(Q) Fill in the blanks:

1. The loudness of sound is proportional to the _____ of the amplitude of the vibration.

2. The speed of sound _____as it moves from solid to gaseous state.

3. In any medium the speed of sound _____ with increase in temperature.

(Ans) 1) Square 2) Decreases 3) Increases.

Q. A person has a hearing range from 20 Hz to 20 kHz. What are the typical wavelengths of sound waves in air corresponding to these two frequencies? Take the speed of sound in air as 344 m/s.

Ans. (I) Wavelength of sound waves corresponding to 20 Hz, u = u = 344 ms–1, v = 20 Hz

λ_1 = v/n = 334/20 = 17.2 m λ_2 =v/n = 334/20,000 = 0.0172 m

Q. The frequency of a source of sound is 100 Hz. How many times does it vibrate in a minute?

Ans. Frequency of sound = 100 Hz = $100s^{-1}$ Number of vibrations in 1 s = 100

Number of vibrations in 1 minute, i.e. 60 seconds =100x60 =6000vibrations

Q. Explain how bats use ultrasound to reach a prey.

Ans. Bats produce high pitched ultrasonic waves that are not heard by humans. These ultrasonic waves strike the prey like an insect and it is reflected back in the form of an echo, which is heard by the bat. This enables the bat to hover on the insect and catch it.

Q. A sonar device on a submarine sends out a signal and receives an echo 5 s later. Calculate the speed of sound in water if the distance of the object from sub-marine is 3,625 m.

Ans. Given, d = 3,625 m; t = 5 s ; u = ? We know that d = (v x t)/2 $\Rightarrow$ v = 2d/t = (2x362)/5 = 1450 ms–1

Q. A sound wave travels at a speed of 339 ms–1. If its wavelength is 1.5 cm, what is the frequency of the wave? Will it be audible?

Ans. Here, u = 339 ms–1, l = 1.5 cm =0.015m

As you know that v=n $\lambda \Rightarrow$ n=v/λ =339 ms–1 / 0.015m = 22600 Hz

The sound will not be audible to the human ear as it has frequency higher than 20,000 Hz, which the upper limit of the human audible frequency range

Q. A stone is dropped from the top of a tower 500 m high into a pond of water at the base of the tower. When is the splash heard at the top ? Given, g = 10 ms–2 and speed of sound = 340 m/s.

Ans. Here, s = 500 m, u = 0 ms–1, g = 10 ms–2 As we know, s = u t + 1/2gt2 you find t = 10sec

So, the stone reaches the pond in 10 s

Now, given that, Speed of sound = 340 ms–1 by

Time taken sound to cover 500m = 500/340 = 1.5sec. Total time taken = (10 + 1.5) s = 11.5 s

:. The splash will be heard at the top after 11.5 s

Q. Which type of waves is produced when a stone is dropped on the surface of water in a pond ?

Ans. Transverse waves.

Q. What kind of waves are produced when a spring is pulled in the downward direction and released?

Ans. Longitudinal waves.

Q. What is the nature of electromagnetic waves?

Ans. They are transverse in nature.

Q.Give three important characteristics of wave motion.

Ans. (1) Wave motion is the disturbance that travels forward through the medium and not the particles of the medium. The particles of the medium just vibrate about their mean positions.

(2) Each particle receives vibrations a litter later than its preceding particle.

(3) The velocity with which wave travels is not the same as the velocity of the particles with which they vibrate about their mean positions.

Q7. Differentiate between a periodic wave and a pulse.

Ans. Difference between a periodic wave and a pulse:

Periodic Wave

1. A periodic wave is a continuous wave having a long duration.

2. A periodic wave is a continuous disturbance in the medium.

3. It is formed due to the displacement of every point or particle in a given part of the medium.

Pulse

1. Pulse is a wave having a short duration.

2. A pulse is a single disturbance in the medium.

3. It is formed due to displacement of only a part of the medium from its mean position.

Q. On what factors do the speed of sound in a gas depends?

Ans. The speed of sound in a gas depends on the following factors:

1. Density. The speed of sound in a gas is inversely proportional to the square root of its density at constant pressure i.e., Speed of sound $\propto 1/\sqrt{}$ Density of gas

2. Temperature. The speed of sound in a gas is inversely proportional to the square root of its absolute temperature, i.e., Speed of sound $\propto 1/\sqrt{}$ absolute temperature of gas

It means that speed of sound increases with the increase in temperature of the gas.

3. Humidity. The speed of sound is directly proportional to humidity i.e., sound travels faster in moist air than in dry air. Speed of sound μ Humidity

4. Wind. The speed of sound increases when the wind blows in the direction of sound and decreases when the wind blows in the opposite direction

(Q) A stone is dropped into a well 44.1 m deep, and sound of the splash is heard after 3.13 s. Calculate the velocity of the sound in air. (Given, g = 9.8 ms–2)

Ans: u = 0, s = 44.1 m; a = 9.8 ms–2 Find Time taken by stone to reach 44.1m deep?

As we know, s = u t + 1/2gt2 putting value we get t = 3sec

The sound takes the remaining time i.e., 3.13 – 3 = 0.13 s to go to up of well through 44.1 m

Speed=d/t= 44.1 m/0.13 = = 339.23 ms–1

Q. A ship sends out ultrasound that returns from the seabed and is detected after 3.42 s. If the speed of ultrasound through seawater is 1531 m/s, what is the distance of the seabed from the ship ?

Ans. Here, Time between transmission and detection, t = 3.42 sec; u = 1531 m/s

Distance travelled by the ultrasound = 2 × depth of the sea = 2d, (where d is the depth of the sea)

2d = 1531 m/s × 3.42 s = 5236 m ⇒ d = 5236 m/2 = 2618 m or 2.62 km

Q. A stone is dropped from the top of a tower 500 m light into a pond of water at the base of the tower, when is the splash heard at the top? (Given g = 10ms^{-2} and speed of sound = 340ms^{-1}).

Ans: s = 500m, u = 0m/s, a = g = 10m/s^2, t = ? s = ut + 1/ you find t = 10s

Time taken by sound to cover 500m = 500/340 = 1.47s

Total time taken = 10s+1.47s = 11.47s

Q. A submarine enters a sonar pulse, which returns from an under water cliff in 1.02 s. If the speed of sound in salt water is 1531 m/s, how far away is the cliff?

Ans: t = 1.02s, v = 1531m/s Now d=s x t

Distance travelled by sonar pulse = 2d = 2x1531x1.02 = 1561.62m

Distance of the cliff = d/2= 1561.62/2 = 780.81m

Q. A ship sends out ultrasound produced by transmitter that returns from the sea bed and detected after 3.42 s. If the speed of ultrasound waves through sea water is 1530 m/s, what is the distance of the sea bed from the ship?

Ans: Depth of sea bed d = *vt/2* = *[*1530x3.42]÷2= 2616.3 m