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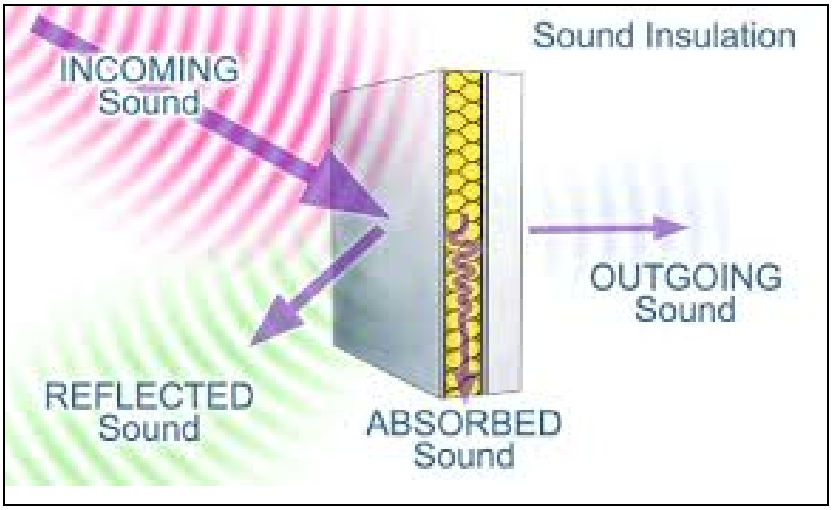
Name: _____ Date: _____

Unit: Design a Noise Canceling Device Lesson: Sound Boxes

Background: Sound Transmission and Soundproofing

Transmission occurs when the energy carried by a wave is allowed to pass through a material. Some energy is usually absorbed by the molecules in the material, leading to a reduction of energy transmitted through a material. In physics this is called **attenuation**. An example of attenuation with sound waves is hearing music through a bedroom wall. In the bedroom the sound is loud but outside it is relatively quieter because the wall material absorbs and reflects some of the energy. The sound waves are carrying less energy as they pass through the wall, which is perceived as lower volume when heard (see graphic below). **Soundproofing** involves the use of materials to reflect and/or absorb sound such that it cannot escape the defined space. Recording studios are examples of soundproof spaces because each studio is made with materials that allow one artist to sing and record songs without disturbing people in adjacent studios.

The amount of attenuation depends on the material through which sound is passing. The sound box provides a consistent testing tool with which to test the amount of transmission of sound through various materials and allows students to draw logical conclusions about the properties of certain materials in terms of transmission, absorption, and reflection of sound.



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Follow the protocol below for testing materials in the sound box. Record your measurements and calculations in the data table. Use a separate sheet of paper and add more rows to the table if needed.

1. Place the sound source at the bottom of the sound box and turn it on with volume set at medium.
2. Cover the sound source with the first material to be tested. Cut larger materials into smaller pieces that can be layered over the sound source and around the inside of the box.
3. For smaller materials such as beads, fill the box to cover the sound source. Add enough material to fill the sound box 2-3 inches above the sound source.
4. Place the sound meter device near the sound box. Make sure it is placed in the same position for each test in order to ensure consistency.
5. Measure and record the sound output three times for each material and then calculate the average value. Empty the sound box and remove the sound source.
6. Repeat steps 1-5 for the remaining materials to be tested

Material Name	**Characteristics**	**Sound Transmission (dBA)**
Ex: Cardboard strips	Thin strips, flexible, about ¼ “ thick, made of 4-5 different layers of paper material	1: 30 Ave: 32.3 2: 36 3: 31
		1: _____ Ave: _____ 2: _____ 3: _____
		1: _____ Ave: _____ 2: _____ 3: _____

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Analysis & Discussion: Discuss the following questions with other students in a group or as a whole class.

1. What was the range of sound data you collected (largest value - smallest value)?
2. Which material transmitted the most sound? The least? How different was the data for these materials?
3. What are the attributes that you think made those materials able to transmit sound well or not so well?
4. What happened to the portion of the sound that was not transmitted well?
5. What do your results mean in terms of materials to choose if you wanted to soundproof your house? Provide two examples to support your thinking.