JEE MAIN : CHAPTER WISE TEST PAPER-14

SUBJECT :- PHYSICS **DATE.....**
CLASS :- 11th **NAME.....**
CHAPTER :- MECHENICAL WAVE **SECTION.....**

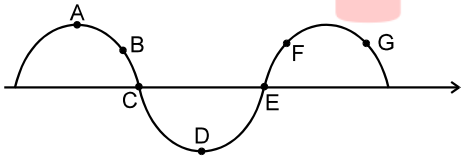
(SECTION-A)

1. The sound intensity is 0.008 W/m^2 at a distance of 10 m from an isotropic point source of sound. The power of the source is :
(A) 2.5 watt (B) 0.8 watt
(C) 8 watt (D) 10 watt

2. The energy per unit area associated with a progressive sound wave will be doubled if :
(A) the amplitude of the wave is doubled
(B) the amplitude of the wave is increased by 50%
(C) the amplitude of the wave is decreased by 41%
(D) the frequency of the wave is increased by 41%

3. If two soap bubbles of different radii are connected by a tube :
(A) air flows from the bigger bubble to the smaller bubble till the sizes become equal
(B) air flows from bigger bubble to the smaller bubble till the sizes are interchanged
(C) air flows from the smaller bubble to the bigger
(D) there is no flow of air

4. The following figure depicts a wave travelling in a medium. Which pair of particles are in phase.



(A) A and D (B) B and F
(C) C and E (D) B and G

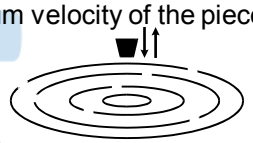
5. Two small boats are 10m apart on a lake. Each pops up and down with a period of 4.0 seconds due to wave motion on the surface of water. When one boat is at its highest point, the other boat is at its lowest point. Both boats are always within a single cycle of the waves. The speed of the waves is :
(A) 2.5 m/s (B) 5.0 m/s
(C) 14 m/s (D) 40 m/s

6. Three waves of equal frequency having amplitudes 10 μm, 4 μm and 7 μm arrive at a given point with a successive phase difference of $\pi/2$. The amplitude of the resulting wave is μm in given by
(A) 7 (B) 6 (C) 5 (D) 4

7. The second overtone of an open pipe A and a closed pipe B have the same frequencies at a given temperature. Both pipes contain air. The ratio of fundamental frequency of A to the fundamental frequency of B is:
(A) 3: 5 (B) 5: 3 (C) 5: 6 (D) 6: 5

8. A pipe of length 85 cm is closed from one end. Find the number of possible natural oscillations of air column in the pipe whose frequencies lie below 1250 Hz. The velocity of sound in air is 340 m/s.
(A) 12 (B) 8 (C) 6 (D) 4

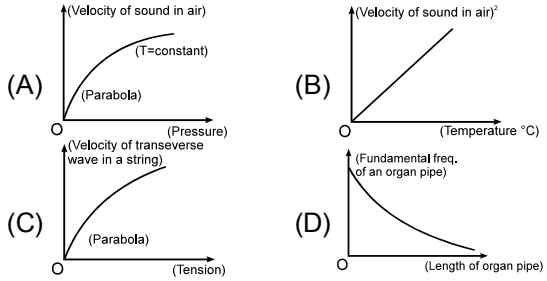
9. A piece of cork is floating on water in a small tank. The cork oscillates up and down vertically when small ripples pass over the surface of water. The velocity of the ripples being 0.21 ms^{-1}, wave length 15 mm and amplitude 5 mm, the maximum velocity of the piece of cork is



