1. A wave has a frequency of 500 Hz and wavelength of 0.68 m. What is the speed of the wave?

A. 340 m/s
B. 850 m/s
C. 250 m/s
D. 100 m/s

Answer: A
Explanation: $v = f \times \lambda = 500 \times 0.68 = 340$ m/s

2. In a string fixed at both ends, the third harmonic has how many antinodes?

A. 2
B. 3
C. 4
D. 5

Answer: C
Explanation: Number of antinodes = harmonic number + 1 = 3 + 1 = 4

3. If the tension in a string is increased 4 times, what happens to the wave speed?

A. Doubled
B. Halved
C. Unchanged
D. Quadrupled

Answer: A
Explanation: $v \propto \sqrt{T} \Rightarrow v_{new} = \sqrt{4} \times v = 2v$

4. The phase difference between two particles separated by a distance $\lambda/2$ in a progressive wave is:

A. 0
B. π
C. 2π
D. $\pi/2$

Answer: B

Explanation: Phase difference = $2\pi \times (x / \lambda) = 2\pi \times (1/2) = \pi$

5. Two tuning forks produce frequencies 256 Hz and 260 Hz. The number of beats heard per second is:

A. 2
B. 4
C. 516
D. 1

Answer: B
Explanation: Beats = $|f1 - f2| = |260 - 256| = 4$

6. A pipe open at both ends resonates with a fundamental frequency of 300 Hz. Its length is 57.2 cm. What is the speed of sound in air?

A. 343 m/s
B. 320 m/s
C. 300 m/s
D. 360 m/s

Answer: A
Explanation: $f = v / 2L \Rightarrow v = 2 \times f \times L = 2 \times 300 \times 0.572 = 343.2$ m/s

7. In a stationary wave, the distance between two consecutive nodes is:

A. λ
B. $\lambda/2$
C. $\lambda/4$
D. 2λ

Answer: B
Explanation: Distance between two nodes = $\lambda/2$

8. The equation of a wave is $y = 0.02 \sin(2\pi t - 0.04x)$. What is the wave speed?

A. 25 m/s
B. 50 m/s

C. 100 m/s
D. 75 m/s

Answer: B
Explanation: $v = \omega / k = 2\pi / 0.04 = 50$ m/s

9. Which phenomenon is responsible for formation of beats?

A. Superposition of waves of same frequency
B. Superposition of waves of different frequencies
C. Interference of longitudinal waves
D. Doppler effect

Answer: B
Explanation: Beats are formed due to superposition of waves of slightly different frequencies.

10. In a closed pipe of length L, the wavelength of the fundamental mode is:

A. 4L
B. 2L
C. L
D. L/2

Answer: A
Explanation: For closed pipe, fundamental wavelength = 4L

11. In a standing wave, which of the following remains stationary?

A. Antinode
B. Node
C. Crest
D. Trough

Answer: B
Explanation: Nodes are points of zero displacement.

12. The amplitude of a wave is 2 cm. What is the maximum particle displacement?

A. 2 cm
B. 4 cm
C. 1 cm
D. 0 cm

Answer: A
Explanation: Amplitude is the maximum displacement

13. In a closed organ pipe of length 85.75 cm, what is the fundamental frequency if the speed of sound is 343 m/s?

A. 100 Hz
B. 150 Hz
C. 200 Hz
D. 300 Hz

Answer: A
Explanation: For closed pipe,
$f = v / 4L = 343 / (4 \times 0.8575) = 100$ Hz

14. The equation $y = A \sin(kx - \omega t)$ represents a wave travelling:

A. To the right
B. To the left
C. Standing wave
D. Longitudinal wave

Answer: A
Explanation: Negative sign before $\omega t \Rightarrow$ wave moves to right

15. The fundamental frequency of a string is 100 Hz. What is the frequency of its 3rd harmonic?

A. 200 Hz
B. 100 Hz
C. 300 Hz
D. 400 Hz

Answer: C

Explanation: nth harmonic = n × fundamental = 3 × 100 = 300 Hz

16. A string of length 2 m is fixed at both ends. If the speed of transverse waves on the string is 100 m/s, what is the fundamental frequency?

