Chapter 12. Sound

Contents:

New word list:

Eardrum pulse whistle oscilloscope compression rarefaction amplitude frequency period Instrument

pluck
Drum
Oud
Echo

3.4 Sound

Core	Supplement
1 Describe the production of sound by vibrating sources	
2 Describe the longitudinal nature of sound waves	10 Describe compression and rarefaction
3 State the approximate range of frequencies audible to humans as 20 Hz to 20 000 Hz	
4 Know that a medium is needed to transmit sound waves	
5 Know that the speed of sound in air is approximately 330–350 m/s	11 Know that, in general, sound travels faster in solids than in liquids and faster in liquids than in gases

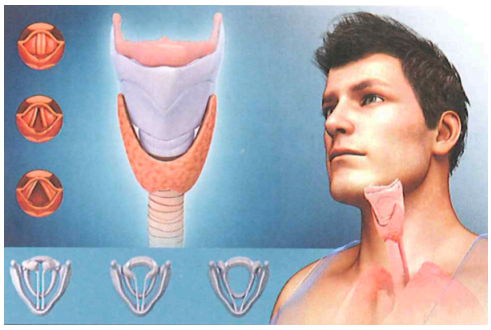
continued

3.4 Sound continued

Core	Supplement
6 Describe a method involving a measurement of distance and time for determining the speed of sound in air	
7 Describe how changes in amplitude and frequency affect the loudness and pitch of sound waves	
8 Describe an echo as the reflection of sound waves	
9 Define ultrasound as sound with a frequency higher than 20 kHz	12 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

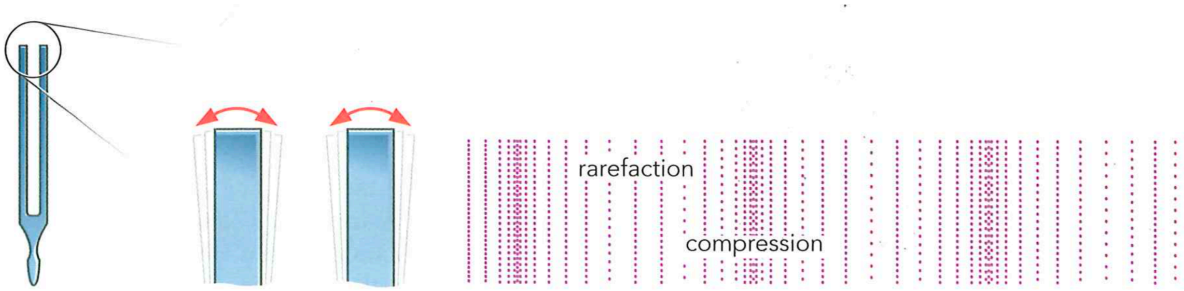
11.1 Making sounds

How does musical instruments make sounds?



