1. 11TH PHYSICS oscillations & waves

Q1. A simple pendulum of length I is suspended from the ceiling of a car moving with a speed v on a circular horizontal road of radius r. **2 Marks**

1. Find the tension in the string when it is at rest with respect to the car.
2. Find the time period of small oscillation.

Q2. A transverse harmonic wave on a string is described by **2 Marks**

$y(x, t) = 3.0 \sin\left(36t + 0.018x + \frac{\pi}{4}\right)$

where x and y are in cm and t in s. The positive direction of x is from left to right.
What are its amplitude and frequency?

Q3. A 4.0kg block is suspended from the ceiling of an elevator through a, string having a linear mass density of 19.2 $\times 10^{-3}$kg/m. Find the speed (with respect to the string) with which a wave pulse can proceed on the string if the elevator accelerates up at the rate of 2.0m/s^2. Take g = 10m/s^2. **2 Marks**

Q4. For the harmonic travelling wave $y = 2\cos 2\pi(10t - 0.0080x + 3.5)$ where x and y are in cm and t is second. **2 Marks**
What is the phase difference between the oscillatory motion at two points separated by a distance of:
4m

Q5. In Exercise, let us take the position of mass when the spring is unstreched as x = 0, and the direction from left to right as the positive direction of x-axis. Give x as a function of time t for the oscillating mass if at the moment we start the stopwatch (t = 0), the mass is: **2 Marks**
At the maximum compressed position.
In what way do these functions for SHM differ from each other, in frequency, in amplitude or the initial phase?

Q6. Given below are some functions of x and t to represent the displacement of an elastic wave. **2 Marks**

$y = 10\cos[(252 - 250)\pi t]\cos[(252 + 250)\pi t]$

Q7. Given below are some functions of x and t to represent the displacement of an elastic wave. **2 Marks**

$y = 5\cos(4\times)\sin(20t)$

Q8. At what temperatures (in ^oC) will the speed of sound in air be 3 times its value at O^oC? **2 Marks**

Q9. Which of the following functions of time represent (a) simple harmonic, (b) periodic but not simple harmonic, and (c) non-periodic motion? Give period for each case of periodic motion (ω is any positive constant): **2 Marks**

$\sin^3 \omega t$

Q10. Two submarines are approaching each other in a calm sea. The first submarine travels at a speed of 36km/h and the other at 54km/h relative to the water. The first submarine sends a sound signal (sound waves in water are also called sonar) at a frequency of 2000Hz. **2 Marks**

1. At what frequency is this signal received by the second submarine?
2. The signal is reflected from the second submarine. At what frequency is this signal received by the first submarine. Take the speed of the sound wave in water to be 1500m/s.

Q11. At a prayer meeting, the disciples sing JAI-RAM JAI-RAM. The sound amplified by a loudspeaker comes back after reflection from a building at a distance of 80m from the meeting. What maximum time interval can be kept between one JAI-RAM and the next JAI-RAM so that the echo does not disturb a listener sitting in the meeting. Speed of sound in air is 320m/s. **2 Marks**

Q12. If you are walking on the moon, can you hear the sound of stones cracking behind you? Can you hear the sound of your own footsteps? **2 Marks**

Q13. In the given progressive wave $y = 5\sin(100\pi t + 0.4x)$ where y and x are in m, t is in s. What is the: **2 Marks**
Wave length

Q14. A transverse harmonic wave on a string is described by **2 Marks**
$y(x, t) = 3.0 \sin\left(36t + 0.018x + \frac{\pi}{4}\right)$
where x and y are in cm and t in s. The positive direction of x is from left to right.
What is the least distance between two successive crests in the wave?

Q15. In Exercise, let us take the position of mass when the spring is unstreched as x = 0, and the direction from left to right as the positive direction of x-axis. Give x as a function of time t for the oscillating mass if at the moment we start the stopwatch (t = 0), the mass is: **2 Marks**
At the maximum stretched position.
In what way do these functions for SHM differ from each other, in frequency, in amplitude or the initial phase?

Q16. Find the change in the volume of 1.0 litre kerosene when it is subjected to an extra pressure of 2.0 x 10^5N/m^2 from the following data. Density of kerosene = 800kg/m^3 and speed of sound in kerosene = 1330m/s. **2 Marks**

Q17. Explain why (or how): **2 Marks**
in a sound wave, a displacement node is a pressure antinode and vice versa,

Q18. When two waves of almost equal frequencies n_1 and n_2 reach at a point simultaneously, what is the time interval between successive maxima? **2 Marks**

Q19. In Exercise, let us take the position of mass when the spring is unstreched as x = 0, and the direction from left to right as the positive direction of x-axis. Give x as a function of time t for the oscillating mass if at the moment we start the stopwatch (t = 0), the mass is: **2 Marks**
At the mean position.
In what way do these functions for SHM differ from each other, in frequency, in amplitude or the initial phase?

Q20. The transverse displacement of a string (clamped at its both ends) is given by **2 Marks**
$y(x, t) = 0.06 \sin\left(\frac{2\pi}{3}x\right) \cos(120\pi\, t)$
where x and y are in m and t in s. The length of the string is 1.5m and its mass is 3.0×10^{-2}kg.
Answer the following:
Does the function represent a travelling wave or a stationary wave?

Q21. Explain your answers. **2 Marks**
What is the amplitude of a point 0.375m away from one end?

Q22. Consider a pair of identical pendulums, which oscillate with equal amplitude independently such that when one pendulum is at its extreme position making an angle of 2° to the right with the vertical, the other pendulum makes an angle of 1° to the left of the vertical. What is the phase difference between the pendulums? **2 Marks**

Q23. Explain why (or how): **2 Marks**
The shape of a pulse gets distorted during propagation in a dispersive medium.

