Globisens

Labdisc
activities

for Elementary School Science

Labdisc Activity

How Loud is Sound

Supporting Labdisc Data Logger, GlobiWorld and GlobiLab Software

For Elementary School Science

How Loud is Sound?

We are surrounded by sound. Sound sources vary from speech and music, to motorcycle engines. If sound can be caused by so many different things then what is sound really? How is it created? And how does it reach our ears?

An object produces sound when it vibrates. When something vibrates in the atmosphere it moves the air particles around it and in turn those air particles move the air particles around them. In this way the pulse of vibration is carried through the air - a vibrating object sending a wave of pressure fluctuation through the atmosphere. These waves are called sound waves. Sound waves spread in every direction, similar to the pressure waves created by a drop of milk falling into a milk jar, travelling at the speed of sound (340 meter per second in air) until they reach our ears.

The **decibel** (abbreviated **dB**) is the unit used to measure the intensity of a sound. The decibel scale is a little strange because the human ear is incredibly sensitive. Your ears can hear a really wide range of sounds, from a leaf falling on grass to a loud jet engine - the sound of the jet engine is about 1,000,000,000,000 times more powerful than the smallest audible sound. That's a big difference!

On the **decibel scale**, the smallest audible sound (near total silence) is 0 dB. A sound 10 times more powerful is 10 dB. A sound 100 times more powerful than near total silence is 20 dB. A sound 1,000 times more powerful than near total silence is 30 dB. Here are some common sounds and their decibel ratings:

Sound Sources examples with distance	***Sound pressure level in decibels***
Jet aircraft 50 m. away	140
Threshold of pain	130
Threshold of discomfort	120
Chainsaw 1 m. distance	110
Disco, standing 1 m. from the speaker	100
Diesel truck 10 m. away	90
Curbside of a busy road 5 m.	80
Vacuum cleaner 1 m. distance	70
Conversational speech 1 m. distance	60
Average home	50
Quiet library	40
Quiet bedroom at night	30
Background in TV studio	20
Rustling leaves in the distance	10
Threshold of hearing	0

The Experiment

Sound level is affected by distance. The closer we are to the sound source, the louder we will hear it. In this activity we will measure the decay of sound level over distance.

Equipment Needed

- 30 cm ruler

Labdisc Setup

1. Turn on the Labdisc by pressing the On/Off key. 
2. Rotate the Labdisc plastic ring to expose the sensors.
3. **SENSORS:**

   Press the SCROLL key  to open the Labdisc menu. Select the SETUP icon  and then the SET SENSOR icon.  Press the Sound sensor  and make sure that this is the only selected sensor for the activity.

4. **SAMPLING RATE:**

   Press the ESC key  to leave the previous menu and then select the SAMPLING RATE icon.  Use the SCROLL key  to choose Manual sampling rate. Press the SELECT key  to confirm.

5. **AMOUNT OF SAMPLES:**

   Press the ESC key  to leave the previous menu and then select the NUMBER OF SAMPLES icon.  Use the SCROLL key  to choose 10 samples. Press the SELECT key  to confirm.

