

Physics of Music

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Physical Science Category
Specialist



ward's
science+

workshop overview

- Students learn Physics best when it is proven to be relevant in their lives.
- “When will we EVER need to know this???”
- Incorporate Physics lessons into something that all students enjoy...MUSIC!
- Topics include origin of sound, transfer of energy, waves, forced vibrations, pitch, frequency



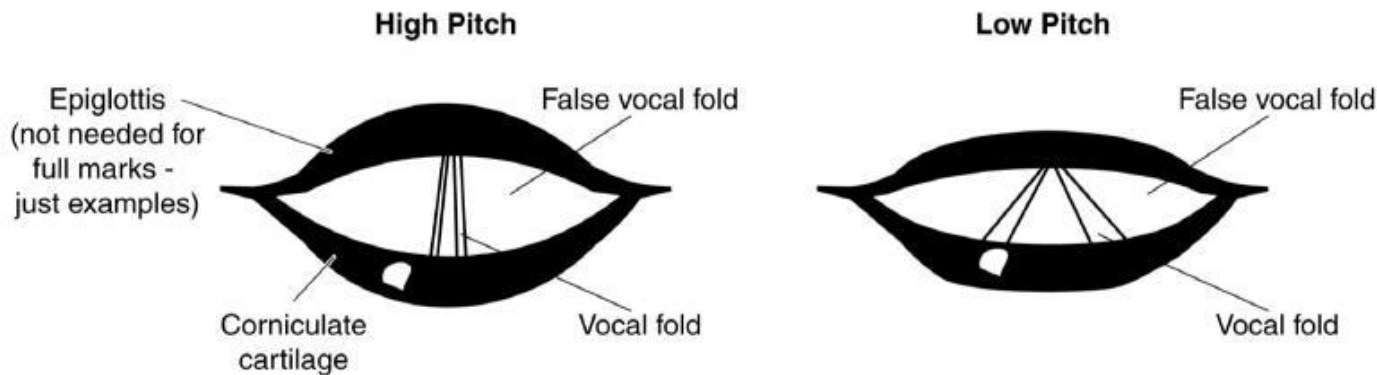
objectives

- Students will...
 - Compare high, medium, and low-pitched sounds
 - Define frequency in terms of vibrations per second
 - Understand that different frequencies produce different pitches
 - Relate the pitch of a sound to the physical properties of the sound source (example: pitch of a pipe is affected by length of the pipe)
 - Adjust the pitch of an instrument



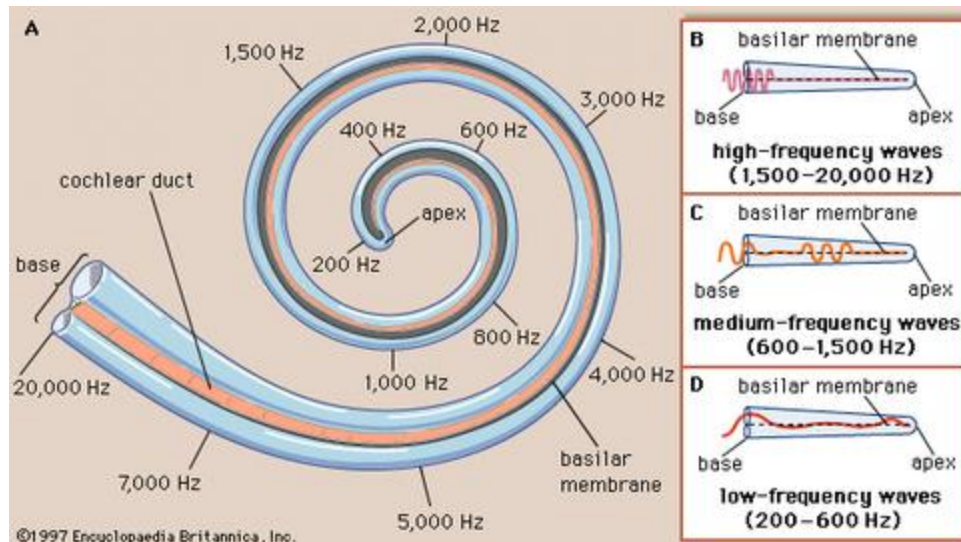
background

- All sounds are produced by vibrating objects. Your own voice is produced by the vibration of your vocal cords! These vibrations disturb the medium at which the waves travel (usually air) and waves of energy are produced and fill the air. The frequency of these sound waves is found by determining how frequently the object vibrates.