A. 25 Hz
B. 50 Hz
C. 100 Hz
D. 200 Hz

Answer: A
Explanation: Fundamental frequency = v / 2L = 100 / (2 × 2) = 25 Hz

17. In a stationary wave, the distance between two successive nodes is 15 cm. What is the wavelength of the wave?

A. 7.5 cm
B. 15 cm
C. 30 cm
D. 60 cm

Answer: C
Explanation: Distance between two nodes = $\lambda/2 \rightarrow \lambda = 2 \times 15 = 30$ cm

18. A tuning fork of frequency 256 Hz produces 4 beats per second with another tuning fork. What could be the possible frequency of the second fork?

A. 260 Hz or 252 Hz
B. 250 Hz or 254 Hz
C. 258 Hz or 250 Hz
D. 262 Hz or 248 Hz

Answer: A
Explanation: Beat frequency = $|f_1 - f_2| = 4 \rightarrow f_2 = 256 \pm 4 \rightarrow f_2 = 252$ or 260 Hz

19. Two sound waves of equal amplitude and frequency interfere at a point. If the phase difference is 180°, what will be the resultant amplitude?

A. 0
B. A
C. √2 A
D. 2A

Answer: A
Explanation: A phase difference of 180° leads to destructive interference, so amplitude = 0

20. In a pipe open at both ends, which harmonic corresponds to the second overtone?

A. 2nd harmonic
B. 3rd harmonic
C. 4th harmonic
D. 5th harmonic

Answer: C
Explanation: For open-open pipe: nth overtone = (n+1)th harmonic → second overtone = 3rd + 1 = 4th harmonic

21. The speed of sound in air is 340 m/s. What is the wavelength of a sound wave of frequency 1700 Hz?

A. 0.2 m
B. 2 m
C. 0.02 m
D. 20 m

Answer: A
Explanation: $\lambda = v / f = 340 / 1700 = 0.2$ m

22. A string vibrates in 5 segments when excited. If the length of the string is 1.0 m, what is the wavelength of the wave?

A. 0.1 m
B. 0.2 m
C. 0.4 m
D. 0.5 m

Answer: C
Explanation: 5 segments = 5 loops = 5 × (λ/2) = 1 → λ = 0.4 m

23. Which of the following is not a characteristic of stationary waves?

A. No net transfer of energy
B. All particles vibrate with the same amplitude
C. Nodes and antinodes are formed
D. The wave appears to be still

Answer: B
Explanation: In stationary waves, amplitude varies from zero at nodes to maximum at antinodes.

24. In a resonance tube, the first resonance is observed at 25 cm. What is the next resonance length if the speed of sound is constant?

A. 50 cm
B. 75 cm
C. 100 cm
D. 60 cm

Answer: B
Explanation: Closed-end tube → resonances at odd multiples of λ/4 → next = 3λ/4 = 75 cm

25. In a stretched string, if tension is quadrupled, how does the fundamental frequency change?

A. Becomes double
B. Becomes four times
C. Becomes half
D. Remains unchanged

Answer: A
Explanation: $f \propto \sqrt{T} \rightarrow f' = f \times \sqrt{4} = 2f$

26. Two tuning forks produce 6 beats per second when sounded together. If one has a frequency of 512 Hz, what is the possible frequency of the other?

A. 506 Hz
B. 518 Hz
C. Both A and B
D. None of these

Answer: C
Explanation: Beat freq = $|f_1 - f_2| \rightarrow f_2 = 512 \pm 6 = 506$ or 518 Hz

27. In a pipe closed at one end, the second overtone corresponds to which harmonic?

A. 2nd harmonic
B. 3rd harmonic
C. 4th harmonic
D. 5th harmonic

Answer: D
Explanation: For closed-end pipe → overtone = odd harmonics only → 2nd overtone = 5th harmonic

28. A wave is described by $y = 0.01 \sin(2\pi x - 20\pi t)$. What is the speed of the wave in m/s?

A. 5
B. 10
C. 20
D. 2

Answer: B
Explanation: Equation: $y = A \sin(kx - \omega t) \rightarrow k = 2\pi$, $\omega = 20\pi$
$v = \omega / k = 20\pi / 2\pi = 10$ m/s

29. What is the phase difference between two adjacent nodes in a stationary wave?

A. 0°
B. 90°
C. 180°
D. 360°

Answer: C
Explanation: Phase difference between adjacent nodes = 180°

30. Which quantity does not change when a sound wave passes from air to water?

A. Wavelength
B. Speed
C. Frequency
D. All of these

Answer: C
Explanation: Frequency remains constant during medium change.

31. In a closed pipe of length 1.5 m, what is the frequency of the fundamental harmonic if the speed of sound is 330 m/s?

