

1. OBJECTIVE QUESTIONS

- Non-mechanical wave can travel
 - in vacuum as well as in a medium
 - in vacuum but not in a medium
 - in medium but not in vacuum
 - neither in a medium nor in vacuum

Ans : (a) in vacuum as well as in a medium
- Sound is produced by the objects.
 - plucking
 - scratching
 - blowing
 - all of these

Ans : (d) all of these
We can produce sound by plucking, scratching, rubbing, blowing or shaking different objects.
- An instrument commonly used in laboratory to produce a sound of some particular frequency is
 - sonar
 - electric bell
 - tuning fork
 - a stretched wire

Ans : (c) tuning fork
Tuning fork is quite handy and can produce pure sound of some particular frequency.
- is the vibrating part which enables us to speak.
 - Vocal cords
 - Larynx
 - Ears
 - Fingers

Ans : (a) Vocal cords
The sound of human voice is produced due to vibrations in the vocal cords.
- In case of transverse waves the particles of a medium vibrate
 - in the direction of wave propagation
 - opposite to the direction of wave propagation
 - at the right angles to the direction of wave propagation
 - none of the above

Ans : (c) at the right angles to the direction of wave propagation
- When a sound wave travels in air, the physical quantity which is transferred from one place to the other is
 - mass
 - force
 - air particle
 - energy

Ans : (d) energy
Basically sound is mechanical energy which is passed on from one to another particle.

- In case of transverse waves, the particles of a medium vibrate
 - in the direction of wave propagation
 - opposite to the direction of wave propagation
 - at the right angles to the direction of wave propagation
 - none of these

Ans : (c) at the right angles to the direction of wave propagation
If the particles of a medium move perpendicular to the direction of motion of the wave, the wave is called a transverse wave.
- In the region of compression or rarefaction, in a longitudinal wave the physical quantity which does not change is
 - pressure
 - mass
 - density
 - volume

Ans : (c) mass
Mass is always a constant quantity.
- The change in density/pressure of a medium from maximum value to minimum value and again to maximum value, due to the propagation of a longitudinal wave is called a complete
 - oscillation
 - frequency
 - amplitude
 - none of these

Ans : (a) oscillation
An oscillation constitutes either one to other compression or one to other rarefaction.
- Sound travels at a speed of 334 m s^{-1} in air. This means that
 - the source of sound moves 334 m in one second
 - the listener moves 334 m in one second
 - air moves 334 m in one second
 - the disturbance in air moves 334 m in one second

Ans : (d) the disturbance in air moves 334 m in one second
The speed with which a disturbance propagates in a medium is called wave speed.
- The vibrations in the ear are amplified by
 - hammer
 - anvil
 - stirrup
 - all of these

Ans : (d) all of these
- A marine survey ship emits a sound wave straight to the sea bed. It detects an echo 4.0 s later. Which is a possible depth of the sea?
 - 600 m
 - 1500 m

- (c) 3000 m (d) 10000 m

Ans : (c) 3000 m

The speed of sound in water is approximately 1500 m s^{-1} . The depth of the sea is approximately $1500 \times 2 = 3000 \text{ m}$.

13. If the density of air at a point through which a sound wave is passing is maximum at an instant, the pressure at that point will be
- (a) minimum
(b) same as the density of air
(c) equal to the atmospheric pressure
(d) maximum

Ans : (d) maximum

As pressure of a gas is directly proportional to its density, density will also be maximum.

14. Sound waves and light waves are similar in that both
- (a) are produced by mechanical vibrations
(b) are longitudinal waves
(c) can travel through vacuum
(d) obey the laws of reflection

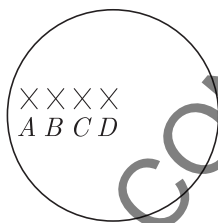
Ans : (d) obey the laws of reflection

15. Which of the following is an elastic wave?
- (a) Sound waves (b) Light waves
(c) X-rays (d) Radio waves

Ans : (a) Sound waves

Elastic waves require a medium for their propagation.

