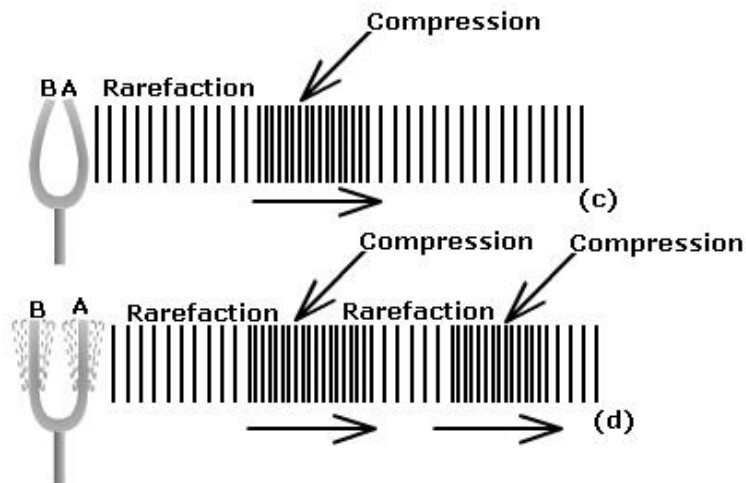


## SOUND

### Longitudinal waves

Waves in which the particles are vibrating parallel to the direction of the waves motion. Examples include sound and some slinky waves. A longitudinal pulse is a single incidence of this.

*\*Draw and label. Include compressions, rarefactions, wavelength.*



Factors Affecting Speed of Sound:

Sound travels at different speeds at different times, so these are some of the factors affecting the speed of sound.

1. Type of medium      Fastest in solids, then liquids, gases.
2. Density of the medium      ex. faster in salt water
3. Temperature of the medium      higher speed when temp. is higher

Temperature:

Since sound is caused by the bumping together of particles, if the particles are moving faster (higher temperature) the energy will be transmitted faster. Thus sound travels faster in warm air than in cold air.

Equation for the speed of sound in air:

$$v = 332 + 0.6 T$$

Where T = temperature (°C)

v = speed of sound (m/s)

Example 1 If it is  $19.0^{\circ}$  outside, what is the speed of sound?

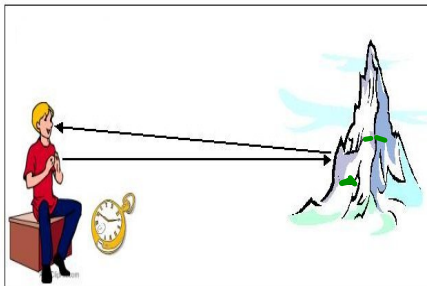
Example 2 If the speed of sound is 342 m/s, what is the temperature?

Example 3 If the speed of sound is 1470 km/h, what is the temperature?

Example 4 A 512 Hz sound is heard and the wavelength is 0.70m. What is the temperature in the room?

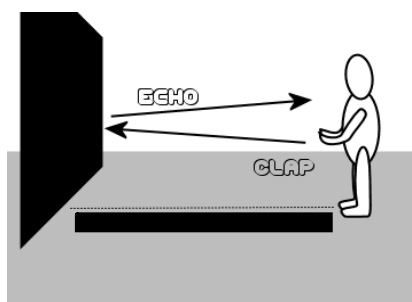
Echoes...

On a day when the temperature is  $16^{\circ}\text{C}$ , a student shouts "ouch!" She hears an echo 2.2s later. How far away is the obstacle?





The ear requires 0.100s between sounds in order to hear them as 2 separate sounds (an echo). What is the minimum distance to a wall at which echoes can be heard at room temperature (20.0°C)?

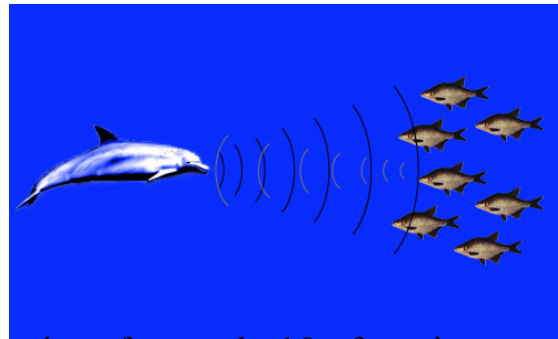


[http://www.youtube.com/watch?](http://www.youtube.com/watch?v=r9mvRRwu5Gw&safety_mode=true&persist_safety_mode=1&safe=active)

[v=r9mvRRwu5Gw&safety\\_mode=true&persist\\_safety\\_mode=1&safe=active](http://www.youtube.com/watch?v=r9mvRRwu5Gw&safety_mode=true&persist_safety_mode=1&safe=active)

[http://www.youtube.com/watch?](http://www.youtube.com/watch?v=p08Y0oRAX3g&safety_mode=true&persist_safety_mode=1&safe=active)

[v=p08Y0oRAX3g&safety\\_mode=true&persist\\_safety\\_mode=1&safe=active](http://www.youtube.com/watch?v=p08Y0oRAX3g&safety_mode=true&persist_safety_mode=1&safe=active)



[http://www.youtube.com/watch?](http://www.youtube.com/watch?v=gZxLUNHEmPw&safety_mode=true&persist_safety_mode=1&safe=active)

[v=gZxLUNHEmPw&safety\\_mode=true&persist\\_safety\\_mode=1&safe=active](http://www.youtube.com/watch?v=gZxLUNHEmPw&safety_mode=true&persist_safety_mode=1&safe=active)

**Dolphins use echolocation to locate the distance to the fish. They send out a high pitch sound wave which echoes back. Depending on how long it takes to hear the echo, they can judge the distance to the fish.**

**SONAR on a boat does the same thing for fishermen.**