The Bodwad Sarvajanik Co-Op Education Society Ltd. Bodwad

Arts, Commerce and Science College, Bodwad

Question Bank

Class: - S.Y.B.Sc. **Sem.:-** IV

Subject: - Physics **Paper Name: -** Waves, Oscillations and Acoustics

PHY 401
Waves, Oscillations and Acoustics

Unit 1: Composition of two SHM'S

1. Two simple harmonic motions are given by $y_1 = A_1 \sin wt$ and $y_2 = A_2 \sin (wt + \phi)$ are acting on the particles in the same direction. The resultant motion is S.H.M. then its amplitude is …….

   a) $\sqrt{A_1^2 + A_2^2 + 2A_1A_2 \cos\phi}$ b) $\sqrt{A_1^2 + A_2^2 - 2A_1A_2 \cos\phi}$

   c) $A_1^2 + A_2^2 - 2A_1A_2 \cos\phi$ d) $A_1^2 + A_2^2 + 2A_1A_2 \cos\phi$

2. The displacement of a particle performing S.H.M. is $x = 3 \sin 314\, t + 4 \cos (314)t$ where x and t are in CGS unit; then the amplitude of S.H.M. is ……

   a) 7 cm b) 3 cm

   c) 4 cm **d) 5 cm**

3. If the two particles performing S.H.M. with same amplitude and initial phase angle then initial phase angle of resultant motion depends on ……

   a) initial phase angle only b) initial phase angle and amplitude of individual

   c) amplitude of individual only d) neither amplitude nor initial phase angle

4. If the phase difference between two S.H.M.s of equal amplitude (a) and equal frequency(n) acting along the same line is $\frac{\pi^C}{2}$ then amplitude of resultant S.H.M. is ……..

   a) 2 a **b)** $a\sqrt{2}$ c) 0 d) a

5. The resultant vibration of the particle due to S.H.M.s having same frequency and acting at right angles to each other represent general equation of ……..

a) Straight line
b) circle
c) ellipse
d) parabola

6. The differential equation of SHM is given by

a) $\frac{d^2y}{dt^2} + \omega^2 y = 0$
b) $\frac{d^2y}{dt^2} + \omega^2 y + ky^2 = a$
c) $\frac{d^2y}{dt^2} + \frac{R}{m}\frac{dy}{dt}\frac{K}{m}y = 0$
d) $\frac{d^2y}{dt^2} + \frac{R}{K}\frac{dy}{dt} + \frac{m}{K}y = 0$

7. Study of composition of two S.H.M.s is necessary to understand …….

a) the nature of waves
b) complex vibrations of musical instrument string
c) resonance phenomena
d) Doppler effect

8. If a particle is simultaneously subjected to two S.H.M.s acting at right angles to each other having frequency in the ratio 2:1 then it traces out a curve which has ……. Loops.

a) 4
b) 3
c) 2
d) 1

9. Two periodic motions are $y_1 = 9 \cos wt$, $y_2 = 12 \cos (wt - 90^o)$ then amplitude of resultant motion is ……. unit.

a) 13
b) 14
c) 12
d) 15

10. The resultant vibration of particle due to two SHMs having same frequency and acting at right angles to each other, having phase difference $\alpha = \frac{\pi}{4}$ or $\frac{7\pi}{4}$, traces a curve which is ……

a) simple ellipse
b) oblique ellipse
c) parabola
d) circle

11. The resultant vibration of particle due to two SHMs having same frequency, same amplitude and acting at right angles to each other, having phase difference $\alpha = \frac{\pi}{2}$ or $\frac{3\pi}{2}$, traces a curve which is ……..

a) simple ellipse
b) oblique ellipse
c) parabola
d) circle

12. Two SHM's with same amplitude and time period, when acting together in perpendicular directions with phase difference of $\pi/2$, gives rise to ……

a) straight motion
b) elliptical motion
c) circular motion
d) none of these

13. The composition of two simple harmonic motions of equal periods at right angles to each other and with a phase difference of π results in the displacements of the particle along the ……..