16. A man sings in a circular room. At which position will he hear himself the loudest?



- (a) A (b) B
(c) C (d) D

Ans : (d) D

When the man makes a sound at the centre of the circular room, the sound will travel in all directions and reflect back to the centre after striking the wall. The man at the centre of the room will receive strong echoes concurrently.

17. A bat releases a sound wave forward. It detects an echo 0.8 s later. If the speed of sound in air is 300 m s^{-1} , how far is the bat away from the obstacle in front?
- (a) 120 m (b) 240 m
(c) 300 m (d) 375 m

Ans : (a) 120 m

Time taken for sound to travel to and from the bat to the obstacle = 0.8 s

Time taken for sound to travel to the obstacle = 0.4 s

Speed of sound in air = 300 m s^{-1}

Distance from the bat to the obstacle

$$= \text{speed} \times \text{time}$$

$$= 300 \times 0.4 = 120 \text{ m}$$

18. Human ear cannot hear those mechanical waves whose frequency lies in the frequency range
- (a) less than 100 Hz but greater than 10000 Hz
(b) between 1000 Hz and 5000 Hz
(c) between 500 Hz and 20000 Hz
(d) less than 20 Hz and more than 20000 Hz

Ans : (d) less than 20 Hz and more than 20000 Hz

The audible frequency range (of human ear) lies between 20 Hz and 20000 Hz.

19. Water waves are
- (a) longitudinal
(b) transverse
(c) Both longitudinal and transverse
(d) neither longitudinal nor transverse

Ans : (c) Both longitudinal and transverse

20. An object moving at a speed greater than that of sound is said to be moving at
- (a) ultrasonic speed (b) sonic speed
(c) infrasonic speed (d) supersonic speed

Ans : (d) supersonic speed

Supersonic speed is the speed that is greater than the speed of sound.

21. In inner ear, the pressure variations are turned into electrical signals by
- (a) Oval window (b) Cochlea
(c) Auditory canal (d) Eardrum

Ans : (b) Cochlea

Cochlea converts sound energy into electrical energy.

22. Which is not the condition for hearing sound?
- (a) There must be a vibrating body capable of transferring energy.
(b) there must be a material medium to pick up and propagate energy.
(c) The medium must have a large density.
(d) There must be receiver to receive the energy and interpret it.

Ans : (c) The medium must have a large density. Density of material is not the essential condition.

23. Which of the following statements are correct?
- (a) Sound is a form of energy which produces a sensation of hearing in our ears.
(b) Sound cannot be produced without utilizing energy.
(c) Vibrating objects produce sound.
(d) All of these

Ans : (d) All of these

24. In case of longitudinal waves, the particles of medium

vibrate

- (a) in the direction of wave propagation
- (b) opposite to the direction of wave propagation
- (c) at right angles to the direction of wave propagation.
- (d) none of the above

Ans : (a) in the direction of wave propagation

25. The membrane of a drum vibrates to produce sound. Similarly the string of a sitar vibrates to produce sound. Which part of a whistle vibrates to produce sound?
- (a) Body of whistle
 - (b) Air column
 - (c) Mouth of the person
 - (d) All of these

Ans : (b) Air column

Whistle has a air column which vibrates and produce sound.

26. In the region of compression or rarefaction, in a longitudinal wave the physical quantity which does not change is
- (a) pressure
 - (b) mass
 - (c) density
 - (d) volume

Ans : (b) mass

Mass is always a constant quantity.

27. Mechanical wave can travel
- (a) in vacuum as well as in a medium
 - (b) in vacuum but not in a medium
 - (c) in a medium but not in vacuum
 - (d) neither in a medium nor in vacuum

Ans : (c) in a medium but not in vacuum

Mechanical wave can travel only in a medium.

28. Which of the following are applications of ultrasound?
1. To scan the womb of a pregnant lady.
 2. To break up kidney stones and gall stones.
 3. To detect flaws in metals.
- (a) 1 and 2
 - (b) 2 and 3
 - (c) 1 and 3
 - (d) 1, 2 and 3

Ans : (d) 1, 2 and 3

Ultrasound is used in all the three applications.

29. A stretched slinky is given a sharp push along its length. A wave travels from one end to another. The wave so produced is
- (a) transverse wave
 - (b) longitudinal wave
 - (c) stationary wave
 - (d) none of the above

Ans : (b) longitudinal wave

When slinky is pushed in the direction of length a wave compression is generated followed by a wave of rarefaction.

