a speed of 330m s^{-1} in air. If the wavelength of the wave is 330 cm, then the frequency of the wave is _____



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13. If 4 waves are produced in 2s, then the time period of the wave is _____



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14. If the wavelength of the wave is 24 cm, then the distance between the first compression and the third subsequent rarefaction in a longitudinal wave is ____ cm



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15. Match the entries in Column A with the appropriate entries in Column B

Column A**Column B**

- | | | |
|---|-----|---|
| A. Time period of a simple pendulum | () | (a) Wavelength |
| B. The position of maximum displacement of a particle in a transverse wave in downward direction. | () | (b) Product of frequency and wavelength |
| C. Reciprocal of time period | () | (c) String instrument |
| D. Distance between two successive troughs or crests | () | (d) Maximum displacement |
| E. Tabla | () | (e) Longitudinal waves |
| F. Sound waves in air | () | (f) Independent of mass of the bob |
| G. Velocity of a wave | () | (g) Frequency |
| H. Clarinet | () | (h) Percussion instrument |
| I. Amplitude | () | (i) Trough |
| J. Mandolin | () | (j) Reed type instrument |

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16. The time period of a simple pendulum can be increased by

A. increasing the mass of the bob

B. increasing the size of the bob

C. increasing the length of the simple pendulum

D. increasing the amplitude of oscillations of the bob.

Answer: C



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17. Which of the following statements is true ?

A. Sound travels faster in iron than in water

B. Sound can travel through inert gases

C. Sound travels in the form of compression and rarefactions in air

D. All the above

Answer: D



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18. Which of the following is a mechanical wave?

A. sound

B. Light

C. Radio

D. All the above

Answer: A



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19. Both sound and light waves can be propagated through

A. vacuum

B. air

C. Both (a) and (b)

D. None of the above

Answer: B



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20. When a disturbance is created in a medium, the particles in the medium perform

A. non-periodic motion

B. circular motion

C. translatory motion

D. periodic motion

Answer: D



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21. If the time between two successive compressions of a wave is 5 seconds, then the time taken to complete 4 successive compressions is ____

A. 5 seconds

B. 10 seconds

C. 2.5 seconds

D. 15 seconds

Answer: D



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22. In a transverse wave, the time interval between 1st crest and 11th crest is 50s, then the time period of the wave is _____

A. 5s

B. 10 s

C. 20 s

D. 2 s

Answer: A



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23. In a tsunami the shock waves originating in the ocean bed propagate

A. as transverse waves only

B. as longitudinal waves only

C. as both transverse and longitudinal waves

D. Neither as transverse nor as longitudinal waves

Answer: C



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24. If the distance between two successive crests of a wave is 12 cm, then the distance between two successive troughs is ___

A. 24 cm

B. 6 cm

C. 12 cm

D. 4 cm

Answer: C



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25. The loudness of sound of the bell in the bell jar experiment gradually decreases with

- A. decrease in the quantity of air
- B. increase in the quantity of air
- C. increase in the atmospheric pressure
- D. None of the above

Answer: A



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26. The bob of an oscillating simple pendulum arrives at one of the extreme positions 100 times in 200s. Then, the time period of the pendulum is ____

A. 2.5

B. 2.0

C. 1.5

D. 1.0

Answer: B



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27. Instrument (s) capable of producing musical notes is/are _____

A. viola

B. oboe

C. cello

D. All the above

Answer: D



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28. Which of the following statements is incorrect ?

A. Sound travels faster in summer than in winter

B. Sound travels in a straight line

C. Sound travels faster in vacuum than in air

D. Sound travels in the form of longitudinal mechanical waves

Answer: C



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29. Among the following statements.

A: A simple pendulum of a given length and at a given place has a constant time period

B: A simple pendulum with constant time period can be used as a time measuring device

A. Only A is true

B. Only B is true

C. both A and B are true

D. Both A and B are false

Answer: B



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30. If the distance between two successive compressions of a sound wave is 16 cm, then the distance between a compression and the next rarefactions is _____

A. 16 cm

B. 32 cm

C. 4 cm

D. 8 cm

Answer: D



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31. In a simple pendulum experiment, the time in seconds taken for 20 oscillations is noted in

5 trials as 39.2, 38.4, 40.8, 41.4, 40.2, then the average frequency is _____

A. $0.5s$

B. $2s^{-1}$

C. $2s$

D. $0.5s^{-1}$

Answer: D



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32. Time period of simple pendulum increase with

A. increases

B. decreases

C. remains same

D. first increases and then decreases

Answer: B



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33. The time in seconds taken for 20 oscillations noted down in an simple pendulum experiment are 38.6, 40.0, 41.5, 42.8 and 39.4, the time period of the given simple pendulum is ____ s

A. 2.5

B. 2.2

C. 2.0

D. 10.1

Answer: C





34. Write down the steps to verify the third law of simple pendulum in a proper sequence.

(a) Set the pendulum into oscillation and determine the time taken for 20 oscillations

(b) Determine the square of the time period (T^2)

(c) Change the length of the simple pendulum and repeat the experiment

(d) Determine the time period of oscillation (T)

(e) Determine the length of the pendulum

(f) Note the value of $V = \frac{\lambda}{T}$ in each case

A. a d b c e f

B. e a d b c f

C. e a b c f d

D. e f a b d c

Answer: B



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35. Compression and rarefactions are formed in _____

A. stationary transverse wave

B. sound wave

C. light wave

D. water wave

Answer: B



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36. Water waves are

- A. transverse
- B. electromagnetic
- C. longitudinal
- D. Both (b) and (c)

Answer: A



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37. What are longitudinal waves ? Give examples. How do such waves propagate ?