a) circle
b) figure of eight
c) straight line
d) ellipse

14. The motion in which a body moves from one place to another with respect to time is called as……..

a) vibrational motion
b) rotational motion
c) circular motion
d) translational motion

15. A motion which repeats itself in equal interval of time is called as ……..

a) periodic motion
b) circular motion
c) translational motion
d) rotational motion

16. A body is said to be in linear S.H.M., if it moves to and fro periodically along a line about a fixed point and in which the force (or acceleration) is directly proportional to the …….. measured from the mean position and always directed towards the mean position.

a) velocity
b) displacement
c) time
d) none of these

17. The maximum displacement of a particle performing S.H.M. from its mean position is called ……. of S.H.M.

a) period
b) frequency
c) amplitude
d) none of these

18. When a particle performs uniform circular motion on a reference circle, its projection point (particle) perform S.H.M. along the …….. of the reference circle.

a) arc
b) diameter
c) radius
d) none of these

19. The quantity $(\omega t + \alpha)$ is called ------ of a particle.

a) phase
b) initial phase
c) epoch
d) amplitude

20. In the quantity $(\omega t + \alpha)$, α is called ------ of a particle.

a) displacement
b) initial phase
c) amplitude
d) phase

21. If the phase difference between the two S.H.M.'s is zero i. e. $(\alpha_1 - \alpha_2) = 0$ then R = ……..

a) -2a
b) 4a
c) 0
d) 2a

22. If the phase difference between the two S.H.M.'s is π radians i. e. $(\alpha_1 - \alpha_2) = \pi$ then R =……..

a) 2a
b) 4 a
c) 0
d) 8 a

23. If the phase difference between the two S.H.M.'s is π/2 radians i. e. $(\alpha_1 - \alpha_2) = \pi/2$ then R = …….

a) a √2
b) √2 / a
c) a √4
d) a/√2

24. Blackburn's pendulum is a ……. method to demonstrate Lissajous' figures.

a) electrical
b) optical
c) mechanical
d) none of these

25. The study of composition of two perpendicular S.H.M.'s by using C.R.O. is ……method to demonstrate Lissajous' figures.

a) optical
b) electrical
c) mechanical
d) none of these

26. In electrical method, Lissajous figures can be obtained by…….

a) Lissajous electrometer
b) Black burn's pendulum
c) Cathod ray oscilloscope
d) None of these

27. Lissajous figures are used for……

a) to detect ultrasonic waves
b) to measure the weight of tuning fork
c) to determine unknown frequency of tuning fork
d) none of the above

28. Lissajous figures are obtained, when a particle is subjected to two S.H.M.s simultaneously……

a) along the same straight line
b) at right angles to each other
c) at an angle of 3π/4 to each other
c) none of the above

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Unit 2 Wave motion

1. The differential equation of wave motion is given by……..

a) $\frac{\partial^2 y}{\partial t^2} = v^2 \frac{\partial^2 y}{\partial x^2}$ b) $\frac{\partial^2 y}{\partial x^2} = v^2 \frac{\partial^2 y}{\partial t^2}$ c) $\frac{\partial^2 y}{\partial t^2} = v^2 \frac{\partial^2 x}{\partial y^2}$ d) None

2. The path difference x and phase difference ϕ are related as……..

a) $\phi = \frac{2\pi}{\lambda} x$ **b)** $x = \frac{2\pi}{\lambda} \phi$ c) $\phi = 2\pi\lambda x$ d) $x = 2\pi\lambda\phi$

3. The velocity of transverse waves in a string is given by……..

a) $c = \frac{1}{2l}\sqrt{\frac{T}{\rho}}$ **b)** $c = \sqrt{\frac{T}{\rho}}$ c) $c = \sqrt{\frac{x}{\rho}}$ d) None

4. The frequency of transverse waves in a string is given by……..

a) $n = \frac{1}{2l}\sqrt{\frac{T}{\rho}}$ b) $n = \sqrt{\frac{T}{\rho}}$ c) $n = \sqrt{\frac{x}{\rho}}$ d) None

5. If the particles of the mediumvibrate about their mean positions at right angles to the direction of propagation of wave, the wave is said to be……..

