Std.: 9 (English) **Science 1**

Chapter: 12

Q.1 **Fill in the blank and rewrite the completed statements** **4**

1 The velocity of sound in steel is ..... than the velocity of sand in water.

Ans The velocity of sound in steel is **greater** than the velocity of sand in water.

2 The incidence of ..... in daily life shows that the velocity of sound is less than the velocity of light.

Ans The incidence of **lightening** in daily life shows that the velocity of sound is less than the velocity of light.

3 Sound does not travel through .....

Ans Sound does not travel through **vacuum.**

4 To discover a sunken ship or objects deep inside the sea, ... technology is used.

Ans To discover a sunken ship or objects deep inside the sea, **SONAR** technology is used.

Q.2 **Solve Numerical problems** **4**

1 Nita heard the sound of lightning after 4 seconds of seeing it. What was the distance of the lightning from her? (The velocity of sound in air is 340 m/s)

Ans **Data :** Velocity of sound in air (v) = 340 m/s.
time (t) = 4 seconds.
To find : distance (λ) = ?

$v = \frac{\lambda}{T.}$

$\lambda = v \times T.$

$\lambda =$ 340 m/s x 4 sec.

$\lambda =$ 1360 m.

Result : Therefore the distance of lightning from Nita is 1360 m

2 The speed of sound in air at 0° C is 332 m/s. If it increases at the rate of 0.6 m/s per degree, what will be the temperature when the velocity has increased to 344 m/s?

Ans **Data :** Speed (v) at 0°C = 332 m/s.
Increase in velocity of sound per degree = 0.6 m/s.
To find : Temperature (T) = ?
Difference in velocity = 344 – 332 = 12 m/s.
For 1°C rise in temperature, velocity increases by 0.6 m/s.
For *x*°C rise in temperature, velocity increases by 12 m/s.

$\frac{1}{x} = \frac{0.6}{12}$

$x = \frac{12}{0.6}$

$x = 20°C.$

Result : Temperature at the velocity 344 m/s is 20°C.

Q.3 **Give scientific reasons** **8**

1 We cannot hear the echo produced in a classroom.

Ans i. Echo of sound depends upon the temperature of the surrounding and distance between source and reflecting surface.

ii. To hear distinct echo at 22 °C, the minimum distance required between the source of sound and obstacle should be 17.2 metre.

iii. In a classroom, the ceiling is not so high and the distance between the opposite walls is usually less than

17.2 m. Hence, we cannot hear echo produced in our classroom.

2 We cannot hear echo produced in our class room or in our house.

Ans i. Echo of sound depends upon the temperature of the surrounding and distance between source and reflecting surface.

ii. To hear distinct echo at 22°C, the minimum distance required between the source of sound and obstacle should be 17.2 metre.

iii. In a classroom, the ceiling is not so high and the distance between the opposite walls is usually less than 17.2 m.

iv. Hence, we cannot hear an echo in our class room or in our house.

3 The roof of a movie theatre and a conference hall is curved.

Ans i. In a movie theatre or a conference hall, sound is produced at one place.

ii. These sound waves are usually reflected by the walls and ceilings.

iii. The acoustics of a movie theatre or conference hall should be such that the sound waves should reach everyone in the audience without any sound loss, echo production, reverberations after reflection.

iv. To make this possible, roof of a movie theatre and conference halls are curved so that sound reflected from the ceilings reaches all parts of the theatre or hall.

4 The intensity of reverberation is higher in a closed and empty house.

Ans i. In a closed house, the sound waves cannot escape and suffer multiple reflections from the wall of the house, resulting into reverberation.

ii. Also, a closed and empty house does not contain any sound absorbing materials like furniture.

iii. Hence, the intensity of reverberation is higher in a closed and empty house.

Q.4 Solve Numerical problems **6**

1 Helium gas is filled in two identical bottles A and B. The mass of the gas in the two bottles is 10 gm and 40 gm respectively. If the speed of sound is the same in both bottles, what conclusions will you draw?

Ans Mass of gas in bottle A = 10 gm

Mass of gas in bottle B = 40 gm

Speed of sound in bottle A = Speed of sound in bottle B.

i.e., $V_A = V_B$

As the gas in both the bottles is same, molecular weight is constant.