A. in a metal but not in a gas

B. in a gas but not in a metal

C. neither in a metal nor in a gas

D. both in a metal and in a gas

Answer: D



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38. The transverse waves can propagate through

- A. both in a gas and in a metal
- B. in a gas but not in a metal
- C. in a metal but not in a gas
- D. neither in a gas nor in a metal

Answer: C



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39. The time taken by a vibrating body to move from one extreme position to the other extreme position is 0.1 s. If the distance between adjacent crests is 2 m, write the steps to determine the wave velocity in proper sequence

(a) Determine the frequency of the wave (f)

(b) Note down the wavelength (λ)

(c) Note down the time period (T)

Determine the velocity of the wave as $v = f\lambda$

A. a b c d

B. b c a d

C. d a b c

D. d c b a

Answer: B



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40. The bell jar experiment shows that

A. sound cannot travel through vacuum

B. sound can travel through gas

C. sound can travel through vacuum

D. velocity of sound is least in gases

Answer: A



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41. Following are down the steps of an experiment to prove that medium is required for the propagation of sound waves. Arrange these steps in propagation of sound waves. Arrange these steps in proper sequence

- (a) Consider a glass jar with an outlet connected to a vacuum pump and a closed lid
- (b) Suspend an electric bell.
- (c) Evacuate the jar by using a vacuum pump
- (d) Switch on the electric bell
- (e) Observe that the intensity of the sound is less when the jar is evacuated
- (f) This proves that medium is required for the propagation of sound

A. f e d a b c

B. a b d e c f

C. a b d c e f

D. a b c d e f

Answer: C



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42. Assertion (A) : A child produces a higher pitched sound compared to that of an adult

Reason (R): Pitch depends on the frequency of sound.

A. A and R are correct and R is the correct explanation of A

B. A and R are correct but R is not the correct explanation of A

C. A is correct but R is not correct

D. Both A and R are not correct

Answer: B



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43. Assertion (A): Sound cannot be propagated on the moon.

Reason (R) : Sound requires a medium to propagate

A. A and R are correct and R is the correct explanation of A

B. A and R are correct but R is not the correct explanation of A

C. A is correct but R is not correct

D. Both A and R are not correct

Answer: A



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44. Two tuning forks A and B of frequencies 200 Hz and 400 Hz are vibrated simultaneously. Then, the ratio of time taken by the sound produced by A and B to travel 660 m and 990 m, respectively in air is _____ (velocity of the sound in air = $330ms^{-1}$)

A. 1 : 2

B. 1 : 3

C. 2 : 3

D. 1 : 1

Answer: C



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45. Two pendulums A and B of length 9m and 16 m, respectively are made to oscillate on the Earth's surface then the ratio of their frequency is ____

A. 3:4

B. 9:16

C. 16:9

D. 4:3

Answer: D



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Level 2

1. The distance between a compression and the next rarefaction of a sound wave is 12.5 cm. If the sound waves can travel 750 m in 3s, then find the number of waves produced in one second



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2. A disc siren with certain number of holes rotates uniformly 270 times in one and half minute. The frequency of the note emitted is

48 Hz. If the velocity of sound in air is 336ms^{-1} , find its wavelength and number of holes on the disc.



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3. Two astronauts go the surface of the moon and would speak to each other. Explain how they could achieve this.



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4. A wave of time period 10 ms travels with a velocity of 1.5ms^{-1} . If the time period of another wave is 6 ms, find its velocity and also find the ratio of their velocities. (Assume that the wavelength of the two waves is same)



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5. A sound wave of frequency 660 Hz incidents normally on a perfectly reflecting object. If the speed of sound in air is 330ms^{-1} , what is the

shortest distance from the wall at which the wave particles have (a) the maximum and (b) the minimum displacement gt



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6. If 500 sound waves are produced in one minute, then find the time taken by a vibrating particle to move from its mean position to the immediate rarefactions



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7. For the range of frequencies of sound 11 kHz to 11 find the time taken by a vibrating particle to move from its mean position to the immediate rarefaction.



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8. A tuning fork is excited first in air and then in water. In which case is the amplitude more ? Explain.



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9. A sound wave travelling in air is made to propagate through a liquid such that the velocity of sound is quadrupled. If the frequency of the sound wave is constant, find the change in the wavelength of the sound wave



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10. A sound wave travels 60m in the time taken to produce 50 waves. Find the wavelength of

the sound wave in centimeters



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11. What would be the time period of a seconds pendulum constructed on the earth if it is taken to the surface of the moon. The acceleration due to gravity on the surface of the moon is $1/6g_{\text{earth}}$



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12. If the percentage decrease in the length of a simple pendulum is 10%, then find the percentage decrease in its time period



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13. The frequency of a sound wave is 200 Hz and its wavelength is 150 cm. What is the distance travelled by a sound wave in the time taken to produce 150 waves ?



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14. The time period of a simple pendulum is

given by $T = 2\pi\sqrt{\frac{l}{g}}$

where 'l' is the length of the pendulum and 'g' is the acceleration due to gravity at that place.