30. A big explosion on the moon cannot be heard on the earth because
- (a) the explosion produces high frequency sound waves which are inaudible
 - (b) sound waves require a material medium for propagation
 - (c) sound waves are absorbed in the moon's

atmosphere

- (d) sound waves are absorbed in the earth's atmosphere

Ans : (b) sound waves require a material medium for propagation

31. An object moving at a speed greater than that of sound is said to be moving at
- (a) ultrasonic speed
 - (b) sonic speed
 - (c) infrasonic speed
 - (d) supersonic speed

Ans : (d) supersonic speed

Supersonic speed is the speed that is greater than the speed of sound.

32. If you go on increasing the stretching force on a wire in a guitar, its frequency
- (a) increases
 - (b) decreases
 - (c) remains unchanged
 - (d) none of these

Ans : (a) increases

As the stretching force increases, the speed of wave increases and hence the frequency also increases.

33. The sound waves having a frequency more than 20,000 Hz are called
- (a) infrasonic waves
 - (b) supersonic waves
 - (c) ultrasonic waves
 - (d) hypersonic waves

Ans : (c) ultrasonic waves

Waves of frequency above 20000 Hz cannot be heard by human beings and are called ultrasonic.

34. Ultrasonic, infrasonic and audible waves travel through a medium with speeds V_u , V_i and V_a respectively, then
- (a) $V_i = V_a = V_u$
 - (b) $V_u > V_a > V_i$
 - (c) $V_u < V_a < V_i$
 - (d) $V_a \leq V_a = V_u$

Ans : (a) $V_i = V_a = V_u$

Speed of sound is independent of frequency.

35. Two waves of sinusoidal waveforms are same wavelengths and different amplitude. They will be having
- (a) same pitch and different intensity
 - (b) same quality and different intensity
 - (c) different quality and different intensity
 - (d) same quality and different pitch

Ans : (a) same pitch and different intensity

The pitch depends upon the frequency of the source. As the two waves have different amplitude therefore they must have different intensity. While quality depends on number of harmonic/overtone produced and their relative intensity. Assuming that their frequencies are the same.

36. Which of the following changes when sound is reflected?
- (a) Wavelength
 - (b) Frequency
 - (c) Speed
 - (d) Amplitude

Ans : (d) Amplitude

When sound wave is reflected, there is no change in wavelength, frequency and speed of the wave. When the sound wave strikes the wall, it losses energy to the

wall and hence the amplitude (loudness) of the sound wave decreases.

37. Each of the properties of sound listed in column A primarily depends on one of the quantities in column B. Choose the matching pairs from two columns.

Column A	Column B
Pitch	Waveform
Quality	Frequency
Loudness	Intensity

- (a) Pitch-waveform, Quality-frequency, Loudness-intensity
 (b) Pitch-frequency, Quality-waveform, Loudness-intensity
 (c) Pitch-intensity, Quality-waveform, Loudness-frequency
 (d) Pitch-waveform, Quality-intensity, Loudness-frequency

Ans : (b) Pitch-frequency, Quality-waveform, Loudness-intensity

38. Of the following, the one which emits sound of higher pitch is

- (a) mosquito (b) man
 (c) lion (d) woman

Ans : (a) mosquito

A mosquito buzz has a frequency around 500-600 Hz which is greater than that of a lion, a man and a woman.

39. A sonar signal from a ship is emitted underwater towards the sea bed. It takes 0.7 s for the signal to bounce back from the sea bed. If sound travels at 1500 m s^{-1} in water, how deep is the sea?

- (a) 525 m (b) 1050 m
 (c) 1071 m (d) 2143 m

Ans : (a) 525 m

When the sound takes 0.7 seconds to reach the bottom of the sea and then returns to the ship, the time taken for the sound to reach the bottom of the sea is 0.35 s.

$$\begin{aligned} \text{Distance} &= \text{speed} \times \text{time} \\ &= 1500 \times 0.35 = 525 \text{ m} \end{aligned}$$

40. The eardrum is a

- (a) bone
 (b) fluid
 (c) coiled tube
 (d) a stretched membrane

Ans : (d) a stretched membrane

The eardrum is a stretched membrane.

