Waves

1. **Assertion (A):** When a pulse on string reflects from free end, the resultant pulse is formed in such a way that slope of string at free end is zero.
Reason (R): Zero resultant slope ensures that there is no force component perpendicular to string.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

2. **Assertion (A):** The pitch of wind instruments rises and that of string instruments falls as an orchestra warms up.
Reason (R): When temperature rises, speed of sound in air increases but speed of wave in a string fixed at both ends decreases.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

3. **Assertion (A):** Sound travels faster on a rainy day than on a dry day.
Reason (R): With increase in humidity pressure increases.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

4. **Assertion (A):** Node of pressure wave is formed at the open end of an organ pipe.
Reason (R): Reflected pressure wave from an open end will have phase difference of π w.r.t. to the incident pressure wave.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

5. **Assertion (A):** When a wave enters from one medium to another, its frequency is not changed.
Reason (R): Speed of a wave in a medium is property of the source.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

6. **Assertion (A):** Two waves moving in a uniform string having uniform tension cannot have different velocities.
Reason (R): Elastic and inertial properties of string are same for all waves in same string. Moreover, velocity of wave in a string depends on its elastic and inertial properties only.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

7. **Assertion (A):** Two sound waves of same intensity in a particular medium will have displacement amplitude in ratio of 2:1 if they have frequency in the ratio 1 : 2.
Reason (R): Two wave of same velocity and amplitude in a particular medium have equal intensity.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

8. **Assertion (A):** Every small part of string does SHM in sinusoidal travelling wave.
Reason (R): In this small segment of string total energy is conserved.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

9. **Assertion (A):** If two waves of same amplitude produce a resultant wave of same amplitude, then the phase difference between them will be 120°.

Reason (R): The resultant amplitude of two waves is equal to sum of amplitude of two waves.

(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)

(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)

(3) (A) is true but (R) is false

(4) Both (A) and (R) are false

10. **Assertion (A):** In a sinusoidal travelling wave on a string potential energy of deformation of string element at extreme position is maximum.

Reason (R): The particles in sinusoidal travelling wave perform SHM.

(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)

(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)

(3) (A) is true but (R) is false

(4) Both (A) and (R) are false

11. **Assertion (A):** $Y = 2A \sin kx \cos wt$ refers to a travelling wave along –ve x-direction.

Reason (R): When a continuous travelling wave interacts with its reflection from a rigid support, forms a standing wave.

(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)

(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)

(3) (A) is true but (R) is false

(4) Both (A) and (R) are false

12. Two person A and B sound whistle. The person A is stationary and heard sound after reflection from a wall which is moving toward him; while person B is moving in a circle and heard the sound after reflection from a small object at the centre of circle.

Assertion (A): The person A observe change in frequency but no Doppler's effect while person B observed Doppler's effect but no change in frequency.

Reason (R): Doppler's effect is phenomena of observing change in frequency due to motion of either source or observer or both. While change in frequency can be observed due to change of wavelength or change of speed of wave-front relative to observer.

(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)

(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)

(3) (A) is true but (R) is false

(4) Both (A) and (R) are false

13. In situation A, an observer moves with a certain velocity towards a stationary source of sound, In situation B, the source moves towards the stationary observer with the same velocity,

Assertion (A): The frequency heard would be the same in both the situations.

Reason (R): The velocity of the source as observed by the observer in both the situations is the same.

(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)

(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)

(3) (A) is true but (R) is false

(4) Both (A) and (R) are false

14. **Assertion (A):** Speed of longitudinal wave in solid and liquid is higher than gases.

Reason (R): Modulus of elasticity is more for solids as compared to liquid & gas.

(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)

(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)

(3) (A) is true but (R) is false

(4) Both (A) and (R) are false

15. **Assertion (A):** The velocity of sound decreases with increase in humidity.

Reason (R): Velocity of sound does not depend on medium.

(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)

(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)

(3) (A) is true but (R) is false

(4) Both (A) and (R) are false

16. **Assertion (A):** The change in air pressure, effect the speed of sound at constant temperature.

Reason (R): The speed of sound in a gas is directly proportional to pressure.

(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)

(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)

(3) (A) is true but (R) is false

(4) Both (A) and (R) are false

17. **Assertion (A):** Sound produced by an open organ pipe has good quality than sound produced by a loosed organ pipe.

Reason (R): In OOP both even & old harmonics are present.