(A) 0.44 ms^{-1} (B) 0.24 ms^{-1}
(C) 2.4 ms^{-1} (D) 4.4 ms^{-1}

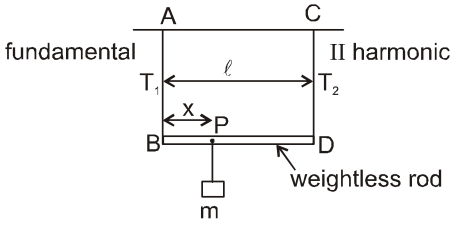
10. The equation of a wave is given by y = a sin $\left(100t - \frac{x}{10}\right)$, where x and y are in metre and t in second; then velocity of wave is :
(A) 0.1 m/s (B) 10 m/s
(C) 100 m/s (D) 1000 m/s

11. Which of the following is/ are correct.



12. A wave in a string has an amplitude of 2 cm. The wave travels in the +ve direction of x axis with a speed of 128 ms^{-1} and it is noted that 5 complete waves fit in 4m length of the string. The equation describing the wave is
(A) y = (0.02)m sin (7.85 x + 100 5t)
(B) y = (0.02)m sin (15.7 x – 2010t)
(C) y = (0.02)m sin (15.7 x + 2010t)
(D) y = (0.02)m sin (7.85 x – 100 5t)

13. A massless rod BD is suspended by two identical massless strings AB and CD of equal lengths. A block of mass 'm' is suspended point P such that BP is equal to 'x', if the fundamental frequency of the left wire is twice the fundamental frequency of right wire, then the value of x is :



(A) 1/5 (B) 1/4 (C) 41/5 (D) 31/4

14. When two progressive waves $y_1 = 4 \sin (2x - 6t)$ and $y_2 = 3 \sin \left(2x - 6t - \frac{\pi}{2}\right)$ are superimposed, the amplitude of the resultant wave is :

(A) 3 (B) 4
(C) 5 (D) None of these

15. The equation of a plane progressive wave is $y = 0.02 \sin 8\pi\left[t - \frac{x}{20}\right]$. When it is reflected at a rarer medium (medium with higher velocity) at x = 0, its amplitude becomes 75% of its previous value. The equation of the reflected wave is

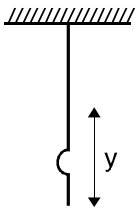
(A) $y = 0.02 \sin 8\pi\left[t - \frac{x}{20}\right]$

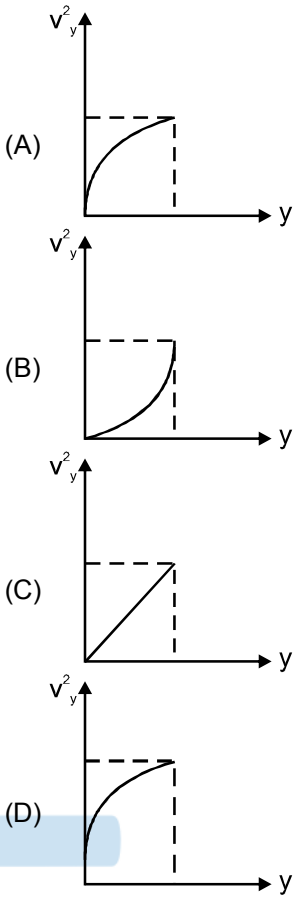
(B) $y = 0.02 \sin 8\pi\left[t + \frac{x}{20}\right]$

(C) $y = +0.015 \sin 8\pi\left[t + \frac{x}{20}\right]$

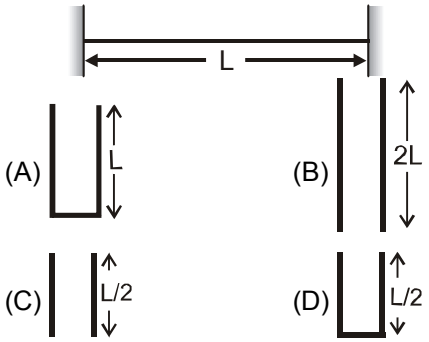
(D) $y = -0.015 \sin 8\pi\left[t + \frac{x}{20}\right]$

16. A non–uniform rope of length ℓ hangs from a ceiling. Mass per unit length of rope (μ) changes as $\mu = \mu_0 e^y$, where y is the distance along the string from its lowest point. Then graph between square of velocity of wave and y will be best represented as :





17. Figure shows a stretched string of length L and pipes of length L, 2L, L/2 and L/2 in options (A), (B), (C) and (D) respectively. The string's tension is adjusted such that the speed of waves on the string equals the speed of sound waves in the air. The fundamental mode of oscillation is then set up on the string. In which pipe will the air column be in the resonance with the sound produced by the string ?



