PHYSICS

BOOKS - BITSAT GUIDE PHYSICS (HINGLISH)

WAVE MOTION

Practice Exercise

1. The equation of a wave travelling on a stretched string along the x-axis is

$y = ae^{-(bx+ct)}$. The direction of propagation of wave is

A. along negative y-axis

B. along positive y-axis

C. along negative x-axis

D. along positive x-axis

Answer: C

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2. In (Q. 1.) the maximum displacement of particle of string is

A. a

B. b

C. c

D. c/b

Answer: A

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3. In (Q. 1.) the speed of wave is

A. c/b

B. b/c

C. a

D. c

Answer: A

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4. The wave travels along a string whose equation is $y = \frac{p^3}{p^2 + (px - qt)^2}$, where p = 2 unit and q = 0.5 units.

Find the direction of propagation of wave.

A. along + y - axis

B. along - x-axis

C. along + x-axis

D. None of these

Answer: C

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5. If wave y = A cos $(\omega t + kx)$ is moving along x-axis The shape of pulse at t = 0 and t = 2 s

A. are different

B. are same

C. may not be same

D. None of these

Answer: B

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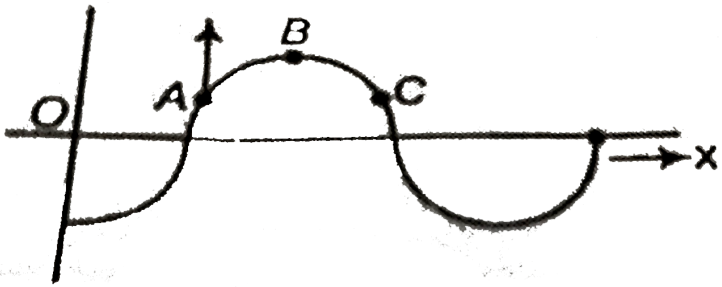
6. At any instant a wave travelling along the string shown in figure. Here, point A is moving upward. Which of the following statement is true?



A. The wave is travelling to the right

B. The displacement amplitude of wave is equal to displacement of B at this

instant

C. At this instant C also directed upward.

D. None of the above

Answer: B

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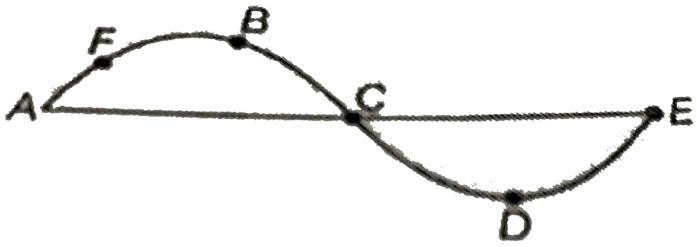
7. In the given figure,



A. the velocity of particles B and C are same

B. the velocity of particles A, C and E are maximum

C. the particle F moves upward

D. all particles have same velocity

Answer: B

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8. If a wave propagates through a medium. Then, the velocity of particle of medium is given by

A. wave velocity $\times$ strain

B. $\frac{\text{wave velocity}}{\text{strain}}$

C. wave velocity

D. $\frac{\text{angular frequency}}{\text{propagation constant}}$

Answer: A

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9. In a wave motion $y = \sin(kx - \omega t)$, y can represent :-

A. electric field

B. magnetic field

C. displacement, pressure

D. All of these

Answer: D

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10. The equation of a wave travelling on a stretched string is $y = 4 \sin 2\pi\left(\frac{t}{0.02} - \frac{x}{100}\right)$ Here, x and y are in cm and t is in second. The speed of wave is

A. 50 m/s

B. 40 m/s

C. 50 cm/s

D. 40 cm/s

Answer: A

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11. In (Q. 10.) the ratio of particle velocity amplitude and wavelength is

A. π

B. 2π

C. 3π

D. 4π

Answer: D

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12. In (Q. 10.) the relative deformation amplitude of medium is

A. 0.02π

B. 0.08π

C. 0.06π

D. None of these

Answer: B

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13. Along a stretched string equation of transverse wave is $y = 3\sin\left[2\pi\left(\frac{x}{20} - \frac{t}{0.01}\right)\right]$

Where, x, y are in cm and t is in second. Calculate wave velocity.

A. 20 m/s

B. 30 m/s

C. 15 m/s

D. 25 m/s

Answer: A

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14. A transverse wave along a string is given by

$$y = 2\sin\left(2\pi(3t - x) + \frac{\pi}{4}\right)$$

where x and y are in cm and t in second. Find acceleration of a particle located at x = 4 cm at t = 1s.