(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)

(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)

(3) (A) is true but (R) is false

(4) Both (A) and (R) are false

18. **Assertion (A):** The fundamental frequency of an open organ pipe increases as the temperature is increased.

Reason (R): As the temperature increases, the velocity of sound increases more rapidly than length of the pipe.

(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)

(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)

(3) (A) is true but (R) is false

(4) Both (A) and (R) are false

19. **Assertion (A):** Transverse mechanical waves can propagate in solid, liquid and gas.

Reason (R): Transverse mechanical waves needs rigidity in the medium to propagate.

(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)

(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)

(3) (A) is true but (R) is false

(4) Both (A) and (R) are false

20. **Assertion (A):** When there is no relative velocity between source and observer then observed frequency is same as emitted.

Reason (R): Velocity of sound is zero when there is no relative velocity between source and observer.

(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)

(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)

(3) (A) is true but (R) is false

(4) Both (A) and (R) are false

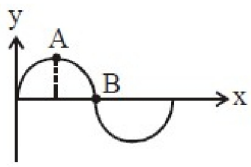
21. **Assertion (A):** A 80 dB sound has twice the intensity of a 40 dB sound.
Reason (R): Loudness of a sound of a certain intensity 'I' is defined as
$L = 100\log_{10}\left(\frac{I}{I_0}\right)$
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

22. **Assertion (A):** For a closed organ resonating pipe, the first resonance length is 60 cm. The second resonating length will be 180 cm.
Reason (R): For a particular closed pipe $n_2 = 3n_1$
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

23. **Assertion (A):** If two sounds of frequencies 256 Hz and 260 Hz reach our ear simultaneously then we hear a sound of frequency 258 Hz.
Reason (R): We hear a striking variation in the intensity of sound that repeat at a frequency of 4 Hz.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

24. **Assertion (A):** When a high pressure pulse of air travelling down an open pipe reaches the other end, turns into a pulse of low pressure pulse travelling up the tube.
Reason (R): Node of pressure means antinode of displacement in case of open pipe.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

25. **Assertion (A):** y-x graph of transverse wave on a string is as shown in figure. At a point 'A' potential energy and kinetic energy both are minimum.



Reason (R): At a point 'A' slope of graph is zero.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

26. **Assertion (A):** A person hear maximum sound at displacement node.
Reason (R): Pressure change is maximum at displacement node.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

27. **Assertion (A):** When observer is at rest with respect to medium and source is moving away from the observer the wavelength of sound observed by observer is more than its actual wavelength.
Reason (R): Wavelength appears to increase or decrease respectively if observer is moving towards or away from stationary source.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

28. **Assertion (A):** In mechanical waves energy transfer takes place because of the coupling through elastic forces between neighbouring oscillating parts of the medium.
Reason (R): Propagation of wave in medium is due to only elastic properties of medium.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

29. **Assertion (A):** In a hoop revolving with some angular speed ω in horizontal plane, transverse wave may appear to be stationary.
Reason (R): Velocity of transverse wave pulse w.r.t. string may be equal and opposite to string velocity.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

30. **Assertion (A):** Transverse mechanical waves cannot be generated within the volume of liquids.
Reason (R): Liquids does not have modulus of rigidity.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

31. **Assertion (A):** In longitudinal wave propagation the distance between two consecutive compression is equal to wavelength of wave.
Reason (R): Standing wave is not a wave as it does not transport energy.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

32. **Assertion (A):** Sound travels faster in air than in water.
Reason (R): Air is always rarer medium with respect to water medium.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

33. **Assertion (A):** Sound waves cannot propagate through vacuum but light waves can.
Reason (R): Sound waves cannot be polarised but light waves can be.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

34. **Assertion (A):** When two vibrating tuning forks having frequencies 240 Hz and 300 Hz are held near each other, beats cannot be heard by us.
Reason (R): This is because beats cannot be distinctly heard due to the property of persistence of hearing.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

35. **Assertion (A):** In a harmonic wave of a given frequency all particles have the same amplitude but different phases at a given time.
Reason (R): In a stationary wave, all particles have the same phase at a given instant but have different amplitudes.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

36. **Assertion (A):** Interference is position dependent phenomenon.
Reason (R): Beats is time dependent phenomenon.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

37. **Assertion (A):** Sound waves can be used to explore the soft tissue of the human body.
Reason (R): Oscillations in the real world are usually damped.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