(a) Express 'g' in terms of T

(b) What is the length of the seconds pendulum ? (Take $g = 10ms^{-2}$)



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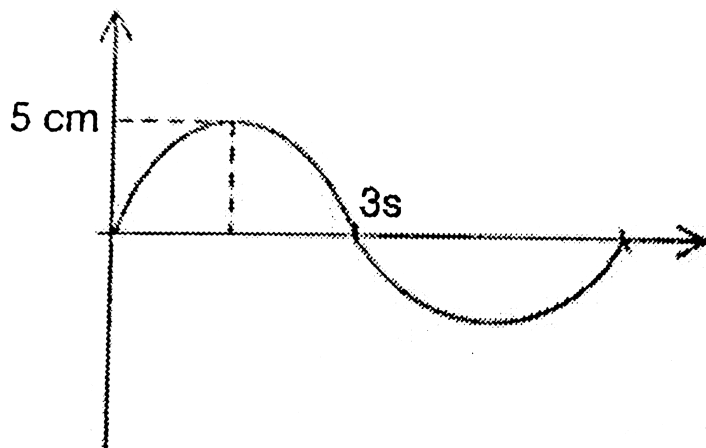
15. The wavelength of a sound wave travelling in a solid becomes one third when it propagates through air. If the frequency of the wave remains constant, then find the decreases in the velocity of the wave



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16. The oscillation of a simple pendulum is graphically represented as follows. Determine the

(a) time period (b) frequency (c) amplitude



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17. Find the ratio of time periods of two pendula whose lengths are in the ratio 1 : 4

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18. Find the ratio of frequency of two pendulum whose lengths are in the ratio 1 : 4



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19. Find the ratio of lengths of two pendula whose time periods are in the ratio 1 : 4



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20. The distance between the 1st crest and the 3rd crest in a transverse wave is 10 m. Find its wavelength



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Level 3

1. A stone is dropped from the top of a tower and it hits the ground at $t = 3.5s$. If the velocity of sound in air is $300ms^{-1}$, find the

time taken to hear the sound by a person on the top of the tower, from the instant the body is dropped ($g = 10ms^{-2}$)



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2. Sound travels in rocks in the form of both longitudinal and transverse waves, but in air, sound travels only in the form of longitudinal waves'. Explain



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3. How does the time period T of a simple pendulum vary with altitude ? Discuss.



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4. The length of the seconds pendulums is first increased by 10 cm and then decreased by 5 cm. If the time period is determined in each case, find their ratio (Take $g = 10ms^{-2}$, $\pi^2 \cong 10$)



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5. Two iron rods of length of 2.2 m and 0.8 m of uniform densities are suspended from their ends and made of oscillate. Find the time periods of the two rods. Which rod gains time as compared to the time period of seconds pendulum ?



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6. The time period of a pendulum on the surface of the moon is 5s. If it is a seconds

pendulum on earth and the acceleration due to gravity on the earth is $9.8ms^{-2}$, find the acceleration due to gravity on the surface of the moon.



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7. Two pendula of the same length oscillate with amplitudes of 3 cm and 5 cm, respectively. The average time period noted for 3 trials for the first pendulum is found to be 2s, what will

be the average time period for the second pendulum ?



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8. If the length of a seconds pendulum is first decreased by 10 cm and its time period is determined and then increased by 20 cm and the time period is once again determined, find the ratio of the time periods in two cases.

(Take $g = 9.8ms^{-2}$)



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9. When a string fixed between two ends is plucked, a wave propagates along the string and reflects at the other end. Find the distance of maximum and minimum displacement of the particle in a wave from its first end, given that the velocity of wave propagation is 330ms^{-1} and the frequency of vibration is 1320 Hz.



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10. The velocity of sound increases by 75% when it enters a liquid from air. Find the percentage increase in its wavelength



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11. The ratio of loudness of sound produced by two sources is 2:3. What is the ratio of amplitude of their vibrations ?



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12. Sound waves travel from air to water. The velocity of the sound waves in air is 332ms^{-1} and wavelength is 2m. If the wavelength of the sound waves in water is 850 cm, find its velocity in water



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13. A sound wave of frequency 660 Hz incidents normally on a perfectly reflecting surface. If the speed of sound in air is 330ms^{-1} , what is the time taken by a particle in the medium to

complete one vibration? Determine the wave length of the wave.



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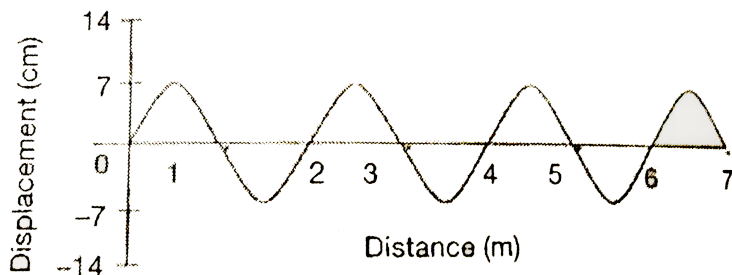
14. The velocity of sound waves in a metal is found to 1400ms^{-1} . When they travel from metal to air its velocity changes to 340ms^{-1} . If the wavelength of sound waves in air is 200 m, find its wavelength in the metal



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15. The adjacent figure shows a displacement vs distance graph of a wave. If the velocity of the wave is 14ms^{-1} , calculate its

(a) wavelength , (b) frequency and (c) amplitude of the wave



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Test Your Concepts Very Short Answer Type Questions

1. Define frequency



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2. What is music and what is noise?



