

## 7. INVESTIGATING SOUND LEVELS

The amplitude of a sound wave determines its loudness. A smaller amplitude equates to a softer or lower sound. A larger amplitude will reflect a louder sound. The `code.Node` will measure loudness in percentages 0 - 100.

A decibel (dB) is a unit used to measure the intensity of a sound. Many of us use headphones or earbuds to listen to music from our smart phone. To minimize damage to your ears, it is suggested to keep sound levels between 60 to 85 decibels.

The `code.Node` measures sound in loudness. A safe range could be considered between 15 to 35% when listening to music.

### Objectives

- Design a program that includes compound conditionals.
- Investigate sound ranges and identify when the intensity of a sound can be harmful to the human ear.

### Materials and Equipment

- Data collection system
- `code.Node`
- Cell phone with earbuds


### Safety

In addition to your normal classroom procedures:

- Do not listen to music from your earbuds once the loudness percentage exceeds 35%.

### Procedure

#### *Part 1 – Investigating Sound Levels*

1. Select Sensor Data in SPARKvue.
2. Connect your `code.Node` to your device.
3. Select only Loudness under Measurements and disable all other sensors.
4. Select the Graph display under Templates. Make sure it is loudness versus time.
5. Using your phone with earbuds plugged in, place the hole of one of earbuds directly over the  
 sound sensor and turn on some music.
6. Start recording data. You can investigate how the sound levels adjust as you turn up and down your music. Remember, the ideal range is 15 to 35%.

### **Part 2 – Create an Alert Program**

1. Your challenge is to program your `//code.Node` to alert you to various levels of loudness and when it is safe or dangerous for your ears.
2. Create a program that follows these parameters:
  - Includes the use of compound conditionals
  - Causes the RGB LED to flash green for safe (0 - 14%), yellow for caution do not exceed (14 - 35%), red for danger zone (36 - 50%), and blue for do not listen (51 - 100%)
  - Utilizes the 5X5 LED array to also adjust to each of the four levels. Use any design you wish.
3. When you have completed your program, test using your earbuds. Make sure you have programmed your compound conditionals properly. You can test this by running a graph of loudness over time, just like you did in Part 1.
4. When your program is complete and free of bugs, save the file according to your teacher's directions. Share and compare with others.

### **Questions and Analysis**

1. Why was it necessary to use compound conditionals in this program?
  
  
  
  
  
  
  
  
  
  
2. The amplitude of a sound wave determines its \_\_\_\_\_ or volume.