A. $36\sqrt{2}\pi^2 cm/s^2$

B. $36\pi^2 cm/s^2$

C. $-36\sqrt{2}\pi^2 cm/s^2$

D. $-36\pi^2 cm/s^2$

Answer: C

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15. A travelling wave is described by the equation $y = y_0 \sin\left(\left(ft - \frac{x}{\lambda}\right)\right)$. The maximum particle velocity is equal to four times the wave velocity if

A. $y_0\pi$

B. $\frac{y_0\pi}{2}$

C. $2y_0\pi$

D. $1.5y_0\pi$

Answer: B

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16. Along a stretched wire a transverse wave passes with speed 3000 m/s. If the tension in

the wire increased four times, then the velocity of the wave is

A. 1500 m/s

B. 3000 m/s

C. 6000 m/s

D. 9000 m/s

Answer: C

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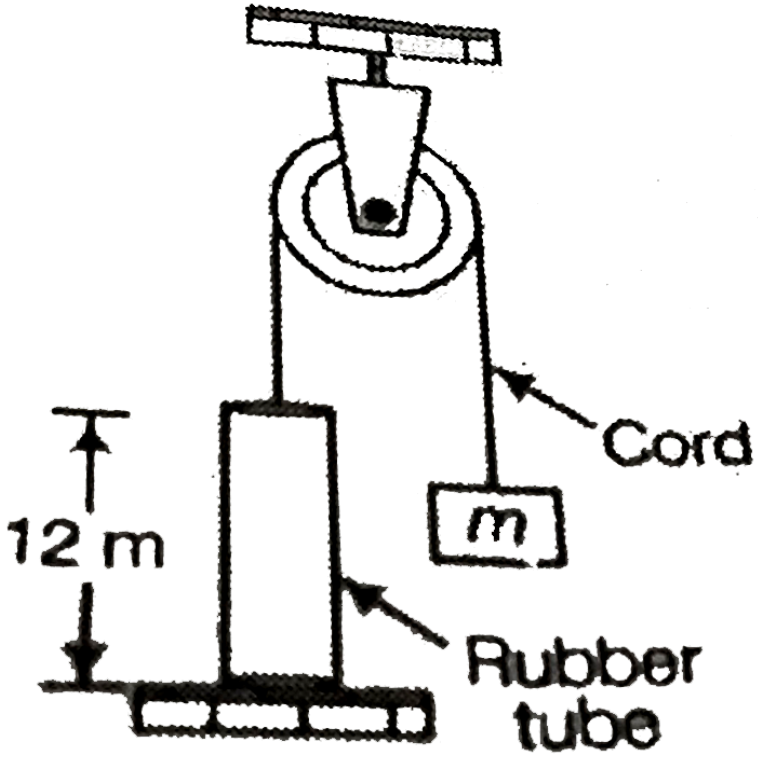
17. A long rubber tube having mass 0.9 kg is fastened to a fixed support and the free end of the tube is attached to a cord which passes over a pulley and supports an object, with a mass of 5 kg as shown in figure. If the tube is struck by a transverse blow at one end, find the time required for the pulse to reach the

other end.



A. 5 s

B. 0.47 s

C. 4.7 s

D. 3.2 s

Answer: B

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18. The time taken by a transverse wave going on a wire having mass 5 g, form one end to another end of wire is 0.5 s. The area of cross-section fo wire is $1mm^2$ and Young's modulus of elasticity is $16 \times 10^{11} N/m^2$. The speed of wave is 80 m/s. The strain in wire is

A. 5×10^{-7}

B. 2×10^{-7}

C. 3×10^{-6}

D. 4×10^{-6}

Answer: A

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19. Find the time taken by a transverse wave to travel the full length fo a uniform rope of

mass 0.1 kg and length 2.45 m hangs from the ceiling

A. 1 s

B. 0.5 s

C. 2 s

D. 1.5 s

Answer: A

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20. A transverse wave of equation y = 2 sin $(0.01x + 30t)$ moves on a stretched string from one end to another end. In the equation of wave, x and y are in cm and t is in second. The time taken by wave to reach from one end to another end of string is 5 s. The length of string is

A. 10 m

B. 100 m

C. 150 m

D. 160 m

Answer: C

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21. A sinusoidal wave travelling in the same direction have amplitudes of 3 cm and 4 cm and difference in phase by $\pi/2$. The resultant amplitude of the superimposed wave is

A. 7 cm

B. 5 cm

C. 2 cm

D. 0.5 cm

Answer: B

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22. Two simple harmonic motions are represented by the equations $y_1 = 10\sin\left(3\pi t + \frac{\pi}{4}\right)$

and $y_2 = 5\left(3\sin 3\pi t + \sqrt{3}\cos 3\pi t\right)$. Their amplitudes are in the ratio of

A. $\sqrt{3}$

B. $1/\sqrt{3}$

C. 2

D. $1/6$

Answer: B

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23. Predict for the wave $y = A\cos.\frac{2\pi x}{\lambda}\sin\left(\frac{2\pi vt}{\lambda}\right)$