18. In Resonance tube experiment, if 400 Hz tuning fork is used, the first resonance occurs when length of air column in the tube is 19 cm. If the 400 Hz. tuning fork is replaced by 1600 Hz tuning fork then to get resonance, the water level in the tube should be further lowered by (take end correction = 1 cm)

(A) 5 cm (B) 10 cm
(C) 15 cm (D) 20 cm

19. A heavy but uniform rope of length L is suspended from a ceiling. A particle is dropped from the ceiling at the instant when the bottom end is given the jerk. Where will the particle meet the pulse :

(A) at a distance If $\frac{2L}{3}$ from the bottom

(B) at a distance $\frac{L}{3}$ from the bottom

(C) at a distance $\frac{3L}{4}$ from the bottom

(D) None of these

20. A horizontal stretched string, fixed at two ends, is vibrating in its fifth harmonic according to the equation, $y(x, t) = (0.01\ m) \sin [(62.8\ m^{-1})\ x] \cos [(628\ s^{-1})t]$. Assuming $\pi = 3.14$, the correct statement is :

(A) The number of nodes is 5.

(B) The length of the string is 0.50 m.

(C) The maximum displacement of the midpoint of the string its equilibrium position is 0.01 m.

(D) The fundamental frequency is 100 Hz.

(SECTION-B)

21. Each of the two string of length 51.6 cm and 49.1 cm are tensioned separately by 20 N force. Mass per unit length of both the strings is same and equal to 1 gm^{-1}. When both the strings vibrate simultaneously the number of beats is

22. A whistle producing sound waves of frequencies 9500 Hz and above is approaching a stationary person with speed v ms^{-1}. The velocity of sound in air is 300 ms^{-1}. If the person can hear frequencies upto a maximum of 10,000 Hz, the maximum value of v upto which he can hear the whistle is:

23. A motor cycle starts from rest and accelerates along a straight path at 2 m/s^2. At the starting point of the motor cycle there is a stationary electric siren. How far has the motor cycle gone when the driver hears the frequency of the siren at 94% of its value when the motor cycle was at rest? (Speed of sound = 330 ms^{-1})

24. The sound intensity is 0.008 W/m^2 at a distance of 10 m from an isotropic point source of sound. The power of the source is :

25. A source of sound of frequency 600 Hz is placed inside water. The speed of sound in water is 1500 m/s and in air it is 300 m/s. The frequency of sound recorded by an observer who is standing in air is :

26. Two vibrating strings of the same material but lengths L & 2L have radii 2r and r respectively. They are stretched under the same tension. Both the strings vibrate in their fundamental modes, the one of length L with frequency f_1 and the other with frequency f_2. The ratio f_1/f_2 is given by :

27. The equation of a wave is represented by :-

$y = 10^{-4} \sin\left(100t - \frac{x}{10}\right)$ m, where x and y are in meter and t in second; then the velocity of wave will be :-

28. A wire having a linear density of 0.05 gm/cm is stretched between two rigid supports with a tension of 4.5×10^7 dynes. It is observed that the wire resonates at a frequency of 420 cycles/sec. The next higher frequency at which the same wire resonates is 490 cycles/sec. The length of wire is approximately.

29. A string fixed at both ends has consecutive standing wave modes for which distances between adjacent nodes are 6 cm and 4 cm. The length of the string is :

30. A 1m long wire having tension of 100 N and of linear mass density 0.01 kg/m is fixed at end A and free at end B. The point C which is 20 cm from end B is constrained to be stationary. To create resonance in this wire, the minimum frequency of the tuning fork will be :