|  |  |  |
| --- | --- | --- |
| **Name: Molly Hamilton** | **Contact Info:** [**hamilmo@cpsboe.k12.oh.us**](mailto:hamilmo@cpsboe.k12.oh.us) | **Date: 2/28/18** |

|  |  |  |  |
| --- | --- | --- | --- |
| **Lesson Title : Can you hear it?** | **Unit #:**  **1** | **Lesson #:**  **2** | **Activity #:**  **3** |
| **Activity Title: How loud can you make it?** |

|  |  |
| --- | --- |
| **Estimated Lesson Duration:** | **Four 45 minute classes** |
| **Estimated Activity Duration:** | **One 45 minute classes** |

|  |  |
| --- | --- |
| **Setting:** | **In class** |

|  |
| --- |
| **Activity Objectives:** |

* Determine how far away different decibel levels can be heard.
* Use logarithms and apply them to sound.

|  |
| --- |
| **Activity Guiding Questions:** |

When is a sound too quiet?

How can I measure sound (intensity, frequency)?

What are the units of sound measurement and what do they mean?

What sounds can’t I hear?

Why would we want to increase the volume of a sound?

| **Next Generation Science Standards (NGSS)** | |
| --- | --- |
| **Science and Engineering Practices (Check all that apply)** | **Crosscutting Concepts (Check all that apply)** |
| ☒ Asking questions (for science) and defining problems (for engineering) | ☐ Patterns |
| ☐ Developing and using models | ☐ Cause and effect |
| ☒ Planning and carrying out investigations | ☐ Scale, proportion, and quantity |
| ☐ Analyzing and interpreting data | ☐ Systems and system models |
| ☐ Using mathematics and computational thinking | ☐ Energy and matter: Flows, cycles, and conservation |
| ☐ Constructing explanations (for science) and designing solutions (for engineering) | ☐ Structure and function. |
| ☐ Engaging in argument from evidence | ☐ Stability and change. |
| ☒ Obtaining, evaluating, and communicating information |  |

| **Ohio’s Learning Standards for Science (OLS)** |
| --- |
| **Expectations for Learning - Cognitive Demands (Check all that apply)** |
| ☐ Designing Technological/Engineering Solutions Using Science concepts **(T)** |
| ☐ Demonstrating Science Knowledge **(D)** |
| ☐ Interpreting and Communicating Science Concepts **(C)** |
| ☐ Recalling Accurate Science **(R)** |

| **Ohio’s Learning Standards for Math (OLS) and/or**  **Common Core State Standards -- Mathematics (CCSS)** | |
| --- | --- |
| **Standards for Mathematical Practice (Check all that apply)** | |
| ☒ Make sense of problems and persevere in solving them | ☐ Useappropriate tools strategically |
| ☒ Reason abstractly and quantitatively | ☒ Attendto precision |
| ☒ Construct viable arguments and critique the reasoning of others | ☐ Look for and make use of structure |
| ☒ Model with mathematics | ☐ Look for and express regularity in repeated reasoning |

|  |
| --- |
| **Unit Academic Standards (NGSS, OLS and/or CCSS):** |

LE.A.4 For exponential models, express as a logarithm the solution to abct = d where a, c, and d are numbers and the base b is 2, 10, or e; evaluate the logarithm using technology.

IF.C.7 Graph functions expressed symbolically and show key features of the graph, by hand in simple cases and using technology for more complicated cases.

IF.C.7e Graph exponential and logarithmic functions, showing intercepts and end behavior, and trigonometric functions, showing period, midline, and amplitude.

CED.A.4 Rearrange formulas to highlight a quantity of interest, using the same reasoning as in solving equations. For example, rearrange Ohm’s law V = IR to highlight resistance R.

REI.D.11 Explain why the x-coordinates of the points where the graphs of the equations y = f(x) and y = g(x) intersect are the solutions of the equation f(x) = g(x); find the solutions approximately, e.g., using technology to graph the functions, make tables of values, or find successive approximations. Include cases where f(x) and/or g(x) are linear, polynomial, rational, absolute value, exponential, and logarithmic functions.

|  |
| --- |
| **Materials**: (Link Handouts, Power Points, Resources, Websites, Supplies) |

|  |
| --- |
| **Teacher Advance Preparation:** |

Make copies of Sound Investigation worksheet.

<https://docs.google.com/a/cpsboe.k12.oh.us/viewer?a=v&pid=sites&srcid=Y3BzYm9lLmsxMi5vaC51c3xtb2xseS1hLWhhbWlsdG9uLTIwMTd8Z3g6NjRjZmM4MjM5YWM4MzY5NQ>

Make sure you have sound generator.

|  |
| --- |
| **Activity Procedures:** |

1. Warm Up - Why would we want to increase the volume of a sound?
2. How far away can you hear a certain frequency and decibel level? Students will be working in groups to collect data about frequency, decibel level, and distance from the sound that they stop hearing it. They will evaluate their data and draw one or more conclusions about sound frequency, intensity, and distance.

**Formative Assessments:** Link the items in the Activities that will be used as formative assessments.

Collection of data on Sound Investigation worksheet.

<https://docs.google.com/a/cpsboe.k12.oh.us/viewer?a=v&pid=sites&srcid=Y3BzYm9lLmsxMi5vaC51c3xtb2xseS1hLWhhbWlsdG9uLTIwMTd8Z3g6NjRjZmM4MjM5YWM4MzY5NQ>

**Summative Assessments:** These are optional; there may be summative assessments at the end of a set of Activities or only at the end of the entire Unit.

Unit 4 Post-assessment.

|  |
| --- |
| **Differentiation:** Describe how you modified parts of the Lesson to support the needs of different learners.  Refer to Activity Template for details. |

* Extended time for IEP students.
* Creating selected groups to maximize student participation.
* Students will be working at their own pace.

|  |
| --- |
| **Reflection:** Reflect upon the successes and shortcomings of the lesson. |

This activity did not work. Some students were not able to cut the intensity in half for certain frequencies. Students did not know how to measure accurately with a tape measure when the distance was farther than one length of the tape measure. Next time, I will have the students pick a frequency and measure the sound intensity level at the source, 2 meters away, 4 meters away, etc.