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3. What is the relation between frequency and time period of a wave ?





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4. How are different musical notes produced in stringed instruments, in musical instruments having stretched membranes and in musical instruments of blow type ?



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5. What is sound?



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6. The S.I. unit of frequency is _____



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7. Among solids, liquids and gases, in which medium is the velocity of sound the maximum and in which medium is the velocity of sound the minimum ?



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8. Compressions and rarefactions are formed in _____



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9. Name some musical instruments that produce sound by vibration of stretched strings, by vibration of stretched membranes and vibration of air columns



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10. Define a wave



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11. Sound cannot travel in _____



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12. Define time period



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13. At mean position of an oscillating simple pendulum



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14. Distinguish between transverse and longitudinal waves.



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15. The time period of a pendulum is directly proportional to _____



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16. Define crest and trough.



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17. The instrument that produces sound by a vibrating membrane is called _____



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18. Define amplitude of a vibrating body



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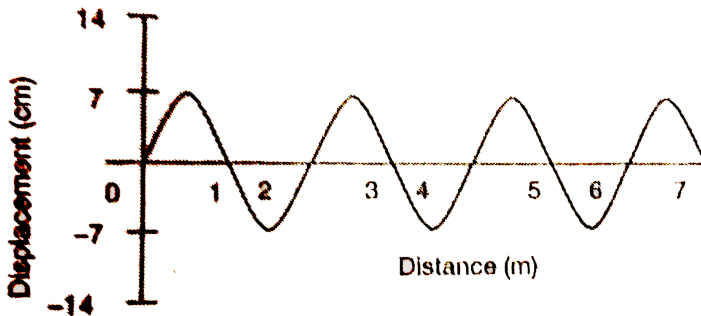
19. A loaded spring produces ____ waves



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[Test Your Concepts Short Answer Type Questions](#)

1. The adjacent figure shows a displacement vs distance graph of a wave. If the velocity of the wave is 14ms^{-1} calculate its

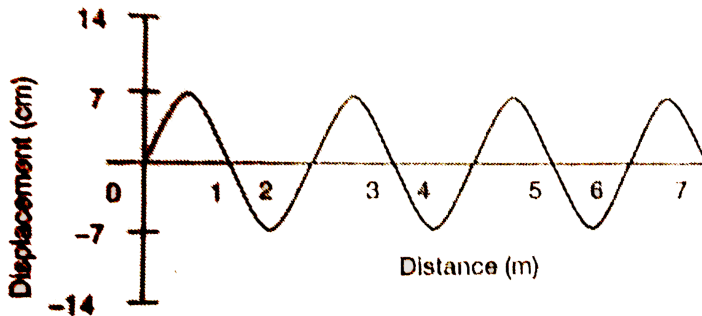


- (i) wavelength,
- (ii) frequency and
- (iii) amplitude of the wave



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2. The adjacent figure shows a displacement vs distance graph of a wave. If the velocity of the wave is 14m s^{-1} calculate its

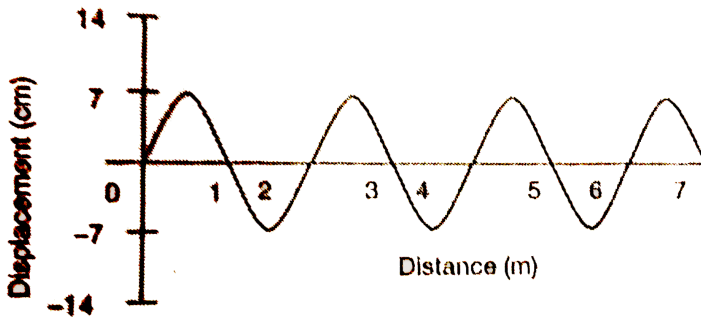


- (i) wavelength,
- (ii) frequency and
- (iii) amplitude of the wave



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3. The adjacent figure shows a displacement vs distance graph of a wave. If the velocity of the wave is 14ms^{-1} calculate its



- (i) wavelength,
- (ii) frequency and
- (iii) amplitude of the wave



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4. Explain why the loudness of a sound note varies with the distance from the source of sound



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5. Describe briefly an experiment to prove the third law of simple pendulum



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6. The distance between the 2nd compression and the 3rd compression in a longitudinal wave is 200 cm. Find the wavelength of the wave



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7. A sound wave travels from kerosene to glass. What changes occur in the velocity, frequency and wavelength of the sound wave ? Explain



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Test Your Concepts Essay Type Questions

1. Write expression for the speed of a longitudinal wave in a long solid rod.



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2. What is vacuum? Explain why, sound cannot travel through vacuum?



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3. What are stringed instruments ? Give examples.



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Concept Application Level 1

1. If the period of a simple pendulum is $2s$, then its frequency is $0.5Hz$



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2. The velocity of sound is generally greater in solids than in gases because



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3. Will a pendulum clock lose or gain time when taken to the top of a mountain?



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4. In a transverse wave, the distance between two successive troughs is $\frac{1}{2}$ of the wavelength.

A. True

B. False

C.

D.

