

PHYSICS CHAPTER 3

1) Define sound waves ?

❖ Sound wave is a mechanical wave that produces a sensation of hearing.

2) What is the sound travels through ?

❖ Sound travels through liquids, gases and solids.

3) What is the best transmitter of sound ?

❖ Solid is the best transmitter of sound.

4) What are the conditions must be fulfilled for hearing a sound ?

❖ For hearing a sound, the following conditions must be fulfilled:

- ✓ There must be a vibrating body.
- ✓ There must be material medium.
- ✓ There must be receiver.

5) List sources of sound waves ?

❖ Sound waves are produced by: ✓ Vibrating strings.

- ✓ Vibrating surfaces
- ✓ Tubes

6) What is the velocity of sound in air ?

❖ The velocity of sound in the air is **330m/s** at **0°C**, for every **1°C** rise of temperature, the velocity is increased by **0.6m/s**.

7) A sound persists for 1/10 seconds in our ear after exciting sound dies off. What is called this time ?

❖ A sound persists for 1/10 seconds in our ear after exciting sound dies off. This time is called persistence of audibility.

8) Define echo?

❖ The reflection of sound wave is called echo.

9) What are the conditions for formation of echoes?

❖ The conditions for formation of echoes are:

- ✓ The minimum distance between the source of sound and the reflecting body should be 17m.
- ✓ The wave length of sound should be less than the height of reflecting body.
- ✓ The intensity of sound should be sufficient so that it can be heard after reflection.

10) Define reverberation?

- ❖ Reverberation is series of reflections that fall on ear from various reflectors one after another in a closed room forming a continuous rolling sound.

11) List uses of echoes?

- ❖ Uses of echoes are:
 - ✓ Determination of the depth of ocean (sea).
 - ✓ Echoes guide insect eating bats and protect them avoid colliding with objects or with one another.
 - ✓ Dolphins communicate with each other.
 - ✓ Echoes are used by army to locate gun positions of enemy.
 - ✓ Echoes are used by geologists for mineral prospecting

❖ Properties of sound are:

- ✓ Intensity
- ✓ Frequency
- ✓ Harmonic content

12) List properties of sound?

- ❖ The intensity of sound is rate at which the sound energy flows through a unit area normal to the direction of sound waves.

13) What is the intensity of sound?

- ❖ Pitch is the change of frequency.

14) Define pitch?

- ❖ The pitch of a note depends on the frequency of the wave reaching the ear.

15) What is the pitch of a note depends on?

- ❖ The number of harmonic contents determines the quality of the sound.

16) What is the number of harmonic contents determines?

- ❖ Fundamental tone is the simplest harmonic content.

18) State types of sound ?

❖ Types of sound are:

- ✓ Sonic vibration
- ✓ Ultrasonic sound ✓ Infrasonic sound 19)

Define sonic vibration?

❖ Sonic vibration is the vibration whose frequency from 20Hz—20,000Hz.

20) Define ultrasonic sound?

❖ Ultrasonic sound is the frequency which exceeds 20,000Hz.

21) Define infrasonic sound?

❖ Infrasonic sound is the frequency which below 20Hz 22) List some animals that can hear ultrasonic sound?

❖ Some animals that can hear ultrasonic sound are dogs, some fish, bats and dolphins.

23) List some animals that can hear infrasonic sound?

❖ Some animals that can hear infrasonic sound are elephants and whales.

24) What are uses of ultrasonic sound?

❖ Uses of ultrasonic sound are

- ✓ Echo sounders
- ✓ Ultrasound scanning
- ✓ Ultrasonic cleaning
- ✓ Homogenizing milk and cosmetics ✓ Sonar (sound navigation and ranging) 25) Define Doppler effect?

❖ Doppler effect is the change in pitch produced by relative motion of source and observer.

26) What is the sonometer?

❖ Sonometer is The instrument that the properties of vibrating strings can be studied.

27) Define forced vibration?

❖ Forced vibration is the setting up of vibrations in an object by a vibrating force.

28) Define resonance?

- ❖ When the frequency of an applied force matches the natural frequency of an object, energy is transferred very efficiently. The condition is called resonance.

FORMULAS OF CHAPTER THREE

1) Speed of sound:

- ❖ $V = 330\text{m/s} + (0.6\text{m/s})T$
- ❖ $T = \frac{V-330\text{m/s}}{0.6\text{m/s}}$

2) Reflection of sound and echo:

- ❖ With echo:
 $\checkmark d = \frac{Vt}{2} \quad V = \frac{2d}{t} \quad t = \frac{2d}{V}$
- ❖ With no echo:
 $\checkmark d = Vt \quad V = \frac{d}{t} \quad t = \frac{d}{V}$

3) Intensity:

- ❖ $I = \frac{P}{A} \quad I = \frac{P}{4\pi r^2} \quad P = I \times A \quad P = I \times 4\pi r^2$

4) Intensity level

- ❖ $\beta = 10\text{db} \log \frac{I}{I_0} \quad I = I_0 \times 10^{\frac{\beta}{10}} \quad \beta_{\text{ell}} = \log \frac{I}{I_0}$

Note that: or

$$I_0 = 10^{-12}\text{W/m}^2$$

$$I_0 = 10^{-16}\text{W/cm}^2$$

5) Doppler effect:

❖ **Case 1: Source moving towards or away from stationary observer.** ✓ Approaches

or towards: $f' = f \frac{V}{V - V_s}$

✓ Recedes or away from: $f' = f \frac{V}{V + V_s}$

❖ **Case 2: Observer moving towards or away from stationary source.** ✓ Approaches or

towards: $f_o = f \frac{V + V_o}{V}$

✓ Recedes or away from: $f_o = f \frac{V - V_o}{V}$

❖ **Case 3: If both source and observer moving towards or away from each other**

✓ Approaches or towards each other: $f_o' = f \frac{V + V_o}{V - V_s}$

✓ Recedes or away from each other: $f_o' = f \frac{V - V_o}{V + V_s}$

6) Standing waves in pipes:

❖ Closed pipe:

✓ $L = \frac{n\lambda}{4} \quad \lambda = \frac{4L}{n} \quad Fn = \frac{nV}{4L} \quad V = \frac{Fn4L}{n}$

❖ Open pipe:

✓ $L = \frac{n\lambda}{2} \quad \lambda = \frac{2L}{n} \quad Fn = \frac{nV}{2L} \quad V = \frac{Fn2L}{n}$

7) Vibrating strings:

❖ Law of Length:

✓ $f_1 L_1 = f_2 L_2$

❖ Law of Diameter:

✓ $f_1 d_1 = f_2 d_2$

❖ Law of Tension:

✓ $f_1 \sqrt{T_2} = f_2 \sqrt{T_1}$

❖ Law of Density:

✓ $f_1 \sqrt{\rho_1} = f_2 \sqrt{\rho_2}$

8) Beats

❖ $f_{beat} = f_2 - f_1$

THE END CHAPTER 3