41. Cochlea, basilar membrane and semicircular canals are the parts of

- (a) outer ear (b) middle ear
 (c) inner ear (d) all of these

Ans : (c) inner ear

42. During night, distant sounds such as that of traffic and loudspeakers become louder. This is due to
 (a) reflection of sound waves
 (b) refraction of sound waves
 (c) absence of other sounds
 (d) clear perception of hearing

Ans : (b) refraction of sound waves

After sunset the surface near the earth cools down more than air in succeeding layers above. The waves undergo a special kind of refraction called total internal reflection and reaches us back.

2. FILL IN THE BLANK

DIRECTION : Complete the following statements with an appropriate word/term to be filled in the blank space (s).

1. The functions which can be represented by a sine or a cosine function are called _____ functions.

Ans : harmonic.

2. Sound waves having the frequency _____ are audible to human being.

Ans : 500 cycles/second

3. Velocity = frequency \times _____

Ans : Wavelength

4. The wavelength of a sound from a tuning fork of frequency 330 Hz is nearly _____ cm.

Ans : 100

5. Wave motion involves the transport of _____

Ans : Energy

6. Velocity of sound in vacuum is _____

Ans : 0

7. A longitudinal wave is made up of _____

Ans : compression and rarefactions

8. The total energy E of sound is related to their frequency as _____

Ans : $E \propto v^2$

9. A transverse wave is made up of _____

Ans : crests and troughs

10. Longitudinal waves cannot pass through _____

Ans : vacuum

11. The frequency of the particles oscillating in a medium is _____ the frequency of waves in the medium.

Ans : the same as

12. The note of the lowest frequency in a musical reach is called _____

Ans : tone

13. Loudness of a note increases with the increase in

Ans : amplitude

3. TRUE/FALSE

DIRECTION : Read the following statements and write your answer as true or false.

- High pitch of sound has a high frequency.
Ans : True
- The pitch of the sound as detected by the observer is independent of original frequency.
Ans : True
- Velocity of sound in air at the given temperature decreases with increases in pressure.
Ans : False
- Longitudinal waves consist of crests and troughs.
Ans : False
- Potential energy of simple harmonic oscillator at the mean position is always zero.
Ans : False
- Longitudinal waves are produced in all the three states.
Ans : True
- The total energy of a simple harmonic oscillator is constant.
Ans : True
- Bells are made of metal and not of wood because the sound is not conducted by metals but is radiated.
Ans : False
- A pure sine wave of sound is called melody.
Ans : False
- The rate of transfer of energy in a wave depends directly on the square of the wave amplitude and square of the wave frequency.
Ans : True
- Pitch of the voice of a child is higher than that of a boy.
Ans : True
- Velocity of sound in air at the given temperature decreases with increase in pressure.
Ans : False

4. MATCHING QUESTIONS

DIRECTION : In the section, each question has two matching

lists. Choices for the correct combination of elements from List-I and List-II are given as options (a), (b), (c) and (d) out of which one is correct.

1.

List-I		List-II	
(P)	High pitch	1	Faint sound
(Q)	Low pitch	2	Loud sound
(R)	Small amplitude	3	High frequency
(S)	Large amplitude	4	Low frequency

	P	Q	R	S
(a)	1	4	3	2
(b)	2	3	1	4
(c)	4	3	2	1
(d)	3	4	1	2

Ans : P-3, Q-4, R-1, S-2

2.

List-I		List-II	
(P)	Megaphone	1	17.2m
(Q)	Minimum distance for echo	2	3000m
(R)	Depth of sea if ultrasonic wave comes back in 4s	3	Multiple reflection of sound
(S)	Echo heard after 5s distance of reflecting surface	4	850m

	P	Q	R	S
(a)	3	1	2	4
(b)	3	4	1	2
(c)	1	3	2	4
(d)	4	2	4	3

Ans : P-3, Q-1, R-2, S-4

3.