Answer:



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5. The distance between the point of suspension of the pendulum and the bottom of the bob is the length of a simple pendulum.

A. True

B. False

C.

D.

Answer:



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6. The ripples in water waves are created due to the translatory motion of particles.

A. True

B. False

C.

D.

Answer:



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7. Velocity of wave propagation is the product of its wavelength and time period.

A. True

B. False

C.

D.

Answer:



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8. If the time period of a wave is 1 millisecond, and the wave is 330ms^{-1} , then its wavelength is ____ cm



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9. The value of acceleration due to gravity increases as we move from equator to poles. For a given simple pendulum, a constant time period can be achieved by ____ its length correspondingly.





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10. If the time periods of two pendulums are 2s and 4s, then the ratio of their lengths is



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11. The instruments that produce sound by vibrating strings are called _____



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12. A sound wave travels with a speed of 330ms^{-1} in air. If the wavelength of the wave is 330 cm, then the frequency of the wave is _____



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13. If 4 waves are produced in 2s, then the time period of the wave is _____



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14. If the wavelength of the wave is 24 cm, then the distance between the first compression and the third subsequent rarefaction in a longitudinal wave is ____ cm



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15. Match the entries in Column A with the appropriate entries in Column B

Column A**Column B**

- | | | |
|---|-----|---|
| A. Time period of a simple pendulum | () | (a) Wavelength |
| B. The position of maximum displacement of a particle in a transverse wave in downward direction. | () | (b) Product of frequency and wavelength |
| C. Reciprocal of time period | () | (c) String instrument |
| D. Distance between two successive troughs or crests | () | (d) Maximum displacement |
| E. Tabla | () | (e) Longitudinal waves |
| F. Sound waves in air | () | (f) Independent of mass of the bob |
| G. Velocity of a wave | () | (g) Frequency |
| H. Clarinet | () | (h) Percussion instrument |
| I. Amplitude | () | (i) Trough |
| J. Mandolin | () | (j) Reed type instrument |

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16. The time period of a simple pendulum can be increased by

A. increasing the mass of the bob.

B. increasing the size of the bob.

C. increasing the length of the simple pendulum.

D. increasing the amplitude of oscillations of the bob.

Answer: C



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17. Which of the following statements is true?

A. Sound travels faster in iron than in water.

B. Sound can travel through inert gases

C. Sound travels in the form of compressions and rarefactions in air.

D. All the above

Answer: D



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18. Which of the following is a mechanical wave?

A. Sound

B. Light

C. Radio

D. All the above

Answer: A



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19. Both sound and light waves can be propagated through

A. vacuum

B. air

C. Both (a) and (b)

D. None of the above

Answer: B



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20. When a disturbance is created in a medium, the particles in the medium perform

A. non-periodic motion

B. circular motion

C. translatory motion

D. periodic motion

Answer: D



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21. If the time between two successive compressions of a wave is 5 seconds, then the time taken to complete 4 successive compressions is ____

A. 5 seconds

B. 10 seconds

C. 2.5 seconds

D. 15 seconds

Answer: D



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22. In a transverse wave, the time interval between 1st crest and 11th crest is 50s, then the time period of the wave is _____

A. 5s

B. 10 s

C. 20 s

D. 2 s

Answer: A



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23. In a tsunami the shock waves originating in the ocean bed propagate

A. as transverse waves only.

B. as longitudinal waves only.

C. as both transverse and longitudinal waves.

D. Neither as transverse nor as longitudinal waves.

Answer: C



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24. If the distance between two successive crests of a wave is 12 cm, then the distance between two successive troughs is ___

A. 24 cm

B. 6 cm

C. 12 cm

D. 4 cm

Answer: C



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25. The loudness of sound of the bell in the bell jar experiment gradually decreases with

- A. decrease in the quantity of air
- B. increase in the quantity of air
- C. increase in the atmospheric pressure
- D. None of the above

Answer: A



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26. The bob of an oscillating simple pendulum arrives at one of the extreme positions 100 times in 200s. Then, the time period of the pendulum is ____

A. 2.5

B. 2.0

C. 1.5

D. 1.0

Answer: B



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27. Instruments capable of producing musical notes is/ are _____

A. viola

B. oboe

C. cello

D. All the above

Answer: D



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28. Which of the following statements is incorrect?

A. Sound travels faster in summer than in winter.

B. Sound travels in a straight line.

C. Sound travels faster in vacuum than in air.

D. Sound travels in the form of longitudinal mechanical waves.

Answer: C



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29. Among the following statements.

A: A simple pendulum of a given length and at a given place has a constant time period

B: A simple pendulum with constant time period can be used as a time measuring device

A. Only A is true

B. Only B is true

C. Both A and B are true

D. Both A and B are false

Answer: B



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30. If the distance between two successive compressions of a sound wave is 16 cm, then the distance between a compression and the next rarefactions is _____

A. 16 cm

B. 32 cm

C. 4 cm

D. 8 cm

Answer: D



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31. In a simple pendulum experiment, the time in seconds taken for 20 oscillations is noted in

5 trials as 39.2, 38.4, 40.8, 41.4, 40.2, then the average frequency is _____

A. $0.5S$

B. $2s^{-1}$

C. $2s$

D. $0.5s^{-1}$

Answer: D



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32. As the acceleration due to gravity increases, the time period of the simple pendulum_____

A. increases

B. decreases

C. remains same

D. first increases and then decreases.

Answer: B



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33. The time in seconds taken for 20 oscillations noted down in an simple pendulum experiment are 38.6, 40.0, 41.5, 42.8 and 39.4, the time period of the given simple pendulum is ____ s

A. 2.5

B. 2.2

C. 2.0

D. 10.1

Answer: C



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34. Write down the steps to verify the third law of simple pendulum in a proper sequence.

