SCIENCE NORTH SCIENCE NORD
SUDBURY, ONTARIO, CANADA

Creating a Rock Concert Part 4 **Grade 4 – Light and Sound**

Lesson Plan

Assessment	AFL, discussion
Cross-curricular	Arts

Big Ideas

- Sound is created by vibrations
- Light is needed to see

Learning Goals

- Solidify ideas explored in the unit so far, namely that sound is vibrating air, and that one of the properties of light and sound is reflection.
- Angle of reflection = angle of incidence
- To make use of the amplification devices students built.

Specific Expectations

2.2 investigate the basic properties of light
2.3 investigate the basic properties of sound
2.4 use technological problem-solving skills to design, build, and test a device that makes use of the properties of light
2.6 use appropriate science and technology vocabulary, including natural, artificial, beam of light, pitch, loudness, and vibration, in oral and written communication
3.6 describe how different objects and materials interact with light and sound energy

Description

This lesson is a follow-up on the previous one in this unit. It assumes that the students will have built an amplifier for an instrument/device and elements of a light show. It is **lesson 4** of a series of five lessons.

Materials

- Household paper rolls (two per student group)
- Headphones (one per student group)
- Items to test for sound reflectivity.
  - Carpet pieces
  - Wood or cardboard
  - Cloth (in item of clothing will do)
  - Glass or plastic
- Large bowl or coffee can
- Cellophane wrap
- Salt

Safety Notes

Introduction

- If students did not finish their light or sound project during the last class take time at the beginning of this lesson to do so. If some groups are already done you may be able to move on to the next part with individual groups.
- Discussion: Why are instruments built the way they are?
    - Instruments are designed to amplify vibrations. They often have large hollow bodies that vibrate with the sound, such as for guitars, violins and drums. Wind instruments amplify the vibrations in the tubes the air passes through.
    - Deeper sounding instruments have larger sound boxes (e.g. Bass or a tuba). This is because low sound waves are LONGER. We will test this today!
- Turning to light: Let's discuss what makes something a good light reflector?
    - E.g. could you have built a mirror ball with little pieces of wood? NO.
    - Good light reflectors have very shiny surfaces that are smooth. (E.g. How would you describe a mirror? Smooth, glass with a layer of metal foil or paint underneath, hard)
    - Hard surfaces are better reflectors than soft ones. Even when you think of snow for example. The reflecting surfaces are actually water ice crystals.
    - Metallic surfaces tend to be good light reflectors.
- What would reflect sound well? Any ideas? Let's test it!

Action

Reflection of Sound

- So what kinds of materials best reflect sound? We can do an experiment.
- Make as many setups as you have iPods, phones or other devices that were used in the previous class. Have students form groups around each one the devices. Equip them with headphones, two tubes (e.g. household paper tube) and a selection of materials to test.
- Student instructions:
    - Play music over headphones. Place a tube (e.g. household paper tube) over one of the earpieces and aim it at a surface. Start with a hard surface, such as wood
    - Take a second tube and listen for the reflected sound. NOTE: The sound will be loudest if you listen at the correct angle of reflection, which is the same as the angle of incidences. So for example if you aim the tube the music plays through at a surface at a 45-degree angle, then the reflected sound will be strongest at a 45-degree angle coming off the surface (so at 90 degrees from the incoming sound). It will be helpful to draw this on the board for students. You can discuss for example how this is similar to something like billiard balls or marbles when you bounce them off a surface (can easily be tested in a little demo).
        - NOTE: If this is too complicated, just instruct students to point tubes at 45-degree angles. The point of this exercise is not about understanding how angles of reflection and incidence are the same, but that different materials reflect sound differently.
    - Now try each of the surfaces. Which ones reflect the sound well? Which ones do so poorly?
- You should find that the soft or uneven surfaces reflect sound much more poorly than a hard, even surface.
    - You may have an example of a room at the school that is designed not to reflect sound – such as carpeted walls (or even just floors) in a library.

- Discuss how this is similar/different from light.
  - Smooth and hard is similar
  - But a mirror reflects sound (almost) no better than wood.

Sound Vibrations – Can we see them?

- Let's make use of the amplification devices we have built now to see if we can see sound waves! This will also tie in nicely with one of the activities in the last lesson where we will see how sound makes the eardrum vibrate. This activity can be done as a demo for students rather than an activity that everyone does.
- Cover a bowl or large can with cellophane wrap. Tightly and with as few wrinkles as possible.
- If an amplified device (built in the last class) fits into the bowl/can place it inside with music playing. Otherwise "aim" the device closely at the cellophane membrane.
- Sprinkle salt on the membrane.
- Observe what happens:
  - Does the salt "bounce" with the music?
  - Do low-pitched sounds or high-pitched sounds have a bigger effect?
    - Lower pitch sound has a LONGER wavelength and should therefore make the membrane move more noticeably.
- If it is hard to see vibrations hold a drum aimed at the membrane and hit it. This should create a nice effect.

Consolidation/Extension

- Discuss results of experiments with emphasis on
  - We can see and feel sound waves with the right experimental setup.
  - We can see how light waves reflect, and we have demonstrated that sound waves do so as well.
- For next class - homework: bring in your sunglasses! If someone has welders goggles or masks bring those too!