List-I		List-II	
(P)	Elephants	1	Reflection of sound
(Q)	Ultrasound	2	Infrasonic waves
(R)	Sonar	3	Multiple reflection of sound
(S)	Reverberation	4	Welding purpose

	P	Q	R	S
(a)	2	4	1	3
(b)	3	1	4	3
(c)	2	1	3	4

	P	Q	R	S
(d)	3	1	4	2

Ans : P-2, Q-4, R-1, S-3

4.

List-I		List-II	
(P)	Slinky when jerked	1	Longitudinal wave
(Q)	Quality of sound	2	Loudness
(R)	Slinky pushed or pulled	3	Transverse wave
(S)	Amplitude	4	Timbre

	P	Q	R	S
(a)	1	4	3	2
(b)	3	1	4	2
(c)	2	1	3	4
(d)	3	4	1	2

Ans : P-3, Q-4, R-1, S-2

5. ASSERTION AND REASON

DIRECTION : In the following questions, a statement of assertion is followed by a statement of reason. Mark the correct choice as:

- (a) Both assertion and reason are true and reason is the correct explanation of assertion.
- (b) Both assertion and reason are true but reason is not the correct explanation of assertion.
- (c) Assertion is true but reason is false.
- (d) Assertion is false but reason is true.

1. **Assertion :** Sound would travel faster on a hot summer day than on a cold winter day.

Reason : Velocity of sound is directly proportional to the square of its absolute temperature.

Ans : (c) Assertion is true but reason is false.

The velocity of sound in a gas is directly proportional to the square root of its absolute temperature. Since, temperature of a hot day is more than cold winter day, therefore sound would travel faster on a hot summer day than on a cold winter day.

2. **Assertion :** The velocity of sound increases with increase in humidity.

Reason : Velocity of sound does not depend upon the medium.

Ans : (c) Assertion is true but reason is false.

Velocity of sound increases with increase in humidity so it depends on the medium.

3. **Assertion :** The velocity of sound changes as we go up in the atmosphere.

Reason : Pressure decreases as we go up in the atmosphere.

Ans : (b) Both assertion and reason are true but reason

is not the correct explanation of assertion.

As we move up the pressure of air, density of air, both decrease. But, velocity of sound will not change as long as temperature of air remains constant. Since temperature falls as we ascend up, hence the velocity of sound also decreases.

4. **Assertion :** Transverse waves travel through air in an organ pipe.

Reason : Air possesses only volume elasticity.

Ans : (d) Assertion is false but reason is true.

Since mechanical transverse wave can propagate through medium which possesses elasticity of shape. Air possesses only volume elasticity therefore transverse wave cannot propagate through air.

5. **Assertion :** Two persons on the surface of moon cannot talk to each other.

Reason : There is no atmosphere on moon.

Ans : (a) Both assertion and reason are true and reason is the correct explanation of assertion.

Sound waves required material medium to travel. As there is no atmosphere, i.e., vacuum is on the surface of moon, therefore the sound waves cannot reach from one person to another. Because of this reason, for communication on moon astronomers use phones, which convert sound wave into radio waves (electromagnetic waves need no medium for propagation).

6. **Assertion :** Sound would travel faster on a hot summer day than on a cold winter day.

Reason : Velocity of sound is directly proportional to the square of its absolute temperature.

Ans : (c) Assertion is true but reason is false.

The velocity of sound in a gas is directly proportional to the square root of its absolute temperature $v = \sqrt{\frac{\gamma RT}{\rho V}}$. Since temperature of a hot day is more than cold winter day, therefore sound would travel faster on a hot summer day than on a cold winter day.

7. **Assertion :** Waves produced in a cylinder containing a liquid by moving its piston back and forth are longitudinal waves.

Reason : In longitudinal waves, the particles of the medium oscillate parallel to the direction of propagation of the wave.

Ans : (b) Both assertion and reason are true but reason is not the correct explanation of assertion.

When piston is moved back and forth, the molecules of the liquid also move along the direction of motion of the piston (direction of disturbance) also the volume and density of liquid is changing with motion of piston.

8. **Assertion :** A vibrating tuning fork sounds louder when its stem is pressed against a desktop.

Reason : When a wave reaches another denser medium, part of the wave is reflected.