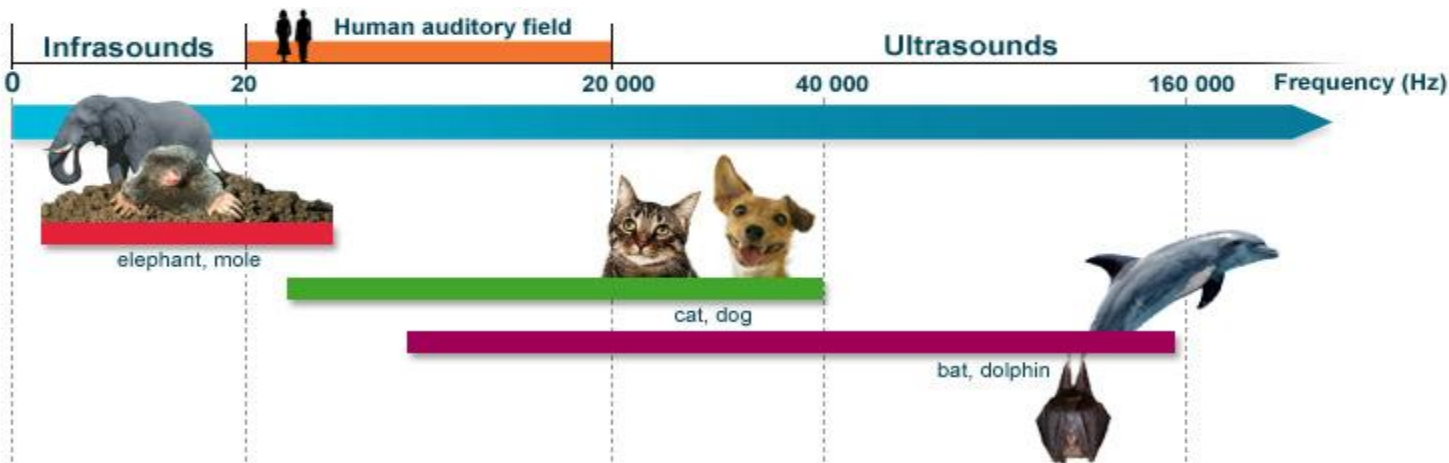
background

- When sound waves reach our ears, we perceive it as sound. The pitch is a descriptor of how high or low a sound is perceived. If an object vibrates at high frequency, the ear will receive many vibrations per second, corresponding to a *high pitch sound wave*. An object vibrating at low frequency is perceived as a low pitch.



background

- The unit of frequency is called the Hertz (Hz) named after Heinrich Hertz, who was the first scientist to demonstrate radio waves (1886).
- Humans can hear objects vibrating between 20 and 20,000 vibrations per second (20-20,000 Hz). Other animals can hear sounds of higher frequency (dolphins) or lower frequencies (elephants).



additional information

- Target Audience: K-12, depending on the activity performed
- Process skills used: basic observation, measurement of data, inference, classification, prediction



why resonance tubes??

- This lab activity uses resonance tubes to show the velocity of sound when it travels through the air in ordinary temperatures.
- The length of our resonance tubes is inversely proportional to the frequency of the sound produced. This means that a short resonance tube will create a high-frequency sound, and a long resonance tube will create a low-frequency sound!



Today's Activity: Battle of the Bands!

- Participants split up into “bands”
- Each band is responsible for performing a hit single
- Using the chart found on page # of your handout, band members will work together to label the resonance tubes appropriately.
- Use **teamwork and collaboration** to assign responsibility...
 - One performer per band?
 - One note per band member?
 - One line of music per band member?
- GET INTO IT! SING AND DANCE! HAVE FUN!!!!



Procedure

- Measure the various lengths of the PVC pipes and label them with their corresponding note. (Use data chart on page # of your handout)
- Practice playing your resonance tubes by holding them in one hand and bringing them down quickly onto the palm of your other hand. Let the end of the pipe make contact with palm.
- Classify pipes in order from low to high pitch for better understanding/organization. **HINT:** a shorter air column vibrates more rapidly throughout the tube, resulting in greater frequency, or, a higher note!
- **Please refrain** from smashing resonance tubes on tables, creating louder music; we have many bands in the same room and don't want to interfere with anyone's band practice!!!!!!



contact information

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thank you!