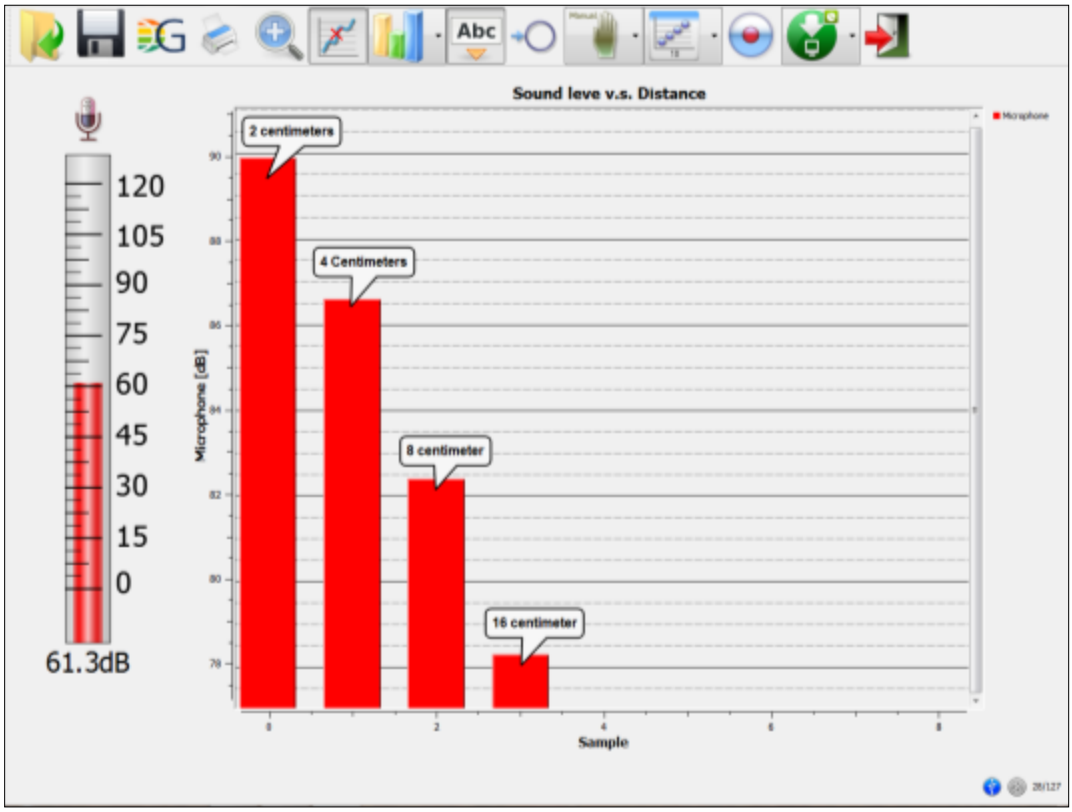
Experiment Procedure

1. Use your computer speaker to create a constant sound of source:
   a. Set the speaker volume to between 80-90%
   b. You need to work with only one speaker, thus set the speaker balance to either L (left) or R (Right).
   c. The www.freesound.org WEB site offers a variety of sound sources, one example is: http://www.freesound.org/samplesViewSingle.php?id=28636 This sound source was created by Mr. Pete Chapman.
   d. Press the small play button  on the WEB and your speaker will produce a pure tone for 30 seconds.
2. Press the SELECT key  to start recording.
3. Place the Labdisc with the sound sensor facing your speaker at a 2 cm distance.
4. Take a manual sample by pressing the Labdisc SCROLL key. 
5. Repeat the above actions for measuring while moving away from the speaker:
   a. Place the Labdisc 4 cm away and press the SCROLL key. 
   b. Place the Labdisc 8 cm away and press the SCROLL key. 
   c. Place the Labdisc 16 cm away and press the SCROLL key. 

6. Press the SELECT and then the SCROLL key to stop recording.

Data Analysis

1. Open the software.
2. Connect the Labdisc to the computer either via wireless communication or through the USB port.
3. Click on the DOWNLOAD icon to retrieve the sound measurements from the Labdisc.
4. Use the annotation tool to mark the distance for every measurement as seen in the graph below:



As is clearly shown in the graph – the sound declines by 3 dB per doubling of distance. We can conclude that the sound level decay is directly proportional to the distance.

Investigation and Questions

View your measurements and try to answer the questions below.

1. When moving away from a sound source, the sound volume we hear?
   - ☐ Decreases over distance
   - ☐ Stays the same regardless of the distance to the sound source
   - ☐ Increases with the distance

2. How can we protect our hearing?
   - ☐ Clean our ears daily
   - ☐ Keep away from loud sounds of over 130dB
   - ☐ Avoid exposure to sounds of over 100 dB for periods of 15 minutes or more

3. Can we hear a person whispering while at a loud rock concert?
   - ☐ No, because in a loud environment our ear sensitivity is low and we cannot hear weak sounds
   - ☐ Yes, because our ears can ignore the background music
   - ☐ No, because when our ears listen to music we cannot process the sound of a voice.

4. Can we hear music or a person's voice in outer space?
   - ☐ Yes, outer space is very quiet and we can easily hear music or voices
   - ☐ In space we have a vacuum and thus sound, which travels via the movement of particles, cannot be formed
   - ☐ No, because space is a vast place and sound simply disappears in it

Further Suggestions

1. Find the quiet and noisiest place in your school.
2. Make a contest between students, to find out who has the loudest whistle.
3. Using both the GPS and sound sensors - check the noise level difference between a busy city street, a quiet residential area, or a park.