(A) Set the pendulum into oscillation and determine the time taken for 20 oscillations,

(B) Determine the square of the time period (T^2). (C) Change the length of the simple

pendulum and repeat the experiment. (D)

Determine the time period of oscillation (T).

(E) Determine the length of the pendulum. (F)

Note the value of $V = \frac{\lambda}{T}$ in each case.

A. A DBCEF

B. E ADBCF

C. E ABCFD

D. E FABDC

Answer: B



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35. Compressions and rarefactions are formed

in _____

A. stationary transverse wave

B. sound wave

C. light wave

D. water wave

Answer: B



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36. Water waves are

A. transverse

B. electromagnetic

C. longitudinal

D. Both (b) and (c)

Answer: A



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37. Longitudinal waves can propagate

A. in a metal but not in a gas.

B. in a gas but not in a metal.

C. neither in a metal nor in a gas.

D. both in a metal and in a gas.

Answer: D



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38. Transverse mechanical waves cannot be propagated through

A. both in a gas and in a metal.

B. in a gas but not in a metal.

C. in a metal but not in a gas.

D. neither in a gas nor in a metal.

Answer: C



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39. The time taken by a vibrating body to move from one extreme position to the other extreme position is 0.1 s. If the distance between adjacent crests is 2 m, write the steps to determine the wave velocity in proper

sequence

(a) Determine the frequency of the wave (f)

(b) Note down the wavelength (λ)

(c) Note down the time period (T)

Determine the velocity of the wave as $v = f\lambda$

A. ABCD

B. B CAD

C. DABC

D. DCBA

Answer: B



40. The bell jar experiment shows that

A. sound cannot travel through vacuum.

B. sound can travel through gas.

C. sound can travel through vacuum.

D. velocity of sound is least in gases.

Answer: A



41. Following are down the steps of an experiment to prove that medium is required for the propagation of sound waves. Arrange these steps in propagation of sound waves.

Arrange these steps in proper sequence

- (a) Consider a glass jar with an outlet connected to a vacuum pump and a closed lid
- (b) Suspend an electric bell.
- (c) Evacuate the jar by using a vacuum pump
- (d) Switch on the electric bell
- (e) Observe that the intensity of the sound is less when the jar is evacuated

(f) This proves that medium is required for the propagation of sound

A. FED ABC

B. ABDECF

C. ABDCEF

D. ABCDEF

Answer: C



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42. Assertion (A) : A child produces a higher pitched sound compared to that of an adult

Reason (R): Pitch depends on the frequency of sound.

A. A and R are correct and R is the correct explanation of A.

B. A and R are correct but R is not the correct explanation of A.

C. A is correct but R is not correct.

D. Both A and R are not correct.

Answer: B



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43. Assertion (A): Sound cannot be propagated on the moon.

Reason (R) : Sound requires a medium to propagate

A. A and R are correct and R is the correct explanation of A.

B. A and R are correct but R is not the correct explanation of A.

C. A is correct but R is not correct.

D. Both A and R are not correct.

Answer: A



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44. Two tuning forks A and B of frequencies 200 Hz and 400 Hz are vibrated simultaneously. Then, the ratio of time taken

by the sound produced by A and B to travel 660 m and 990 m, respectively in air is _____
(velocity of the sound in air = 330ms^{-1})

A. 1 : 2

B. 1 : 3

C. 2 : 3

D. 1 : 1

Answer: C



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45. Two pendulums A and B of length 9m and 16 m, respectively are made to oscillate on the Earth's surface then the ratio of their frequency is ____

A. 3:4

B. 9:16

C. 16:9

D. 4:3

Answer: D



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Concept Application Level 2

1. The distance between a compression and the next rarefaction of a sound wave is 12.5 cm. If the sound waves can travel 750 m in 3s, then find the number of waves produced in one second



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2. A disc siren with certain number of holes rotates uniformly 270 times in one and half minute. The frequency of the note emitted is 48 Hz. If the velocity of sound in air is 336m s^{-1} , find its wavelength and number of holes on the disc.



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3. Two astronauts go the surface of the moon and would speak to each other. Explain how

they could achieve this.



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4. A wave of time period 10 ms travels with a velocity of 1.5ms^{-1} . If the time period of another wave is 6 ms, find its velocity and also find the ratio of their velocities. (Assume that the wavelength of the two waves is same)



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5. A sound wave of frequency 660 Hz incidents normally on a perfectly reflecting object. If the speed of sound in air is 330ms^{-1} , what is the shortest distance from the wall at which the wave particles have (a) the maximum and (b) the minimum displacement gt



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6. A sound wave of frequency 660 Hz incidents normally on a perfectly reflecting object. If the

speed of sound in air is 330ms^{-1} , what is the shortest distance from the wall at which the wave particles have (a) the maximum and (b) the minimum displacement



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7. If 500 sound waves are produced in one minute, then find the time taken by a vibrating particle to move from its mean position to the immediate rarefactions



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8. Audible ranges of frequencies is 20 Hz to 20,000 Hz. Find the range of wavelengths corresponding to this frequency. Given, velocity of sound = 340m s^{-1} .



