I. Objectives

1. Observe and identify external factors that can influence sound levels.
2. Use a sound meter to compare sound levels at different locations.
3. Calculate and compare sound intensities.

II. Introduction

Sound intensity is defined as the sound power per unit area. The usual context is the measurement of sound intensity in the air at a listener's location. The basic units are *watts/m²*. Many sound intensity measurements are made relative to a standard threshold of hearing.

The most common approach to sound intensity measurement is to use the decibel, the unit of measurement used to compare two sound intensities. Decibels measure the ratio of a given intensity to the threshold of hearing intensity, so that this threshold takes the value 0 decibels (0 *dB*). To assess relative sound loudness, as distinct from an objective intensity measurement, the sensitivity of the ear must be factored in (http://hyperphysics.phy-astr.gsu.edu/hbase/sound/intens.html).

III. Calculations

The intensity level β of a sound in decibels is defined as:

$$\beta = (10\ dB) \log\left(\frac{I}{I_0}\right)$$

where

I = sound intensity

$I_0 = 1.0\ x\ 10^{-12}\ W/m^2$, the threshold of human hearing.

We can also calculate I :

$$\log\left(\frac{I}{I_0}\right) = \frac{\beta}{10\ dB}$$

$$10^{\log\left(\frac{I}{I_0}\right)} = 10^{\left(\frac{\beta}{10\ dB}\right)}$$

$$\frac{I}{I_0} = 10^{\left(\frac{\beta}{10\,dB}\right)}$$

$$I = I_0 10^{\left(\frac{\beta}{10\,dB}\right)}$$

IV. Equipment and Materials

Sound meter, calculator

V. Procedure

1. Using the sound meter, measure the intensity level for 10 different campus locations and record your results in Table 1.

2. Calculate the sound intensity at each location.

VI. Data

Table 1 Sound Intensity Levels

A	B	C
Location	Intensity level β in decibels	Sound intensity I in W/m^2

VII.   Discussion Questions

1. Which campus locations had the loudest sound levels? What specific factors in the environment affected this sound level?

2. Which campus locations had the lowest sound levels? What specific factors in the environment affected this sound level?

3. Which campus locations had similar sound levels? Why?

4. What does an intensity level of 0 *dB* indicate? Hint: the answer is in your textbook.