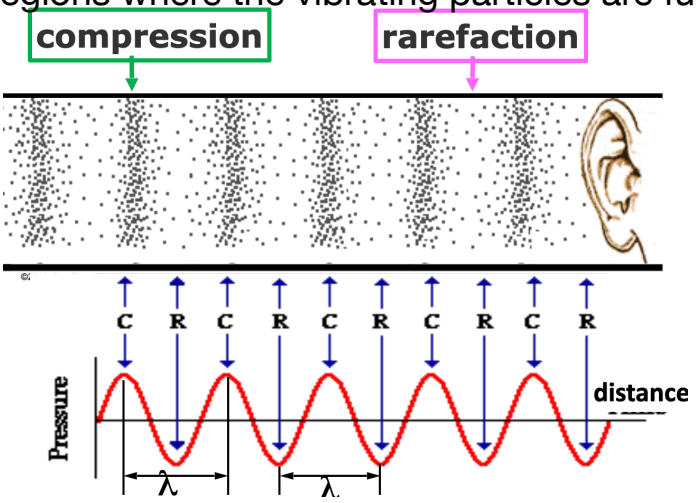
All sounds are caused by vibrations

11.2 How does sound travel



Compression: regions where the vibrating particles are closest together

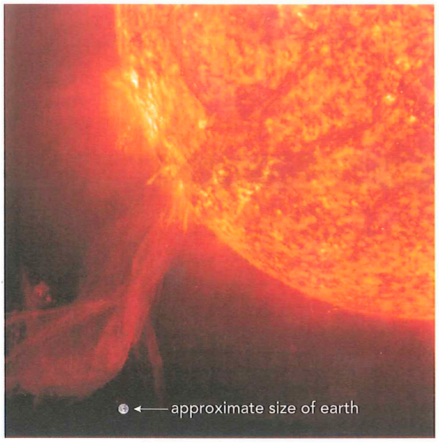
Rarefaction: regions where the vibrating particles are furtherest apart

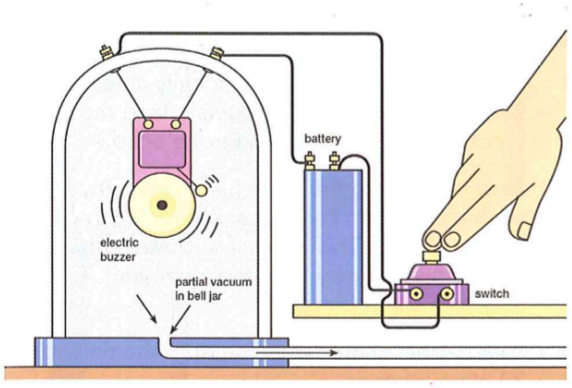


The medium particles oscillate backwards and forwards as the compressions and rarefactions pass through.
When a compression passes, the pressure rises. When a rarefaction passes, the pressure falls

11.3 The speed of sound

Sound vs light
Why do we always see the lightening first then hear the thunder?





Sound can travel in solid, liquid, gas; **cannot travel in vacuum.**

Light can travel in **vacuum**.

In vacuum, speed of light = 300000000m/s

In air, speed of sound = 330-350m/s

Sound speed in different materials

Medium	Speed of sound(m/s)
Rubber	60
Air at 0 °C	332
Air at 20 °C	343
Air at 40 °C	355
Lead	1210
Gold	3240
Glass	4540
Copper	4600
Aluminum	6320

In general, speed of sound

in solid > in liquid > in gas.

Particles are closer together => vibrations can be passed on more easily

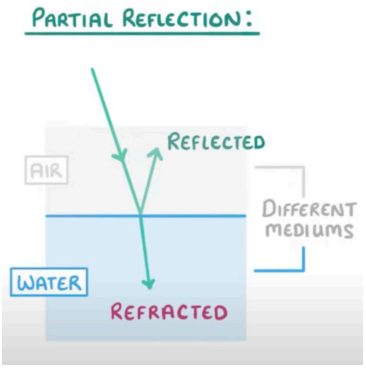
Exercise 12.1

A boy sees lightning and hears the thunderclap 9 seconds later. Calculate how far away the storm is.

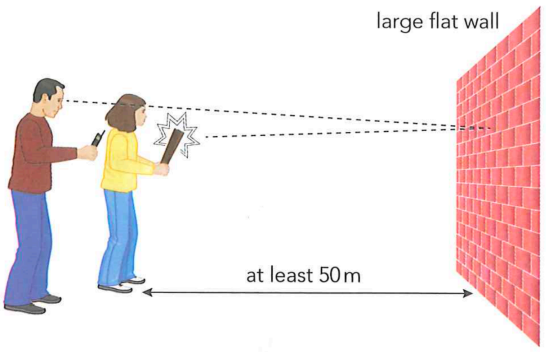
Exercise 12.2

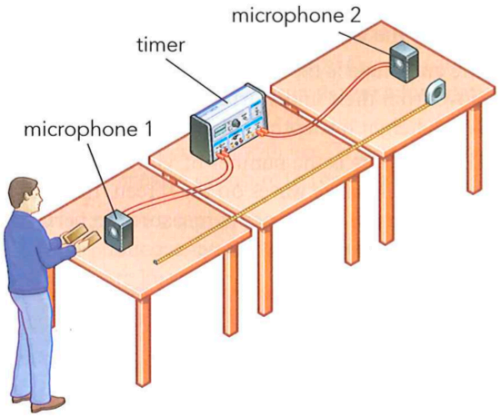
Sound travels at 1500m/s in fresh water and at 1530m/s in salt water. Explain the difference in speeds.