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9. A tuning fork is excited first in air and then in water. In which case is the amplitude more ? Explain.



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10. A sound wave travelling in air is made to propagate through a liquid such that the velocity of sound is quadrupled. If the frequency of the sound wave is constant, find the change in the wavelength of the sound wave



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11. A sound wave travels 60m in the time taken to produce 50 waves. Find the wavelength of the sound wave in centimeters



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12. What would be the time period of a seconds pendulum constructed on the earth if it is taken to the surface of the moon. The acceleration due to gravity on the surface of the moon is $1/6g_{\text{earth}}$





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13. If the percentage decrease in the length of a simple pendulum is 10%, then find the percentage decrease in its time period



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14. The frequency of a sound wave is 200 Hz and its wavelength is 150 cm. What is the distance travelled by a sound wave in the time taken to produce 150 waves ?



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15. The time period of a simple pendulum is

given by $T = 2\pi \sqrt{\frac{l}{g}}$

where 'l' is the length of the pendulum and 'g' is the acceleration due to gravity at that place.

(a) Express 'g' in terms of T

(b) What is the length of the seconds pendulum ? (Take $g = 10ms^{-2}$)



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16. The time period of a simple pendulum is

given by $T = 2\pi\sqrt{\frac{l}{g}}$

where 'l' is the length of the pendulum and 'g' is the acceleration due to gravity at that place.

(a) Express 'g' in terms of T

(b) What is the length of the seconds pendulum ? (Take $g = 10ms^{-2}$)



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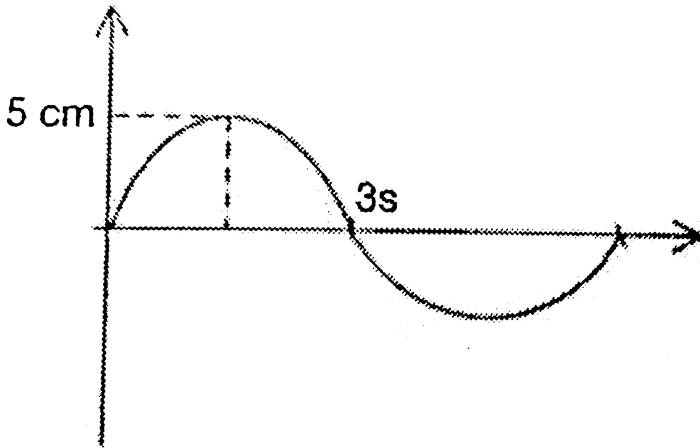
17. The wavelength of a sound wave travelling in a solid becomes one third when it propagates through air. If the frequency of the wave remains constant, then find the decrease in the velocity of the wave



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18. The oscillation of a simple pendulum is graphically represented as follows. Determine the

(a) time period (b) frequency (c) amplitude

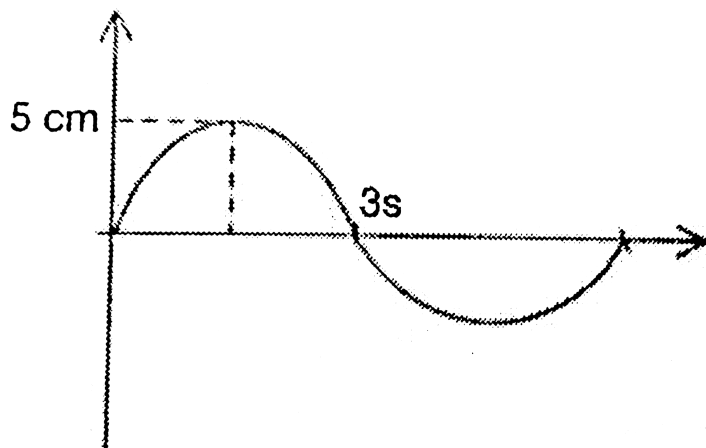


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19. The oscillation of a simple pendulum is graphically represented as follows. Determine the

the

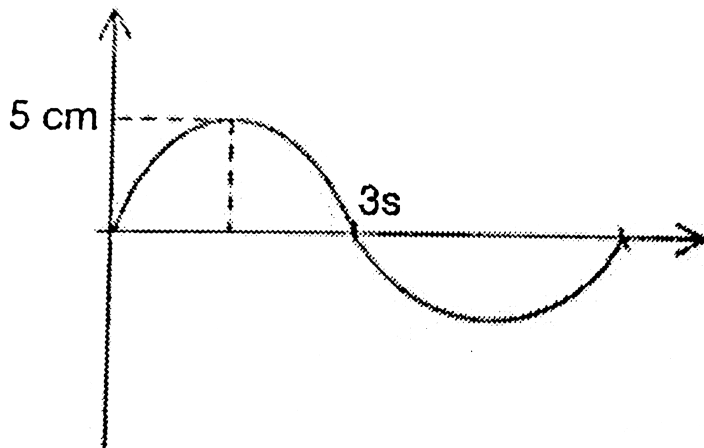
(a) time period (b) frequency (c) amplitude



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20. The oscillation of a simple pendulum is graphically represented as follows. Determine the