a) a transverse wave b) a longitudinal wave
c) a stationary wave d) a sound wave

6. If the particles of the mediumvibrate about their mean positions in the direction of propagation of the wave, the wave is said to be ……..

a) a transverse wave b) a light wave
c) a stationary wave **d) a longitudinal wave**

7. …….. is a mathematical equation for a progressive wave.

a) $y = a \sin(kt - \omega x)$ b) $y = a \sin(2\pi t - \lambda x)$
c) $\boldsymbol{y = a \sin(\omega t - kx)}$ d) $y = a \sin(\lambda t - \phi)$

8. A standing, or stationary wave, is a wave in which each point along the axis of the wave has a ……..

a) constant amplitude b) variable amplitude
c) variable frequency d) none of these

9. In stationary waves, the locations at which the amplitude from the axis is at a minimum are called …….. and the points along the axis where the amplitude is maximum are called ……..

a) antinodes, nodes **b) nodes, antinodes**

c) phase, epoch d) none of these

10. Which one of the following is correct in case of stationary waves?

a) Particles at nodes have maximum displacement

b) Particles at nodes have zero displacement

c) Particles at nodes have maximum velocity

d) none of these

11. Which one of the following is correct in case of stationary waves?

a) Particles at nodes have zero velocity

b) Particles at nodes have infinite velocity

c) Particles at nodes have maximum velocity

d) none of these

12. Which one of the following is correct in case of stationary waves?

a) Particles at antinodes have zero velocity

b) Particles at antinodes have minimum velocity

c) Particles at antinodes have maximum velocity

d) none of these

13. Which one of the following is correct in case of stationary waves?

a) Particles at antinodes have zero displacement

b) Particles at antinodes have minimum displacement

c) Particles at antinodes have maximum displacement

d) none of these

14. The distance between two consecutive nodes or antinodes is ……..

a) λ b) $\lambda/4$ c) 2λ **d) $\lambda/2$**

15. For stationary waves, the length-wavelength relationship is given by……

a) $L = \lambda$ **b)** $L = \frac{n}{2}\lambda$ c) $L = 2n\lambda$ d) $\lambda = \frac{n}{2}L$

16. A wave in which the disturbance propagated outward in all directions from the source of wave is called ……..

a) plane wave b) transverse wave c) longitudinal wave **d) spherical wave**

Unit 3 Forced Oscillations

1. Resonance is a special case of …….
   a) Undamped free oscillations **b) Damped free oscillations**
   c) Forced oscillations d) Resonant oscillator

2. In case of forced oscillations …….
   a) amplitude remains constant b) amplitude decays exponentially with time
   c) amplitude increases with time d) none of the above

3. If an external periodic force is applied on an oscillator then it executes …….
   a) Undamped free oscillations b) Damped free oscillations
   c) Forced oscillations d) None of the above

4. When the natural frequency $\frac{\omega}{2\pi}$ is equal to the forcing frequency $\frac{q}{2\pi}$ then, …….
   a) velocity resonance takes place
   b) amplitude resonance takes place
   c) both velocity and amplitude resonance take place
   d) none of the above

5. $m\frac{d^2y}{dt^3} + R\frac{dy}{dt} + ky = f \sin qt$ represents differential equation for …….
   a) Undamped free oscillations b) damped free oscillations
   c) Forced oscillations d) None of the above

6. Oscillations or vibrations of the system (or body) under the influence of some external periodic force are called as …….
   a) Free oscillations **b) Forced oscillations**
   c) Damped oscillations d) None of the above

7. Resonance is a special case of …….
   a) Forced oscillations b) Free oscillations
   c) Damped oscillations d) None of the above

8. If the frequency of external periodic force is equal to the natural frequency of the oscillator then the oscillator oscillates with maximum amplitude. This phenomenon is called as …….
   a) Free damped oscillations **b) Resonance**
   c) Forced oscillations d) All of the above

9. Barton's pendulum is an example of -------.
   a) Acoustic resonance
   b) Electrical resonance
   c) Optical resonance
   d) Mechanical resonance

10. Magnetic properties are studied with a special technique of …….
   a) Nuclear magnetic resonance
   b) Nuclear resonance
   c) Mechanical resonance
   d) Electrical resonance