Now, $V_A \alpha \sqrt{T_A}$

$V_B \alpha \sqrt{T_B}$

Also,

$V_A \alpha \frac{1}{\sqrt{\rho_A}}$, $V_B \alpha \frac{1}{\sqrt{\rho_B}}$

where,

ρ_A = density of helium in bottle A,

ρ_B = density of helium in bottle B,

$\therefore \quad V_A = \sqrt{\frac{T_A}{\rho_A}}$

$V_B = \sqrt{\frac{T_B}{\rho_B}}$

But, $V_A = V_B$

$\therefore \quad \sqrt{\frac{T_A}{\rho_A}} = \sqrt{\frac{T_B}{\rho_B}}$

$\sqrt{\frac{T_A}{T_B}} = \sqrt{\frac{\rho_A}{\rho_B}}$

Taking squares on both sides

$\frac{T_A}{T_B} = \frac{\rho_A}{\rho_B}$

$\frac{T_A}{T_B} = \frac{10}{40}$

$\frac{T_A}{T_B} = \frac{1}{4}$

$T_B = 4T_A$

Temperature of B of **4 times** the temperature of A.

2 Sunil is standing between two walls. The wall closest to him is at a distance of 360 m. If he shouts, he hears

the first echo after 4 s and another after another 2 seconds

i. What is the velocity of sound in air?

ii. What is the distance between the two walls?

Ans **Given :** Distance of closest wall = 360 m

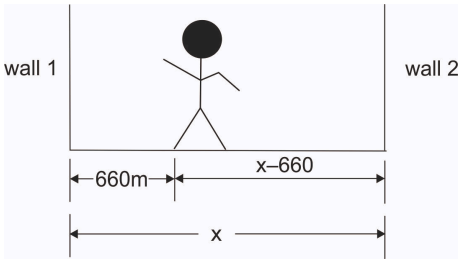
Time for first echo (T_1) = 4 s

Time for second echo (T_2) = 2 s

To find : i. Velocity of sound in air.

ii. Distance between two walls.

Calculation : i.



Disatance = 660 m

echo produced after time = 4 sec

$\therefore$ Time taken by sound to travel given distance = 2 sec

velocity = $\frac{\text{Distance}}{\text{time}}$

velocity = $\frac{660}{2}$

velocity = **330 m/s**

ii. Let distance between two walls be x

$\therefore$ Distance of observer from wall 2 is (x - 660) m.

As, total time taken by sound to travel

(x - 660) m is $\frac{4}{2} + \frac{2}{2} = 2 + 1 = 3\text{s}$

$\frac{x - 660}{3} = 330$

$\therefore$ **x = 1650 m**

i. Velocity of sound in air is **330 m/s.**

ii. Distance between two walls is **1650 m.**

Q.5 **Answer the following** **9**

1 What should be the dimensions and the shape of classrooms so that no echo can be produced there?

Ans i. For an echo to be heard, the minimum distance from the source should be 17.2m.

ii. Hence to avoid echo in the classroom , the distance between the two opposite walls should be less than 17.2m.

iii. Also dome shaped roof should be avoided in order to hear quality sound and no reverberations.

iv. Also sound absorbing materials like benches, furniture, boards, etc. should be used in order to prevent echoes in the classroom.

2 Where and why are sound absorbing materials used?

Ans i. Sound absorbing materials are used in auditorium and halls to reduce excessive reverberation.

ii. The roofs and walls of the auditorium are covered with sound absorbing materials like thermocol, fibre board, rough plaster etc.

iii. Seats are made of sound–absorbing materials so that excessive reverberation is reduced.

3 What is an echo? What factors are important to get a distinct echo?

Ans i. An echo is the repetition of the original sound because of reflection by some surface.

ii. At 22°C, the velocity of sound in air is 344 m/s. Our brain retains the sound for 0.1s.

iii. Thus for us to be able to hear a distinct echo, the sound should take more than 0.1s after starting from the source to get reflected and come back to us.

iv. We know that,

Distance = Speed x Time

= 344 m/s $\times$ 0.1s

= 34.4 m

v. Thus, to be able to hear a distinct echo, the reflecting surface should beat a minimum distance of half and above i.e. 17.2m

vi. As the velocity of sound depends on the temperature of air, this distance depends on the temperature.