Math and Science

Science in Our World: **Sound**

Use after enVisionMATH Lesson 1-4.

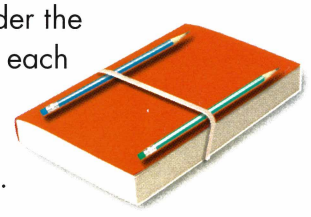
Different Pitches

When a guitarist plucks a guitar string, the string vibrates. These vibrations make a sound. Some sounds are higher, and some are lower. This is called **pitch.**

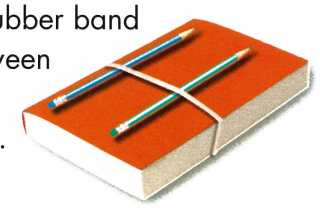
Make a Rubber-Band Guitar

What You Need

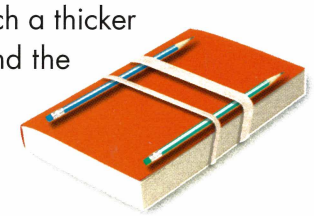
1. Stretch a rubber band around the book.
2. Insert a pencil under the rubber band near each edge so that the rubber band is lifted off the book.



3. Pluck the rubber band at any point between the two pencils. See how the rubber band vibrates between the pencils. Listen to the pitch.
4. Slide one pencil a little closer to the other. Pluck the rubber band at any point between the two pencils. Listen to the pitch.



5. Slide the pencil closer, again. Pluck the rubber band and listen. Do this several more times.
6. Slide the pencil backnear the edge of the book. Stretch a thicker rubber band around the book and pencils. Do not remove the first rubber band.



7. Pluck each rubber band and listen to the pitches. If you like, you may add more rubber bands with different thicknesses to your rubber-band guitar.
8. Tell how the pitch changed when you changed the length of the vibrating part of the rubber band.
9. Do the thick and thin rubber bands make the same pitch? Explain your answer.
10. Look at the picture of the guitarist.
    a. How do you think a guitarist can make different pitches with the same string?
    b. Why do you think the strings of a guitar have different thicknesses?

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Vibrations and Sound

A **vibration** is a back-and-forth motion. Sound is caused by vibrating objects. Air carries the vibrations to your eardrums and causes them to vibrate.

The human ear can only hear sounds that vibrate between 20 and 20,000 times per second. Animals can hear sounds that humans cannot hear. The table below shows the sounds animals can hear.

When there are more vibrations per second, the **pitch** of the sound is higher. When there are fewer vibrations per second, the pitch is lower.

Did You Know?

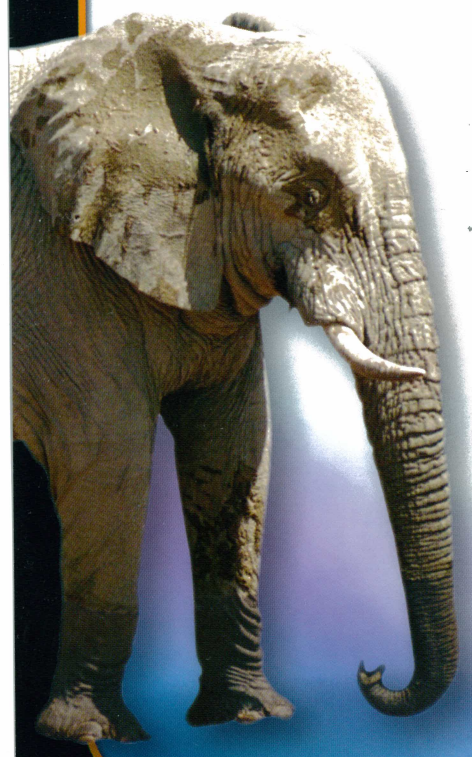
A dolphin uses sound to find objects. It sends very high sounds through the water. When the sounds hit an object, echoes are created. The dolphin listens to these echoes and can tell where the object is.

The dolphin is the Florida state salt-water mammal.

Show What You Know!

Solve each problem. Use the **What Do Animals Hear?** table.

1. Which animals hear sounds lower than what humans hear?
2. Which animals hear sounds higher than what humans hear?
3. Do dogs or cats hear higher sounds?
4. Which animal hears the highest sounds?
5. **Think It Through** When a vibrating object makes a sound, you might not see the vibrations.
   a. If you clap your hands, can you see your hands vibrate?
   b. If you pluck a guitar string, can you see the string vibrate?



Use the table. Which animal hears the lowest sounds?

Lower sounds are produced by fewer vibrations per second. Elephants can hear the fewest vibrations per second.

So, elephants hear the lowest sounds.

Data

What Do Animals Hear?

Animal	Lowest Sound Heard (Number of Vibrations per Second)	Highest Sound Heard (Number of Vibrations per Second)
Bat	2,000	120,000
Bird	200	20,000
Bullfrog	100	3,000
Cat	45	65,000
Dog	50	45,000
Dolphin	75	150,000
Elephant	5	12,000
Goldfish	20	3,000
Mouse	1,000	100,000
Parakeet	200	8,500
Shark	10	800

MA.4.A.6.1 Use and represent numbers through millions in various contexts, including estimation of relative sizes of amounts or distances.