A. It is a progressive wave

B. It is a transverse progressive wave

C. It is a longitudinal progressive wave

D. It is a stationary wave

Answer: D

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24. A string of length l is fixed at both ends and is vibrating in second harmonic. The amplitude at anti-node is 2 mm. The amplitude of a particle at distance $l/8$ from the fixed end is

A. $5\sqrt{2}mm$

B. $\frac{5}{\sqrt{2}}mm$

C. $5mm$

D. $\frac{10}{\sqrt{2}}mm$

Answer: B

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25. In (Q. 24.) the tension in string is T and the linear mass density of string is μ. The ratio of magnitude of maximum velocity of particle and the magnitude of maximum acceleration is

A. $\frac{1}{2\pi}\sqrt{\frac{\mu l^2}{T}}$

B. $2\pi\sqrt{\frac{\mu l^2}{T}}$

C. $\frac{1}{2\pi}\sqrt{\frac{T}{\mu l^2}}$

D. $\frac{1}{4\pi}\sqrt{\frac{\mu l^2}{T}}$

Answer: A

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26. In (Q. 24.) if at t = 0, y = 2.5 mm, the equation of standing wave is

A. $(2.5mm)\sin.\ \frac{2\pi}{l}x\cos\left(2\pi\sqrt{\left(\frac{T}{\mu l^2}\right)}\right)t$

B. $5mm\sin.\ \frac{\pi}{l}x\cos 2\pi t$

C. $5mm\sin.\ \frac{2\pi}{l}x\cos\left(2\pi\sqrt{\left(\frac{T}{\mu l^2}\right)}\right)t$

D. $5mm\cos.\ \frac{2\pi}{l}x\cos\left(2\pi\sqrt{\left(\frac{T}{\mu l^2}\right)}\right)t$

Answer: C

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27. If a string fixed at both ends vibrates in four loops. The wavelength is 10 cm. The length of string is

A. 5 cm

B. 15 cm

C. 30 cm

D. None

Answer: B

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28. In (Q. 27.) the distance of plucking poing from the fixed end is

A. 5 cm

B. 10 cm

C. 2.5 cm

D. 7.5 cm

Answer: C

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29. A stretched wire carries a body of density $\sigma = 8000 kg/m^3$ at its end. The fundamental frequency of vibration of wire is 280 Hz. The body is dipped completely in a vessel of water. Find the new frequency of fundamental mode

of vibrations. (Density of water is $\rho = 1000 kg/m^3$)

A. 262 Hz

B. 260 Hz

C. 243.2 Hz

D. 255.5 Hz

Answer: C

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30. An elastic string of length 2 m is fixed at its end. The string starts to vibrate in third overtone with a frequency 1200 Hz. The ratio of frequency of lower overtone and fundamental is

A. 1

B. 2

C. 3

D. 4

Answer: B

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31. If a string is stretched with a weight 4 kg then the fundamental frequency is equal to 256 Hz. What weight is needed to produce its octave?

A. 4 kg-wt

B. 12 kg-wt

C. 16 kg-wt

D. 24 kg-wt

Answer: C

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32. A string fixed at both ends has consecutive standing wave modes for which the distances between adjacent nodes are 18 cm and 16 cm` respectively. The minimum possible length of the string is:

A. 150 cm

B. 144 cm

C. 140 cm

D. 142 cm

Answer: B

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33. A sonometer wire of length 114 cm is fixed at both the ends. Where should the two bridges be placed so as to divide the wire into three segments whose fundamental frequencies are in the ratio $1:3:4$?

A. At 36 cm and 84 cm from one end

B. At 24 cm and 72 cm from one end

C. At 48 cm and 96 cm from one end

D. At 72 cm and 96 cm from one end

Answer: C

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34. A wave of angular frequency ω propagates so that a certain phase of oscillation moves

along x-axis, y-axis, z-axis with speeds $c_1 c_2$ and c_3 respectively.

A. $\frac{\omega}{\sqrt{c_1^2 + c_2^2 + c_3^2}}\left(\hat{i} + \hat{j} + \hat{k}\right)$

B. $\frac{\omega}{c_1}\hat{i} + \frac{\omega}{c_2}\hat{j} + \frac{\omega}{c_3}\hat{k}$

C. $\left(\omega\hat{i} + \omega\hat{j} + \omega\hat{k}\right)\frac{1}{c}$

D. None of these

Answer: B

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35. Wave of frequency 500 Hz has a phase velocity $360m/s$. The phase difference between two displacement at a certain point at time $10^{-3}s$ apart will be

A. π rad

B. $\frac{\pi}{2}$ rad

C. $\frac{\pi}{4}$ rad

D. 2π rad

Answer: A

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36. Equation of a plane wave is given by $4\sin.\frac{\pi}{4}\left[2t+\frac{x}{8}\right]$. The phase difference at any given instant of two particles 16 cm apart is