(a) time period (b) frequency (c) amplitude



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21. Find the ratio of time periods of two pendula whose lengths are in the ratio 1 : 4



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22. Find the ratio of frequency of two pendulum whose lengths are in the ratio 1 : 4



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23. Find the ratio of lengths of two pendula whose time periods are in the ratio 1 : 4



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24. The distance between the 1st crest and the 3rd crest in a transverse wave is 10 m. Find its wavelength



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Concept Application Level 3

1. A stone is dropped from the top of a tower and it hits the ground at $t = 3.5s$. If the velocity of sound in air is $300ms^{-1}$, find the

time taken to hear the sound by a person on the top of the tower, from the instant the body is dropped ($g = 10ms^{-2}$)



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2. Sound travels in rocks in the form of both longitudinal and transverse waves, but in air, sound travels only in the form of longitudinal waves'. Explain



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3. How does the time period T of a simple pendulum vary with altitude ? Discuss.



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4. The length of the seconds pendulums is first increased by 10 cm and then decreased by 5 cm. If the time period is determined in each case, find their ratio (Take $g = 10ms^{-2}$, $\pi^2 \cong 10$)



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5. Two iron rods of length of 2.2 m and 0.8 m of uniform densities are suspended from their ends and made of oscillate. Find the time periods of the two rods. Which rod gains time as compared to the time period of seconds pendulum ?



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6. The time period of a pendulum on the surface of the moon is 5s. If it is a seconds

pendulum on earth and the acceleration due to gravity on the earth is $9.8ms^{-2}$, find the acceleration due to gravity on the surface of the moon.



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7. Two pendula of the same length oscillate with amplitudes of 3 cm and 5 cm, respectively. The average time period noted for 3 trials for the first pendulum is found to be 2s, what will

be the average time period for the second pendulum ?



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8. If the length of a seconds pendulum is first decreased by 10 cm and its time period is determined and then increased by 20 cm and the time period is once again determined, find the ratio of the time periods in two cases.

(Take $g = 9.8ms^{-2}$)



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9. When a string fixed between two ends is plucked, a wave propagates along the string and reflects at the other end. Find the distance of maximum and minimum displacement of the particle in a wave from its first end, given that the velocity of wave propagation is 330ms^{-1} and the frequency of vibration is 1320 Hz.



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10. The velocity of sound increases by 75% when it enters a liquid from air. Find the percentage increase in its wavelength



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11. The ratio of loudness of sound produced by two sources is 2:3. What is the ratio of amplitude of their vibrations ?



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12. Sound waves travel from air to water. The velocity of the sound waves in air is 332ms^{-1} and wavelength is 2m. If the wavelength of the sound waves in water is 850 cm, find its velocity in water



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13. A sound wave of frequency 660 Hz incidents normally on a perfectly reflecting surface. If the speed of sound in air is 330ms^{-1} , what is the time taken by a particle in the medium to

complete one vibration? Determine the wave length of the wave.



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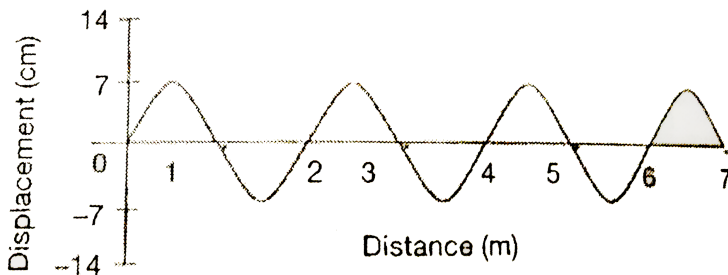
14. The velocity of sound waves in a metal is found to 1400ms^{-1} . When they travel from metal to air its velocity changes to 340ms^{-1} . If the wavelength of sound waves in air is 200 m, find its wavelength in the metal



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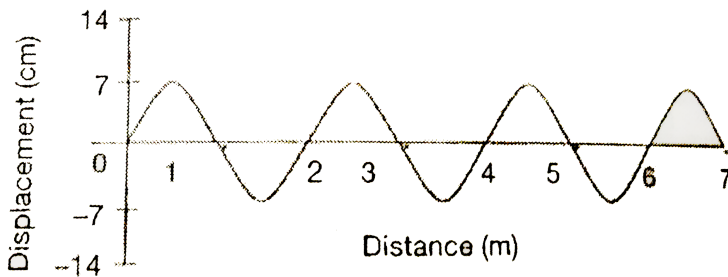
15. The adjacent figure shows a displacement vs distance graph of a wave. If the velocity of the wave is 14ms^{-1} , calculate its

(a) wavelength , (b) frequency and (c) amplitude of the wave



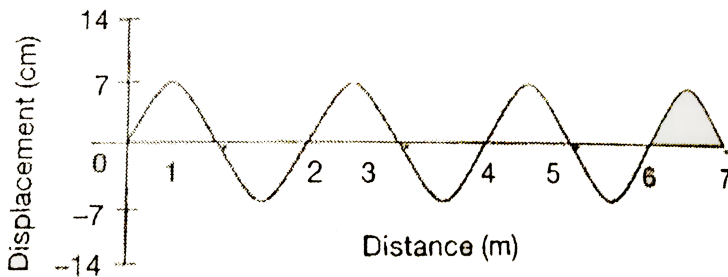
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