

SOL 5.2 -- SOUND ENERGY

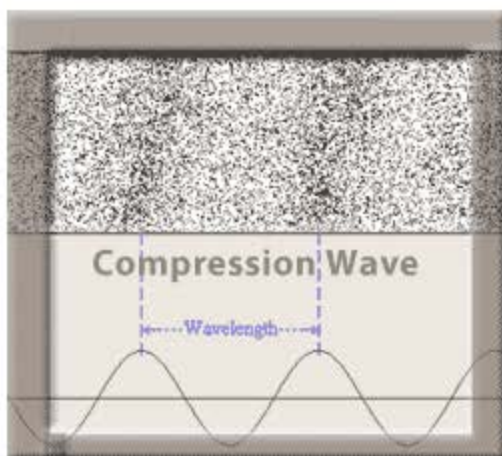
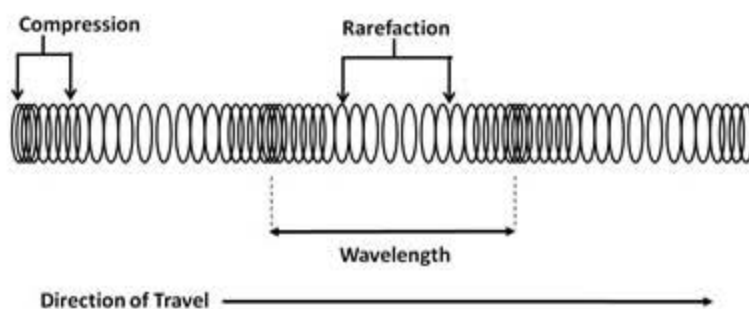
Key concepts:

- compression waves;
- vibration, compression, wavelength, frequency, amplitude;
- the ability of different media (solids, liquids, and gases) to transmit sound;
- uses and applications of sound waves

VIBRATING MATTER - COMPRESSION WAVES

- Sound is a form of **energy** produced and transmitted by **vibrating matter**.
- Sound waves are **compression (longitudinal) waves**.
- When compression (longitudinal) waves move through matter (solid, liquid, or a gas), the molecules of the matter move backward and forward in the direction in which the wave is traveling.
 - As sound waves travel, **molecules are pressed together** in some parts (**compression**) and in some parts are spread out (**rarefaction**).
 - A child's toy in the form of a coil is a good tool to demonstrate a compression (longitudinal) wave.

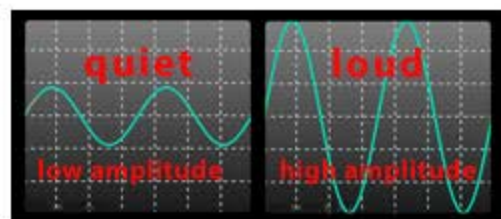
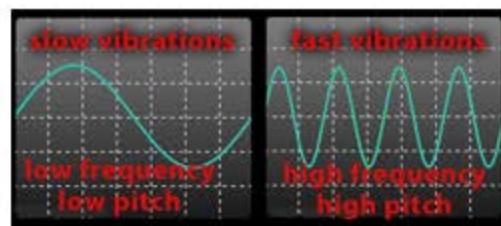
Compression (Longitudinal) Wave



FREQUENCY, WAVELENGTH, PITCH & AMPLITUDE

- The **frequency** of sound is the **number of wavelengths** in a given unit of time.
- The **wavelength** of sound is the distance between two compressions or between two rarefactions. The wavelength can be measured from any point on a wave as long as it is measured to the same point on the next wave.

- **Pitch** is determined by the **frequency** of a vibrating object.
 - Objects **vibrating faster** have a **higher pitch** than objects vibrating slower.
 - A change in frequency of sound waves causes an audible sensation—a difference in pitch.
- **Amplitude** is the **amount of energy** in a compression (longitudinal) wave and is related to intensity and volume.
 - For example, when a **loud sound** is heard, it is because **many molecules** have been vibrated with much force.
 - A soft sound is made with fewer molecules being vibrated with less force.





Solid

Liquid

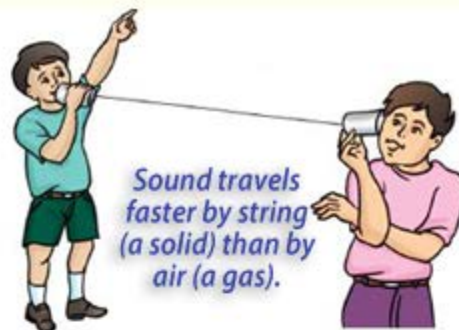
Gas

Sound travels fastest through solids where molecules are packed tightly together.

Sound can't travel through empty space where there are no molecules to vibrate.

THE MEDIUM

- When we talk, sound waves travel in air. Sound also travels in liquids and solids. Sound waves must have a medium through which to travel. In a vacuum sound cannot travel because there is no matter for it to move through.



- Sound travels more **quickly through solids** than through liquids and gases because the molecules of a solid are **closer together**. Sound travels the slowest through gases because the molecules of a gas are farthest apart.

ANIMALS

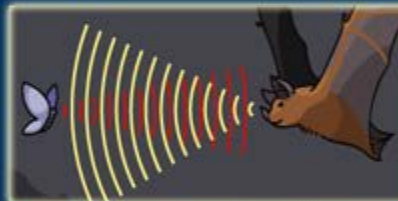
- Some animals make and hear **ranges of sound vibrations** different from those that humans can make and hear.



Whales make low-frequency moans that distant whales can hear.



Dogs can hear high-frequency sounds that humans cannot hear.



Bats use high frequency sounds to locate objects

MUSICAL INSTRUMENTS

- **Musical instruments** vibrate to produce sound. There are many different types of musical instruments and each instrument causes the vibrations in different ways.
- The most widely accepted way to classify musical instruments is to classify them by the way in which the sound is produced by the instrument.
- The four basic classifications are **percussion instruments** (e.g., drums, cymbals), **stringed instruments** (e.g., violin, piano, guitar), **wind instruments** (e.g., flute, clarinet, trumpet, trombone), and **electronic instruments** (e.g., electronic organ, electric guitar).