A. 60°

B. 90°

C. 30°

D. 120°

Answer: B

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37. The transverse displacement $y(x, t)$ of a wave on a string is given by $y(x, t) = e^{-\left(ax^2 + bt^2 + 2\sqrt{(ab)}xt\right)}$. This represents a :

A. wave moving in - x-direction with speed $\sqrt{\frac{b}{a}}$

B. standing wave of frequency $\sqrt{b}$

C. standing wave of frequency $\frac{1}{\sqrt{b}}$

D. wave moving in + x-direction with speed $\sqrt{a/b}$

Answer: A

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38. For a wave y = 0.0002 sin $\left[2\pi\left(110t - \frac{x}{3}\right) + \frac{\pi}{3}\right]$ is travelling in a medium. Find energy per unit

volume being transferred by wave if density of medium is $1.5kg/m^3$.

A. $14 \times 10^{-4} J/m^3$

B. $143.2 \times 10^{-4} J/m^3$

C. $14.3 \times 10^{-4} J/m^3$

D. $1.43 \times 10^{-4} J/m^3$

Answer: B

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1. The equation of a simple harmonic motion is given by $y = 3\sin.\ \frac{\pi}{2}(50t - x)$, where x and y are in metres and t is in seconds, the ratio of maximum particle velocity to the wave velocity is

A. 25 m/s

B. 30 m/s

C. 50 m/s

D. None of these

Answer: C

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2. A stretched string of length 2 m vibrates in 4 segments. The distance between consecutive nodes is

A. 0.5 m

B. 0.25 m

C. 1.0 m

D. 0.75 m

Answer: A

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3. At t=0, a transverse wave pulse in a wire is described by the function $y = 6/\left(x^2 - 3\right)$ where x and y are in metres. The function y(x,t) that describes this wave equation if it is travelling in the positive x direction with a speed of $4.5m/s$ is

A. $y = \dfrac{6}{(x + 4.5t)^3 - 3}$

B. $y = \dfrac{6}{(x - 4.5t^2) + 3}$

C. $y = \dfrac{6}{(x + 4.5t)^2 - 3}$

D. $y = \dfrac{6}{(x - 4.5t)^2 - 3}$

Answer: C

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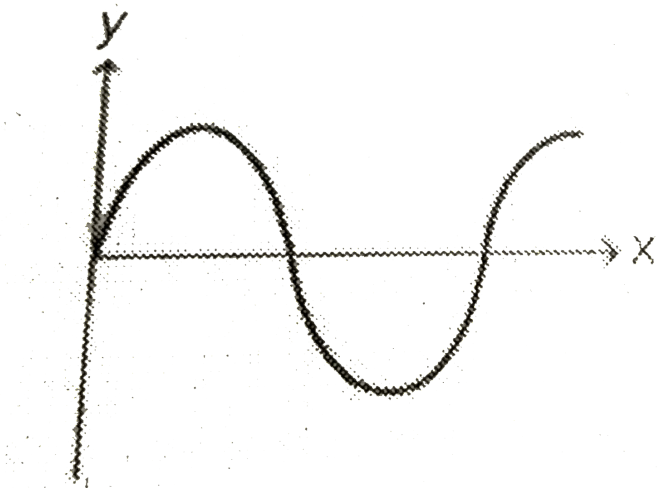
4. in a sine wave ,postive of different particles at time t=0 is shown in figure. The equation for this wave if it is travelling along postive x -axis

can beB



A. $y = A\sin(\omega t - kx)$

B. $y = A\cos(kx - \omega t)$

C. $y = A\cos(\omega t - kx)$

D. $y = A\sin(kx - \omega t)$

Answer: D

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5. A wave has velocity u in medium P and velocity 2 u in medium Q . If the wave is incident in medium P at an angle of 30° then the angle of refraction will be

A. 30°

B. 45°

C. 60°

D. 90°

Answer: A

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6. The equation of progressive wave is $y = 0.2 \sin 2\pi \left[\frac{t}{0.01} - \frac{x}{0.3} \right]$, where x and y are in metre and t is in second. The velocity of propagation of the wave is

A. 30 m/s

B. 40 m/s

C. 300 m/s

D. 400 m/s

Answer: A

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7. Two progressive waves having equation $x_1 = 3\sin\omega\tau$ and $x_2 = 4\sin(\omega\tau + 90^\circ)$ are superimposed. The amplitude of the resultant wave is

A. 5 unit

B. 1 unit

C. 3 unit

D. 4 unit

Answer: D

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8. A particle on the trough of a wave at any instant will come to the mean position after a time (T = time period)

A. $T/2$

B. $T/4$

C. T

D. 2 T

Answer: B

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