Q24. Explain why (or how): **2 Marks**
Bats can ascertain distances, directions, nature, and sizes of the obstacles without any “eyes”,

Q25. You have learnt that a travelling wave in one dimension is represented by a function y = f(x, t) where x and t must appear in the combination x – v t or x + v t, i.e. y = f (x ± v t). Is the converse true? Examine if the following functions for y can possibly represent a travelling wave: **2 Marks**

1. $(x - vt)^2$
2. $\log[(x + vt)/x_0]$
3. $1/(x + vt)$

Q26. The frequencies of two tuning forks A and B are 250Hz and 255Hz respectively. Both are sounded together. How many beats will be heard in 5 seconds? **2 Marks**

Q27. The speed of sound wave depends on temperature but speed of light waves does not. Why? **2 Marks**

Q28. What are the uses of ultrasonic waves? **2 Marks**

Q29. In an experiment, it was found that a tuning fork and a sonometer wire gave 5 beats per second, both when the length of the wire was 1m, and 1.05m. Calculate the frequency of the fork. **2 Marks**

Q30. Define longitudinal wave motion. What are the essential conditions required for the formation of longitudinal wave motion? **2 Marks**

Q31. In case of an oscillating simple pendulum what will be the direction of acceleration of the bob at: **2 Marks**

1. The mean position.
2. The end points?

Q32. With the help of examples differentiate between free oscillations and forced oscillations. **2 Marks**

Q33. A girl is swinging in the sitting position. How will the period of the swing be changed if she stands up? **2 Marks**

Q34. The intensity maxima due to two interfering waves of equal amplitude $a_1 = a_2 = a$ is $4a^2$. Does this violate the law of conservation of energy? Justify. **2 Marks**

Q35. What travels faster-a rifle bullet or the sound of a shot? **2 Marks**

Q36. Show that for small oscillations the motion of a simple pendulum is simple harmonic. Derive an expression for its time period. Does it depend on the mass of the bob? **2 Marks**

Q37. Obtain an expression for apparent frequency of sound when the source is moving with a velocity v_s towards the stationary listener. **2 Marks**

Q38. A steel wire has a length of 12.0m and a mass of 2.10kg. What should be the tension in the wire so that the speed of transverse wave on the wire equals the speed of sound in dry air at 20°C? Take the speed of sound at 20°C = 343m/s. **2 Marks**

Q39. An open pipe resonates with a frequency v. When half of it is immersed in a dense liquid, what is the fundamental frequency? **2 Marks**

Q40. A child blows air at one end of a straw and slowly cuts pieces of the straw from the other end. What will be the outcome that will be observed? **2 Marks**

Q41. Explain graphically that number of beats formed per second is $n = v_1 - v_2$ where v_1 and v_2 be the frequency of two superimposing waves. **2 Marks**

Q42. A man with a wrist watch on his hand falls from the top of a tower. Does the watch give correct time during the free fall? **2 Marks**

Q43. Why do we see the flash of lightning first and hear the thunder later? **2 Marks**

Q44. What is the length of a simple pendulum, which ticks seconds? **2 Marks**

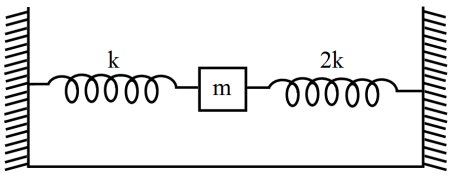
Q45. Why can't we use a pendulum to work as a clock in a satellite? **2 Marks**

Q46. The frequencies of the two tuning forks A and B are 250Hz and 255Hz respectively. Both are sounded together. How many beats will be heared in 5s? **2 Marks**

Q47. **2 Marks**

The frequency of oscillations of a mass m suspended by a spring is 'v_1'. If the length of spring is cut to one half, the same mass oscillates with frequency 'v_2'.
Determine the value of $\frac{v_2}{v_1}$.

Q48. Two springs of force constants K and 2K are connected to a block of m as shown below. What is the frequency of oscillation of this block? **2 Marks**



Q49. Define temperature coefficient of the velocity of sound. **2 Marks**

Q50. A spring of mass 2.50kg is under a tension of 200N. The length of the stretched string is 20.0m. If a transverse jerk is struck at one end of the string, how long does the disturbance take to reach the other end? **2 Marks**

Q51. A closed and an open pipe are sounded for same frequency. What is the ratio of their lengths? **2 Marks**

Q52. Estimate the time taken by the oscillating pendulum to shift from x = 0 to $x = \frac{A}{2}$ where A is the amplitude. **2 Marks**

Q53. If the length of a simple pendulum is increased by 25%, then what is the change in its time period? **2 Marks**

Q54. An observer at a sea-coast observes waves reaching the coast. What type of waves does he observe? Why? **2 Marks**

Q55. Air gets thinner as we go up in the atmosphere. Will the velocity of sound change? **2 Marks**

Q56. The apparent frequency of the whistle of an engine changes in the ratio 3 : 2 as the engine passes a stationary observer. If the velocity of sound is 330m/s, calculate the velocity of the engine. **2 Marks**

Q57. If $Y = 3\sin(36t + .018x + \frac{\pi}{4})cm$ find the amplitude and velocity of the wave. **2 Marks**

Q58. Two sound sources produce 20 beats in 5s. By how much do their frequencies differ? **2 Marks**

Q59. On what factors does the speed of transverse waves setup in a string depend? **2 Marks**

Q60. Why should a bat be able to sense high frequencies? **2 Marks**