IGCSE Physics:

PROPERTY OF WAVES

Lesson 3.12

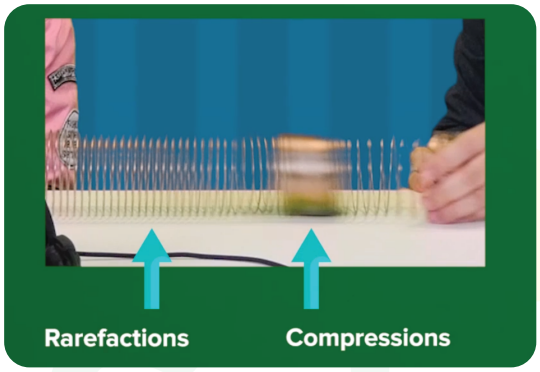
Properties of Sound Waves

Revision Notes

Cambridge will assess your ability to:

- Describe the longitudinal nature of sound waves
- Describe compression and rarefaction
- State the approximate range of frequencies audible to humans as 20 Hz to 20000 Hz
- Describe how changes in amplitude and frequency affect the loudness and pitch of sound waves
- Define ultrasound as sound with a frequency higher than 20 kHz
- Describe the uses of ultrasound in non-destructive testing of materials, medical scanning of soft tissue and sonar including calculation of depth or distance from time and wave speed

- Sound waves are **longitudinal waves**.
  - Longitudinal waves are transmitted when the particles vibrate parallel to the direction of wave propagation.
  - Longitudinal waves consist of compressions and rarefactions (refer to slinky)



    - The compression is a region of the wave where most particles are present. This is the high-pressure zone and is analogous to the peak of a transverse wave.

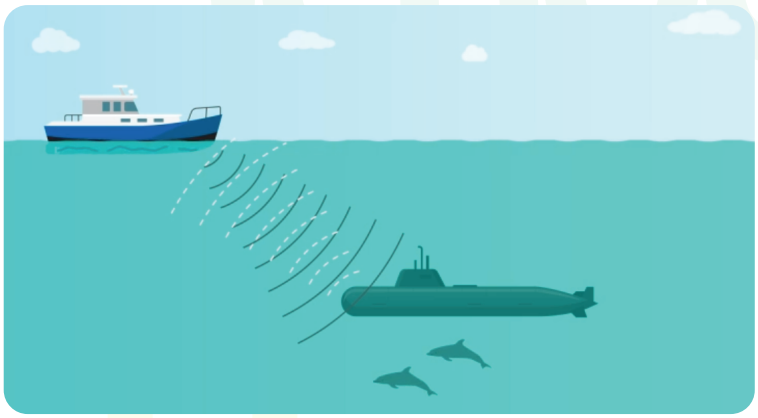
        - The rarefaction is a region where less particles are present. This is the low-pressure zone and is analogous to the trough of a transverse wave.

- As sound is a wave, it also has the following properties:
    - The **amplitude** of a sound wave corresponds to its **loudness**. The larger the amplitude, the louder the sound.
    - The **frequency** of the sound wave corresponds to its **pitch**. The higher the frequency (in Hz), the higher pitched the sound.
        - The higher the frequency of the sound, the shorter the wavelength.
- A **human ear** can hear sounds approximately from **20 Hz to 20,000 Hz.**

    - 20,000 Hz is also 20 kHz (kilohertz), so do be careful when reading the units!
- A sound with a frequency of **over 20,000 Hz** is called **ultrasound**.
    - Ultrasound is not audible to the human ear.
    - Ultrasound is used for:
        - Non-destructive testing of materials

- Ultrasound imaging via echolocation of waves in the body

- SONAR (Sound navigation and ranging)



Sample examination question on this topic:

(1) Which frequency produces a sound that can be heard by a person?

a. 2 Hz
b. 10 Hz
c. 2 kHz
d. 30 kHz

Answer: C

Humans can hear a range from 20 Hz to 20,000 Hz. The only option within that range is C, which is 2000 Hz.