11. In steady state forced vibrations, the amplitude of vibrations at resonance is ..... damping coefficient.
   a) equal to
   b) directly proportional to
   c) inversely proportional to
   d) independent of

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Unit 4: Sound

1. The sound waves having frequencies greater than 20 KHz upto the range of 10^6 KHz are called as …… waves.
   a) ultrasonic
   b) infrasonic
   c) audible
   d) supersonic

2. The sound waves of frequencies less than 20 Hz are called as …… waves.
   a) ultrasonic
   b) infrasonic
   c) supersonic
   d) hypersonic

3. The sound waves of frequencies greater than 10^9 Hz are called as ……..waves.
   a) ultrasonic
   b) infrasonic
   c) hypersonic
   d) supersonic

4. In the generation of ultrasonic waves ……. Crystal undergoes compressions and expansions in each cycle.
   a) NaCl
   b) diamond
   c) Calcite
   d) quartz

5. Piezoelectric effect is not produced by electrical or mechanical pressures along ….. axis.
   a) Optical
   b) mechanical
   c) Electrical
   d) magnetic

6. The velocity of longitudinal waves in quartz crystal is …….. m/sec.
   a) 550 **b) 5.5×10^3**
   c) 55000 d) 5.5

7. All sounds other than musical notes are called as ……
   a) transverses b) overtones
   c) noises d) musicals

8. The amount of sound energy crossing per unit area around a point in one second is known as …… of sound.
   a) amplitude b) volume
   c) density **d) intensity**

9. Sound intensity is directly proportional to …… of wave amplitude.
   a) square b) square root
   c) cube d) magnitude

10. It d is the distance between source and listener, when source produces sound its intensity is directly proportional to …….
    a) d **b) $1/d^2$**
    c) d^2 d) d^3

11. A shrill (sound of higher pitch) is produced by a source of …… frequencies.
    a) very low b) low
    c) high d) extremely low

12. Loudness level for pure tones is measured in the unit called ……
    a) $\sqrt{I}$ b) I^2
    c) I **d) log I**

13. Loudness level for pure tones is measured in the unit called ……..
    a) Phon b) m/sec
    c) m^2.sec d) $m.sec^2$

14. ……. Is the property of musical sound which depends on number of harmonics.
    a) Intensity **b) Quality or Timbre**
    c) Frequency d) Noise

15. The MKS unit of acoustic intensity is ……

a) watt / metre
b) watt-metre
c) watt/(metre)^2
d) watt.metre^2

16. The sound intensity level in decibel (dB) is given by …….. where
I – intensity of sound under consideration and I_O- intensity of least audible sound

a) 20.log (I / I_O)
b) 10 log (I. I_O)
c) 10 log (I_O / I)
d) 10.log (I / I_O)

17. The smallest audible intensity for a given frequency of sound wave is called …….. of audibility.

a) threshold
b) limit
c) range
d) test

18. The average rate of transfer of sound energy per unit area perpendicular to the direction of propagation is known as ……. of sound.

a) loudness
b) intensity
c) pressure
d) pitch

19. The phon scale and the decibel scale coincide at a sound frequency of ……. Hz.

a) 1
b) 10
c) 1000
d) 100

20. Pitch depends on the ……. Of the musical note emitted.

a) intensity
b) quality
c) amplitude
d) frequency

21. The natural frequency of vibration of the quartz crystal is determined by its dimensions ……. to the direction of vibration.

a) parallel
b) antiparallel
c) perpendicular
d) inclined.

22. In Doppler Effect the frequency of a sound note …….. if there is a relative motion between source and listener.

a) appears to change
b) does not appear to change
c) in creases
d) decreases

23. According to Doppler Effect in sound the frequency or pitch appears to ……. as the source approaches to stationary listener.

a) decrease
b) increase
c) remain constant
d) zero

24. The apparent change in frequency of a note (or pitch) whenever there is a relative motion between source and listener is known as ……

a) Piezo electric Effect
b) Compton Effect
c) Doppler Effect
d) Seebeck Effect.

25. …….. in frequency (or pitch) occurs if the source of sound and the listener move with same velocity and in the same direction.

a) Change
b) Increase
c) Decrease
d) No change

26. According to sign conventions, velocity of medium is taken as ……, if the medium is moving from source to listener.

a) Positive
b) negative
c) zero
d) none of these.

27. In Doppler, Effect, if source of sound and listener are stationary(at rest) or moving with same velocity in the same direction then apparent frequency and actual frequency are …….

a) Zero
b) equal
c) unequal
d) constant

28. If the source of sound and the listener are moving towards eachother in a stationary medium, then apparent frequency (n') is …… than actual frequency (n).

a) zero
b) smaller
c) larger
d) constant and equal

29. If the source of sound and the listener are moving a way from eachother in a stationary medium then apparent frequency (n') is ……than actual frequency (n).

a) very very larger
b) slightly larger
c) unchanged
d) smaller

30. For a stationary medium if listener is steady and apparent frequency (n') is smaller than actual frequency(n), this indicates that source of sound is …… the listener.

a) moving away from
b) moving towards
c) also steady with
d) moving along with.

31. In Doppler Effect, if source, listener and medium are related to eachother by oblique incidences then the factor appearing in the formulae is only ……. of angles θ and ϕ.

a) sine
b) cosine
c) tangent
d) sec.

32. In the case of sound waves, the Doppler Effect is ……. in nature

a) anomalous
b) symmetric
c) asymmetric
d) absurd.

33. Like sound, the Doppler Effect is observed in light showing ……. nature.

a) complex
b) asymmetric
c) constant
d) symmetric

34. Due to Doppler Effect in light an apparent change in …….. is appeared.

a) wavelength
b) velocity
c) periodic time
d) phase.

35. Observed Red Shifts and expansion of the universe indicate an application of Doppler Effect in ……

a) sound
b) light
c) mechanics
d) heat.

36. For supersonic speeds of flight or bullets. Doppler Effect is ……..

a) constant
b) applicable
c) not applicable
d) observed.

37. For a stationary medium when source of sound moves away from a steady listener, then the frequency of note is ……..

a) constant
b) doubled
c) zero
d) halved.

38. If V, V_S , V_L and W are velocities of sound, source of sound, listener, medium all moving in same directions, and n is frequency of sound then due to Doppler effect the apparent frequency ($n^{/}$) is given bg ….

a) $n^{/} = \left[\frac{V+W+V_L}{V+W+V_S}\right] n$
b) $n^{/} = \left[\frac{V+W-V_L}{V+W-V_S}\right] n$
c) $n^{/} = \left[\frac{V+W+V_S}{V+W+V_L}\right] n$
d) $n^{/} = \left[\frac{V+W-V_S}{V+W-V_L}\right] n$

39. If the source of sound and listener moving with same velocity in the same direction then apparent change in frequency is …….

a) large
b) small
c) zero
d) infinity

40. Doppler effect in sound and light …….

a) Both are symmetric in nature

b) both are asymmetric in nature

c) Symmetric and asymmetric in nature respectively

d) Asymmetric and symmetric in nature respectively.

41. If n and $n^{/}$ frequency and apparent frequency of sound and if source of sound and listener are moving away from each other then $n^{/}$ - n is ……

a) negative b) positive

c) zero d) infinity

42. If n and $n^{/}$ frequency and apparent frequency of sound and it source of sound and listener are moving towards each other then $n^{/}$ - n is ……..

a) positive b) negative

c) zero d) infinity

43. A railway train coming towards a station at a speed of 20 m/s. the frequency of whistling sound of engine is 930 Hz, speed of sound is 330 m/s and air is at rest then apparent change is frequency is ……..

a) 30 Hz b) 45 Hz

c) 60 Hz d) 90 Hz

44) According to Weber- Fechner law, Loudness is proportional to…….. where I intensity of sound.

a) e^{I} b) $1/e^{I}$ **c) log I** d)1/log I

45) $l_{dB} = 10 l_{bel} =$ …… ….

a) $10 \log_{10} \frac{I}{I_o}$ b) $10 \log_{10} \frac{I_o}{I}$ c) $10 \log_{10} I\, I_o$ d) none of these

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