Sound is wave, wave can be ( ), sound waved being reflected causes ( )

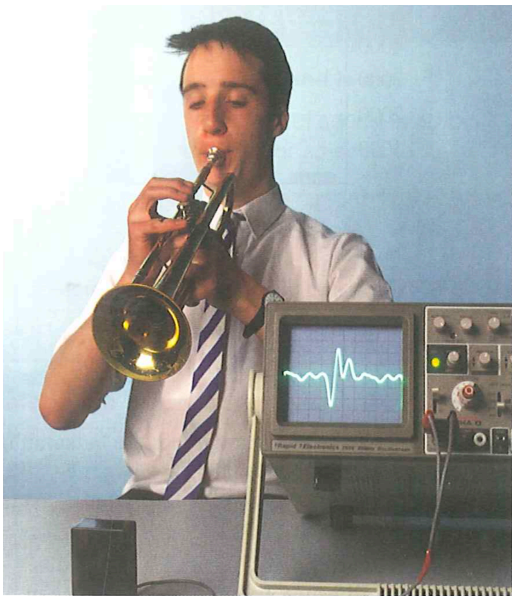


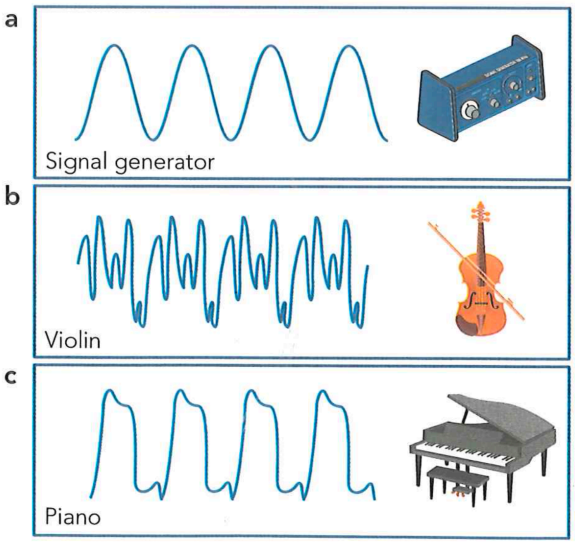
Experiment: measuring the speed of sound in air

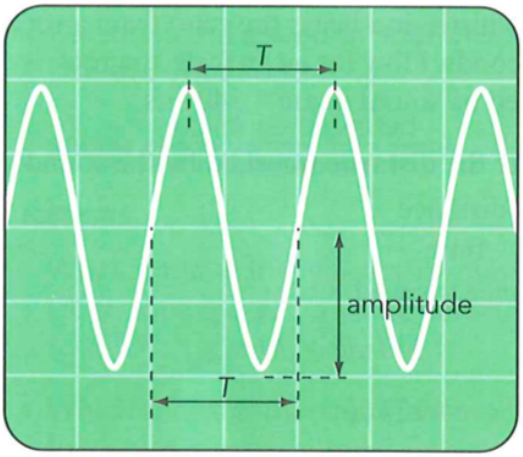




11.4 Seeing and hearing sounds



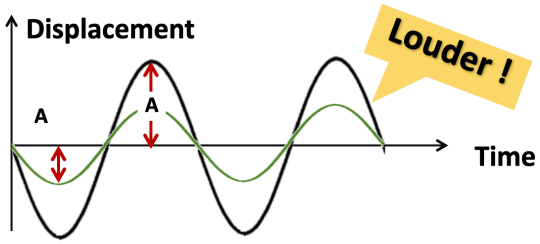


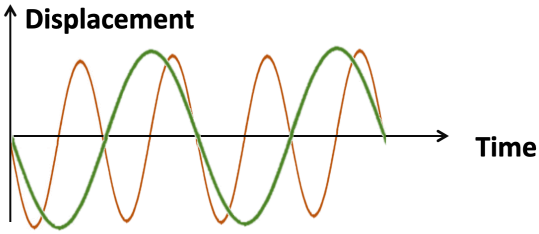


Amplitude: A
The furthest distance the particles move from their undisturbed position

Frequency: f
The number of vibrations each second.

Hertz: Hz
Unit of frequency, 1Hz = 1 wave per second





loudness => amplitude

How quiet a sound is depends on the amplitude of the sound wave.

The greater the amplitude of the wave the louder the sound.

pitch=> frequency

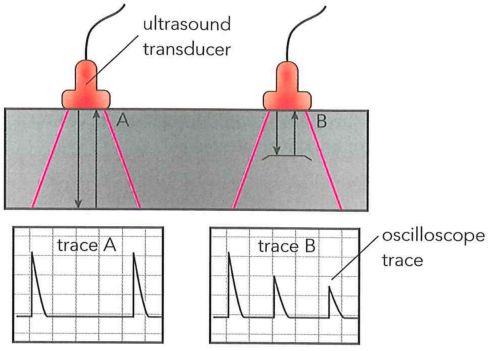
The pitch of a note depends on the frequency of the wave.

The higher the frequency of the wave the higher the note.

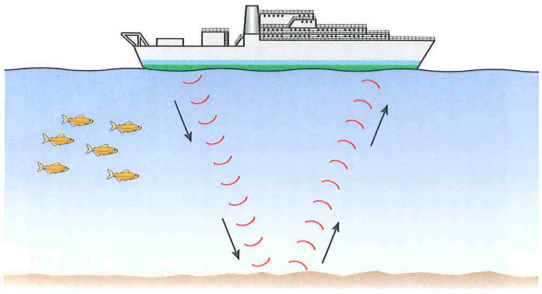
Frequencies that are audible to human:

20Hz - 20kHz

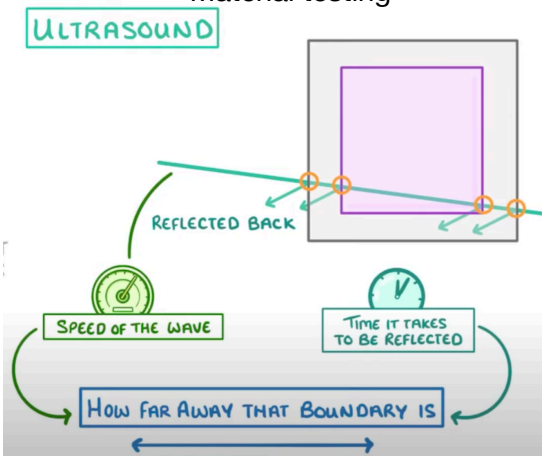
Application of ultrasound

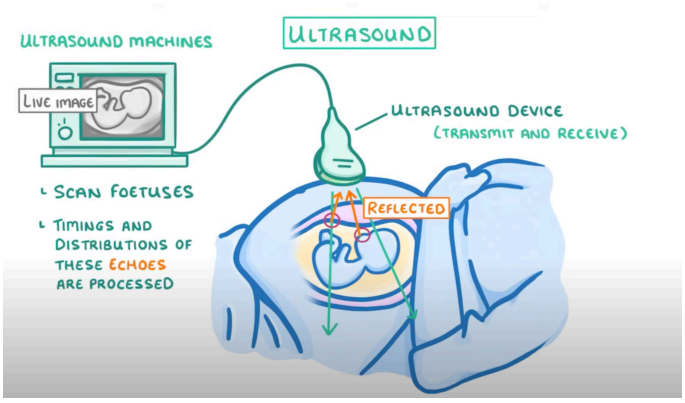


Material testing



Sonar





Medical ultrasound