Ans : (c) Assertion is true but reason is false.

If the tuning fork is held in hand and hit with hammer,

a sound is produced as the prongs of the tuning fork set surrounding air particles into vibrational motion. The sound produced by the tuning fork in air is barely audible. However, if the tuning fork is set on a desktop. The desktop begins vibrating at the same natural frequency of the tuning fork. The tuning fork forces surrounding desktop particles into vibrational motion. The vibrating desktop in turn forces surrounding air particles into vibrational motion. As the surface area of desktop is greater than the surface area of tuning fork, more surrounding air particles will be forced into vibration. This causes an increase in the amplitude and thus loudness of the sound.

9. Assertion : Waves produced by a motor boat sailing in water are both longitudinal and transverse in nature.

Reason : The longitudinal and transverse waves cannot be produced simultaneously.

Ans : (c) Assertion is true but reason is false.

The propeller of a motor boat cuts the water surface laterally and also pushes it in backward direction. Hence, it will result in both longitudinal and transverse waves.

10. Assertion : The speed of sound in solids is maximum though their density is large.

Reason : The coefficient of elasticity of solid is large.

Ans : (a) Both assertion and reason are true and reason is the correct explanation of assertion.

The velocity of sound in solid is given by, $v = \sqrt{\frac{E}{\rho}}$. Though ρ is large for solids, but their coefficient of elasticity E is much larger (compared to that of liquids and gases). That is why v is maximum in case of solid.

11. Assertion : The flash of lightening is seen before the sound of thunder is heard.

Reason : Speed of sound is greater than speed of light.

Ans : (c) Assertion is true but reason is false.

The speed of sound is 340 m/s and speed of light is 3×10^8 m/s in air. Thus flash of lightening is seen before the sound of thunder is heard.

12. Assertion : Two persons on the surface of moon cannot talk to each other.

Reason : There is no atmosphere on the moon.

Ans : (a) Both assertion and reason are true and reason is the correct explanation of assertion.

Sound waves require material medium to travel. As there is no atmosphere (vacuum) on the surface of moon therefore the sound waves cannot travel from one person to another. Because of this reason, for communication on moon astronomer use phones, which convert sound wave into radio waves (electromagnetic waves which need no medium for propagation).

13. Assertion : The longitudinal waves are called pressure waves.

Reason : Propagation of longitudinal waves through a medium involves changes in pressure and volume of air, when compression and rarefaction are formed.

Ans : (a) Both assertion and reason are true and reason is the correct explanation of assertion.

In longitudinal wave, pressure variations travel along the tube with the density variations, when the density reaches its maximum at a particular location, the pressure also reaches its maximum at that location.

14. Assertion : Compression and rarefaction involve changes in density and pressure.

Reason : When particles are compressed, density of medium increases and when they are rarefied, density of medium decreases.

Ans : (a) Both assertion and reason are true and reason is the correct explanation of assertion.

A compression is a region of medium in which particles are compressed i.e., particles come closer i.e., distance between the particle becomes less than the normal distance between them. Thus there is temporary decrease in volume and a consequent increase in density of medium. Similarly in rarefaction, particles get farther apart and a consequent decrease in density.

15. Assertion : Transverse waves can be produced in liquids.

Reason : Light waves are transverse waves.

Ans : (b) Both assertion and reason are true but reason is not the correct explanation of assertion.

16. Assertion : The velocity of sound in hydrogen gas is less than the velocity of sound in oxygen gas.

Reason : The density of oxygen is more than the density of hydrogen.

Ans : (d) Assertion is false but reason is true.

The velocity of sound in gaseous medium is given by $v = \sqrt{\frac{\gamma P}{\rho}}$. Clearly, the velocity of sound in a gas is inversely proportional to the square root of density of the gas. The density of oxygen is 16 times the density of hydrogen, therefore, the velocity of sound in hydrogen is four times the velocity of sound in oxygen.

17. Assertion : Echo is produced when sound is incident on hard and polished surface.

Reason : Sound energy can be totally reflected by objects with soft and loose texture.

Ans : (c) Assertion is true but reason is false.

Sound energy gets partially absorbed by objects with soft and loose texture.