Vibrations

Summary

Students experiment with various materials to identify the relationship between size of the source, vibration speed, and pitch.

Time Frame

1 class periods of 45 minutes each

Group Size

Small Groups

Materials

For Each Group: (2-3 Students)

- 4 rubber bands of different thicknesses
- 2 pencils
- textbook
- 12 inch ruler
- yo-yo

For the Teacher:

- bicycle
- playing card

Background for Teachers

Sound is produced through the vibrations of compressed molecules. For instance, as the wings of a tiny hummingbird move, they collide with air molecules and compress them closely together for a moment of time. However, these molecules quickly move to their original position. But on their way, they bump into other molecules, transferring this energy. This wavelike movement produces the hum of a hovering hummingbird.

Sounds can be created using a variety of materials. During the following experiments, be aware of the kinds of energy used to create the sounds. Stress the differences of volume (intensity of the sounds wave) and pitch (how high or low the tone sounds) with each different experiment. Encourage the students to hypothesize and create their own experiments, then test and find out about the sound produced.

Intended Learning Outcomes

- Observe simple objects, patterns, and events, and report their observations.
- Compare things, processes, and events.
- Use data to construct a reasonable conclusion.
- Cite examples of how science affects life.

Instructional Procedures

Explain to students that sound is created by vibration. For example: When the string of a guitar is plucked, it vibrates. That vibration causes the molecules to move and bump into other molecules. This process continues until the molecules near your ear vibrate which causes the tiny bones inside your ear to vibrate and you hear a sound.

Today students will complete activities to explore vibration and its affect on sound.

Divide students into small groups (2-3) and have them complete the following activities.

Four Rubber Bands

Take each rubber band and hold it approximately six inches wide while another student plucks it.

Repeat the process with each of the four rubber bands.

Look for differences in vibration speed and the pitch that results.

Record all observations in a science journal.

Textbook Pitches

Stretch a rubber band around the length of a textbook. Place two pencils under the band, one near the top of the book and one near the bottom. Pluck the rubber band and note its sound.

Next, place your finger down an inch from the top pencil. Record your prediction on how the sounds will change. Have your partner pluck the rubber band between your finger and the bottom pencil. Note the change in the frequency and pitch of sound produced. Were your predictions correct?

Continue to shorten the length of the rubber band as you pluck, each time noting the changes in frequency and pitch of the vibrations.

Record these observations in a science journal.

Ruler

Place two inches of the ruler on the edge of a desk and strum the remaining ten inches that are in the air. Note the vibration speed and pitch.

Repeat the process continually moving more of the ruler onto the desk and less in the air. Each time noting vibration speed and pitch.

Record all observations in a science journal.

Yo-yo

Unwind the string. Have one student hold the string while another holds the plastic base to his or her ear.

Strum the string and note the sound heard.

Place a finger on the string close to the plastic base and hold it down slightly. Strum the string and note the difference in pitch.

Continue to move the finger down the string getting closer and closer to the end of the string. Continue noting differences in pitch.

Record all observations in a science journal.

To test students' ideas about the relationship between speed of vibrations and the pitch of the sounds produced, complete the following activity as an entire class.

Bring in a bicycle and place it upside down in the center of the room. Have a student hold a playing card against the spokes and allow a second student to turn the pedals. How does the pitch of the sound change as the bike tire speeds up?

Have the students apply what they have learned to human vocal cords. How do we produce sounds, and how do we change the nature of those sounds with our vocal cords? (It may help students if they lightly place their fingers on the front of their throat and recite the alphabet varying their pitch and speed.)

Extensions

Have students apply what they have learned about vibrations and pitch to design their own musical instrument. The instruments are shared with the class. Students then work in groups to compose their own musical number which are performed for one another in the "Battle of the Bands."

Assessment Plan

Use the Science Journal Rubric to assess student entries for their experiments as well as their

explanations of how human vocal chords work.

Rubrics

Science Journal Rubric

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