A. 55 Hz
B. 110 Hz
C. 165 Hz
D. 220 Hz

Answer: A
Explanation: Closed pipe → fundamental $\lambda = 4L = 6$ m
$f = v / \lambda = 330 / 6 = 55$ Hz

32. Two sound waves have amplitudes in the ratio 3:2. What is the ratio of their intensities?

A. 3:2
B. 2:3
C. 9:4
D. 4:9

Answer: C
Explanation: $I \propto A^2 \rightarrow (3/2)^2 = 9:4$

33. A standing wave is formed on a string of length 2 m with fixed ends. How many nodes are formed in the 3rd harmonic?

A. 2

B. 3
C. 4
D. 5

Answer: D
Explanation: For nth harmonic → number of nodes = n + 1 → 3 + 1 = 4 nodes

34. The speed of a transverse wave on a stretched string depends on:

A. Frequency only
B. Mass of string
C. Tension and linear mass density
D. Amplitude

Answer: C
Explanation: $v = \sqrt{(T/\mu)}$

35. If the tension in a string is increased four times, the wave speed becomes:

A. Half
B. Double
C. Four times
D. Same

Answer: B
Explanation: $v \propto \sqrt{T} \rightarrow \sqrt{4} = 2$ times

36. In a resonance tube, a tuning fork of 512 Hz produces resonance at 16 cm and 48 cm. What is the speed of sound in air?

A. 328 m/s
B. 330 m/s
C. 344 m/s
D. 360 m/s

Answer: C
Explanation: $\lambda = 2 \times (48 - 16) = 64$ cm $= 0.64$ m
$v = f \times \lambda = 512 \times 0.64 = 327.68 \approx 328$ m/s

37. Two waves are given by $y_1 = 5 \sin(\omega t)$ and $y_2 = 5 \sin(\omega t + \pi)$. The resultant amplitude is:

A. 0
B. 5
C. 10
D. 2.5

Answer: A
Explanation: Phase difference = π → destructive interference → A = 0

38. In a progressive wave, the distance between two points having a phase difference of π is:

A. λ
B. $\lambda/2$
C. $\lambda/4$
D. 2λ

Answer: B
Explanation: Phase difference of π corresponds to $\lambda/2$

39. When two tuning forks of frequencies 256 Hz and 260 Hz are sounded together, how many beats are heard per second?

A. 4
B. 2
C. 516
D. 520

Answer: A
Explanation: Beat frequency = $|f_1 - f_2| = 260 - 256 = 4$ Hz

40. What is the intensity level (in decibel) of a sound whose intensity is 10^{-8} W/m²? ($I_o = 10^{-12}$ W/m²)

A. 40 dB
B. 80 dB
C. 100 dB

D. 20 dB

Answer: A
Explanation: $L = 10 \log(I/I_0) = 10 \log(10^4) = 40$ dB

41. The equation of a stationary wave is $y = 4 \sin(\pi x) \cos(200\pi t)$. What is the distance between two consecutive antinodes?

A. 2 m
B. 1 m
C. 0.5 m
D. 4 m

Answer: B
Explanation: $y = 2A \sin(kx) \cos(\omega t) \rightarrow k = \pi \rightarrow \lambda = 2$
Distance between antinodes = $\lambda/2 = 1$ m

42. A pipe open at both ends produces a fundamental frequency of 300 Hz. What will be the frequency of its second overtone?

A. 600 Hz
B. 900 Hz
C. 1200 Hz
D. 150 Hz

Answer: B
Explanation: Open pipe $\rightarrow f_n = n \times f_1$
Second overtone = 3rd harmonic = $3 \times 300 = 900$ Hz

43. A wave has a frequency of 500 Hz and a wavelength of 0.68 m. Its velocity is:

A. 340 m/s
B. 100 m/s
C. 200 m/s
D. 150 m/s

Answer: A
Explanation: $v = f\lambda = 500 \times 0.68 = 340$ m/s

44. The ratio of fundamental frequencies of a closed pipe and open pipe of same length is:

A. 1:2
B. 2:1
C. 1:3
D. 3:1

Answer: A
Explanation: Closed pipe: $f_1 = v / 4L$, Open pipe: $f_1 = v / 2L \rightarrow$ Ratio = 1:2

45. Which of the following is a necessary condition for resonance to occur in a pipe?

A. Both ends must be closed
B. Length of pipe must be $\lambda/2$
C. Frequency of source = natural frequency of pipe
D. Pipe must be open at one end only

Answer: C
Explanation: Resonance occurs when external frequency matches the natural frequency