38. **Assertion (A):** An acoustic guitar depends for its sound on the acoustic resonance produced in the hollow body of the instrument by the oscillations of the strings.
Reason (R): Electric guitar is a solid instrument that based upon resonance. (In electric guitar the oscillations of the metal strings are sensed by electric "pickups" that send it to an amplifier).
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

39. **Assertion (A):** When two tuning fork of frequency 256 Hz and 324 Hz are vibrating together. Beats will not be heard.
Reason (R): Superposition of sound waves is possible for all frequencies of sound.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

40. **Assertion (A):** In a stationary–wave system, displacement nodes are pressure antinodes, and displacement antinodes are pressure nodes.
Reason (R): When a closed organ pipe vibrates, the pressure of the gas at the closed end remains constant.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

41. **Assertion (A):** Interference can happen in sound waves.
Reason (R): In Quincke's tube, interference is present due to initial phase difference as well as the phase difference due to path difference.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

42. **Assertion (A):** When we start filling an empty bucket with water, the pitch of sound produced goes on decreasing.
Reason (R): The frequency of man voice is usually higher than that of woman.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

43. **Assertion (A):** For a given medium in a wave, particle velocity varies w.r.t. time, while the wave velocity is independent of time.
Reason (R): For propagation of mechanical wave, medium must have the properties of elasticity and inertia.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

44. **Assertion (A):** Sound is produced due to vibratory motion, but a vibrating pendulum does not produce audible sound.
Reason (R): A vibrating source always produce audible sound.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

45. **Assertion (A):** With increase in temperature, the speed of sound in a gas increases.
Reason (R): When temperature increases, the gas molecules move faster.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

46. **Assertion (A):** Sound waves travel faster on a hot summer day than on a cold winter day.
Reason (R): Velocity of sound is directly proportional to the temperature of medium.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

47. **Assertion (A):** Both arms of a tuning fork vibrate with the same frequency.
Reason (R): The two arms of a tuning fork vibrate in phase.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

48. **Assertion (A):** Beats are not observed in case of light waves from two independent sources.
Reason (R): The phase difference between two light sources changes randomly.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

49. **Assertion (A):** A vibrating tuning fork sounds louder, when its stem is pressed against a desk top.
Reason (R): When a sound wave is incident on the surface of a desk, it is totally reflected.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

50. **Assertion (A):** The energy stored by a stationary wave is zero.
Reason (R): When two identical waves travelling in opposite directions superimpose, their whole energy is converted into heat.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

51. **Assertion (A):** Doppler effect for sound waves is symmetrical.
Reason (R): With the help of Doppler effect we can determine the distance between source and observer.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

52. **Assertion (A):** Whistle of the approaching railway engine is shriller than the receding engine.
Reason (R): Apparent frequency of railway engine in both cases is same.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

53. **Assertion (A):** In n^{th} normal mode of a stretched string, there are n antinodes and (n +1) nodes.
Reason (R): The ends of string are nodes, so the number of nodes is one more than the number of antinodes.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

54. **Assertion (A):** It is not possible to have interference between the waves produced by two violins of different frequency.
Reason (R): For interference of two waves, the phase difference between the waves must remain constant.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

55. **Assertion (A):** In everyday life, the Doppler effect is observed readily for sound waves than light waves.
Reason (R): Velocity of light is greater than the sound.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

56. **Assertion (A):** A tuning fork is in resonance with a closed pipe in fundamental mode, but the same tuning fork cannot be in resonance in fundamental mode with an open pipe of same length.
Reason (R): The same tuning fork will not be in resonance with open pipe of same length due to end correction of pipe.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

ANSWER KEY																				
Que.	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**
Ans.	1	1	3	2	3	4	3	3	3	4	4	4	4	1	4	4	1	1	4	3
Que.	**21**	**22**	**23**	**24**	**25**	**26**	**27**	**28**	**29**	**30**	**31**	**32**	**33**	**34**	**35**	**36**	**37**	**38**	**39**	**40**
Ans.	4	2	2	2	1	1	3	3	1	1	3	4	2	2	3	2	2	3	2	3
Que.	**41**	**42**	**43**	**44**	**45**	**46**	**47**	**48**	**49**	**50**	**51**	**52**	**53**	**54**	**55**	**56**				
Ans.	3	4	2	3	2	3	3	1	3	4	4	3	1	1	2	3				