



Grade 9 Physics (Notes)

Chapter: Sound

- Sound is mechanical energy which produce a sensation of hearing.
- Condition for hearing sound.
 - a) There must be a vibrating body.
 - b) There must be a material medium.
 - c) There must be a receiver.
- Experimentally, Human ear is not sensitive to all kinds of vibrations.
- Frequency less than 20 per second; cannot be perceived by human ear. Called as infrasonic vibrations.
- It generally acts as destructive vibration.
- Frequency of 20HZ to 20,000 HZ is perceived by the human ear. The vibration called sonic vibrations or audio-vibrations.
- Lower frequency – Bass effect
Higher frequency – Shrill effect
- Frequency $< 20,000$ HZ not received by the human ear called ultrasonic vibrations.
- Unit of sound is Hertz (HZ). No. of produced by a body in one second.
- When the ultrasonic vibrations are passed through certain medium its particles are agitated at a very high frequency and medium gets homogenized.
 - Phenomenon is applied for following purpose.
 1. Ultrasonic vibrations are used for homogenizing milk.
 2. Welding metals like tungsten which cannot be welded by conventional method.
 3. Used for dish washing machine.
 4. Dissipating fogs on the airports.
 5. Scanning internal organs of the human body.
- Use of ultrasonic waves by animals.
 - ➔ Dogs can be trained to respond ultrasonic whistle.
 - ➔ Insect eating bats use these sound waves to produce echo. This help to turn in the air to avoid colliding.
 - ➔ Dolphins uses to communicate with each other.
- Difference between ultrasonic and supersonic.
 - ➔ When frequency is 20,000 HZ or above moving with speed of sound $I 332$ m/s at 0°C .
 - ➔ Supersonic is independent of frequency moving with speed more than the speed of sound.
- Condition required for propagation of sound.
 - ➔ The particle medium must be elastic.
 - ➔ The particle medium should have inertia for movement.
 - ➔ Particle of the medium should be frictionless for smooth motion.
- Speed of sound in different medium.

Air	332 m/s
Alcohol	1210 m/s
Hydrogen	1270 m/s
Aluminium	5000 m/s
Water	1450 m/s
Iron glass	4550 m/s

- Factors affecting the speed of sound in air.
The average speed of sound in air is 332 m/s at 20°c
 1. Temperature: Increases by 0.6 m/s for every 1°c
 2. Humidity: Speed of sound increases with increase in moisture.
 3. Pressure: Remains unaffected
 4. Direction of wind: 1) In direction of wind, speed increase. 2) Opposite direction of wind, speed decreases.
- Propagation of Energy.
 - Basically, there are three modes of transmission energy.
 - However, in sound the energy has been transmitted from one particle of the medium to another and so on, till it is transferred to the well.
 - This kind of transfer of energy when the particles move about their mean position is called wave motion.
 - Once energy is passed through a medium, it regains their original position.
 - Thus, it is also called as elastic waves or material waves.
 - Wave: A disturbance produced in a medium by the to and fro motion of its particles about their mean position.
 - Wave motion: The transference of energy, when the particles of medium move about their mean position.
 - Examples: Waves produced: On the surface of water by an aeroplane in the air in the stretched strings.
- Characteristics of wave motion.
 1. Requires material medium.
 2. Periodic in nature.
 3. The particles of medium simply vibrate up & down or to and fro about their mean position.
 4. There is always a phase difference b/w the particles.
 5. No net displacement of the medium.
 6. Energy transfer at constant speed.
 7. Energy transfer depends on material.
 8. Wave propagate at constant velocity.
 9. Velocity of each particle changes with its oscillation about its mean position.
- Important terms:
 1. Amplitude: The maximum displacement of a vibrating particle about its mean position.
 2. Frequency: The number of complete vibrations executed by a vibrating particle of a medium about its mean position in one second
(or)
No. of waves passing through one particular point in one second.
 - Denoted by f
 - SI unit Hertz (or) waves/second
 - 1 KHZ = 10^3 HZ; 1MHZ = 10^6 HZ.
 3. Time period: the time required by wave to execute one complete oscillation.
 - Denoted by T
 - SI unit is second (s)
 4. Wavelength: The linear distance between two consecutive particles of a vibrating medium in the same phase.
 - Denoted by λ (lambda)
 5. Wave velocity: the distance covered by a disturbance in some particular medium in one second.
 - Denoted by ' u '
 - SI Unit is meter/second.

- Relation b/w frequency and time period.
F be the frequency of wave when 'T' is its time period.

∴ 1 wave is produced in $\frac{1}{F}$ second.

$$\therefore T = \frac{1}{F} \text{ or } F = \frac{1}{T}$$

→ If λ is distance covered by wave = $\frac{\lambda}{T}$

But, distance covered in one sec = velocity of wave

$$\therefore u = \frac{\lambda}{T}$$

Also, $\frac{1}{T} = F$

$$\therefore u = \frac{\lambda}{\frac{1}{F}} \quad \Rightarrow \quad u = F \lambda$$

Light waves	Sound waves
Produced when electrons are in excited state.	Due to vibration.
Speed in air 3×10^8 m/s	332 m/s at 20°C
Can travel through vacuum.	Requires some material medium.
Their velocity doesn't change in temp, humidity, etc.	Changes.
Produce sensation of vision.	Sensation of hearing.