

Physics - Waves

Topics : [Computer engineering](#)

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1. Waves:

Waves are disturbances that propagate through a medium or space, transferring energy without transferring matter.

2. Classification:

- **Mechanical Waves:** Require a medium (solid, liquid, or gas) to travel through. Examples: sound waves, water waves, seismic waves.
- **Electromagnetic Waves:** Can propagate through a vacuum and do not require a medium. Examples: light waves, radio waves, microwaves.

3. Key Characteristics:

- **Amplitude:** Maximum displacement of particles from their equilibrium position.
- **Wavelength (λ):** Distance between two consecutive points in phase.
- **Frequency (f):** Number of complete oscillations passing a point per second (measured in hertz, Hz).
- **Period (T):** Time taken for one complete oscillation ($T = 1/f$, measured in seconds, s).
- **Wave Speed (v):** Speed of wave propagation ($v = \lambda f$).

4. Types of Waves:

- **Transverse Waves:** Particle vibration perpendicular to wave direction (e.g., electromagnetic waves).
- **Longitudinal Waves:** Particle vibration parallel to wave direction (e.g., sound waves).

5. Wave Behavior:

- **Reflection:** Bouncing of waves off a boundary or obstacle.
- **Refraction:** Bending of waves due to change in medium.
- **Diffraction:** Bending of waves around obstacles or through openings.
- **Interference:** Combination of waves resulting in constructive or destructive interference.

6. Applications:

- Used in communication (radio waves), medical imaging (X-rays), navigation (sonar waves), and music (sound waves).

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