Physical Science for Teachers

Sound Waves Lab

Traveling Sound

Name _____ Date_____

Partners_____

Stuff you need:

Hanger; string; metal spoon; plastic spoon; wood spoon; yarn, different thicknesses of string, thin wire.

Steps you do:

1. Cut a piece of string about half a meter long and tie it to the neck of a metal hanger.
2. Wrap each end of the string around a finger on each hand about the same amount.
3. Swing the hanger so that it strikes a desk or table. Observe and describe the sound as you hear it through the air.

4. Repeat while holding the tips of your fingers in your ears: swing the hanger and strike it against a desk or table. (Each one in the group must try this. You can't hear it without doing it yourself.) Describe the sound now as heard through the string.

5. Repeat steps #2-4 using a metal spoon instead of a hanger. Compare the sounds of the spoon with those of the hanger. How were they alike? How were they different?

6. Repeat #2-4 using the plastic spoon and then the wooden spoon. Make a chart and compare the loudness of the sounds made with each of the spoons, metal, plastic, wooden.

Why it works:

Try to explain your results after a group discussion: Write down your conclusions to compare with the class explanation.

Class explanation:

Variations:

If you finish before time to switch stations, try having the sound travel through different types of materials. Replace the string with yarn, metal wire, thinner or thicker string. Remember: Keep the amount of force you are striking with the same each time (a *controlled* variable!) . What else should you keep the same each time you change the material the sound is traveling through? (Write answer here.)

Physical Science for Teachers

Sound Waves Lab

Phone Home

Name _____ Date_____

Partners _____

Stuff you need:

Two each of several different sizes of cups; a piece of string about ten meters long for each pair of cups; paperclips

Steps you do:

1. Use a sharp instrument and poke a hole in the bottom of the middle of each of the cups.
2. For each pair of cups push the string from the outside the cup through the hole to the inner bottom side of the cup. Temporarily pull the string up as far as the top of the cup.
3. For each the two cups, tie the piece of string that is sticking up to a paper clip. Then from the outside, pull the paper clip back down to the bottom of the cup. (The paper clips will keep the string from slipping out of the cups.)
4. One student will talk into one cup while another places the other cup to her ear. Try this with the string loose. Describe the result:

5. Repeat #4 with the string pulled a little tighter. Compare how this differs from the loose string.

6. Repeat #5 with the string pulled tightly (tight enough to pull the string taut, but not tight enough to damage the cups). Compare the results with a loose and a semi-loose string.

7. Repeat #1-3 and #6 using different size cups. Write a comparison of how they are alike and how they are different from each other.

Why it works:

Try to explain your results after a group discussion: Write down your conclusions to compare with the class explanation.

Class explanation:

Variation:

Keep the cups the same each time and change the string to a thicker, and a thinner string, yarn and thin wire.

Physical Science for Teachers

Sound Waves Lab

String Pitch

Name _____ Date_____

Partners _____

Middle School Lesson

Stuff you need:

Cans with a small hole in the bottom, strings of different thicknesses.

Steps you do:

1. The different types of strings should be threaded through the hole and tied to a paper clip to make sure they will not slide out through the hole.
2. Wrap the end of one of the strings around something solid to hold it steady and **pull on the can** to make the string taut.
3. Pluck the string to produce a tone.
4. Shorten the string in small steps by loosening the string and then pulling on the end. After each shortening, pull on the can with the same tension used previously. Pluck the string and observe the tone. What happens as the string becomes shorter?

5. Repeat steps 2-4 using the other strings and compare results.

6. What is the relationship of the length of string to the pitch produced?

7. Try changing the tension in the string without changing the length. Have the string very tight and pluck it. Then let up on the tension a little and pluck again. Repeat until there is no tone produced.

8. What is the relationship between the tension and the pitch?

9. Try switching back and forth between different strings, making each just as tight as the previous string and plucking the string. How does the heaviness of the string affect the pitch?

10. The things you experimented with above are key factors for stringed instruments.

    a. Look at a guitar or violin. (Your teacher should bring one to lab.) How does the size of the string compare for the high strings and the low strings?

    b. What do you do to a string if it is tuned too low or too high? What do you adjust to change the tension and tune the string?

    c. When you play the instrument, what do you do to the string to make it produce a higher pitch?

Class explanation:

Physical Science for Teachers

Sound Waves Lab

Pitch

Name _____ Date_____

Partners _____

Stuff you need:

About 8 glass bottles (same size) and/or 4 bottles and 4 glasses, spoon

Steps you do:

1. Fill the bottles with varying amounts of water. One should have almost no water and one should be about 3/4 full.
2. Blow over the top of the bottles and compare the sounds. What relationship do you observe between the amount of water in the bottles and the pitch (how high the tone of the sound is)?

3. Now strike the bottles with a spoon instead of blowing. What relationship do you observe between the amount of water in the bottles and the pitch this time?

4. Fill the glasses with varying amounts of water from very little to nearly full. Strike the glasses and listen to the pitch changes. What is the relationship between the amount of water and the pitch?

Why it works:

See how much you can figure out:

A. When you blew, what else was in the bottle besides water?

B. What then did you start vibrating when you blew?

C. How does the height of the vibrating column of air seem to relate to the highness or lowness of the pitch of the sound you hear?

D. When you did not blow, but made your sound by striking, you were vibrating the glass with the spoon. What else in the glass were you also causing to vibrate? (Not the air.)

E. Since water has mass, which glasses would have to vibrate more mass?

F. What is the relationship between the amount of mass that is vibrating and the pitch of the sound that you hear?

Class explanation: