

Energy and Sound: Loudness and Frequency

All of these actions involve energy. So another thing we can say about sound is that it takes energy to make something vibrate, so that it will produce a sound. But energy also has something to do with why sounds are different. The amount of energy used to create a sound, affects the loudness of the sound that is produced.

For example, let's say that I hit a bar of this vibraphone very lightly.

[SOFT DONG]

The sound that results is soft, but if I hit it harder--

[LOUD DONG]

--the sound is much louder. So what does this tell us? Well, it may mean that there's some connection between energy and the volume, or loudness--

[DONG]

--of a sound. To explore this idea further, you can do a simple experiment with a ruler.

[BOING]

Place one end of the ruler on the edge of a table or desk.

[BOING]

Now snap the ruler but use only a little force.

[SOFT BOING]

Observe how much the ruler vibrates, and listen to the sound it makes.

[SOFT BOING]

Now snap the ruler again but with much more force.

[LOUD BOING]

The ruler vibrates up and down more and it makes a louder noise. So it seems that a greater force, or input of energy, will produce a larger vibration and a louder noise.

[LOUD BOING]

But a weak energy input will produce a sound that is soft.

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[SOFT BOING]

Perhaps so soft that we can't hear it.

There are other reasons why vibrations don't always result in sounds that we can hear. Try shaking your hand back and forth. Obviously, even though your hand is vibrating, there's no sound. Why? We can't hear sounds from things that vibrate too slowly.

Even if you move your hand back and forth as quickly as possible, you might manage to make it vibrate three or four times a second. And we humans can't hear anything that vibrates less than 20 times a second. The number of times something moves back and forth each second, that is how often it vibrates, is called frequency. Frequency is measured in units called hertz, which is abbreviated as hz.

So since your hand can vibrate at a rate of say three times a second, we would say that it has a frequency of 3 hertz. While we can't hear things that vibrate too slowly, we also can't hear things that vibrate too quickly, or over 20,000 times a second. Well, you may be saying, if we can't hear it then there's no sound, right? Well, not exactly.

There are special whistles, for example, that produce frequencies of over 25,000 hertz. If you blow such a whistle, you won't be able to hear anything, but a dog will hear the whistle easily. Let's look at some sounds that we can hear, and see what frequencies they have.

[BOOMING]

Thunder has a frequency that's under 100 hertz. A telephone ringing--

[RINGING]

--has a frequency of around 300 hertz. The sound of a tea kettle whistling--

[WHISTLING]

--has a still higher frequency, somewhere in the range of 2,000 to 3,000 hertz.
