***ACTIVITY IDEAS BY SCIENCE CONCEPT***

VIBRATIONS

* Tuning fork vibration exploration – How does force relate to volume? How does size relate to pitch? How does a tuning fork make sound?

RESONANCE

* Hum Drum activity – bowl begins to resonate by humming, vibrating bowl makes salt ‘dance’ that is different motion than blowing salt (wind moving air vs. vibration of air)
* Grandpa John Resonating Tuning Forks Video Clip – Demonstrates how one tuning fork can vibrate a ‘twin’ across a distance without touching (resonance)

MAKING AND SENSING SOUNDS IN THE BODY

* Vocal Chord & Ear Drum Readings – How do we make sound when we talk and sing? What parts of our body help us make loud sounds? (vocal chords, diaphragm) How do we hear sounds?

**ENERGY**

* **“Sound is Energy” – The force of sound; What does ‘volume’ mean?**

DISTANCE

* Hallway Investigation – Volume of sound decreases over distance

TRAVELS THROUGH A MEDIUM

* Recess Ball Bounce Observations – Sound of bouncing ball travels in all directions, can feel vibrations in floor, echo off walls; volume decreases with distance
* Sound in the Ground – Listening through tables, doors, and floor for sound. How does sound travel?

Amended Notes:

* At a 4th grade level, we did not plan to go into the level of molecule movement. However, students brought up the idea of particles so some small group discussions focused on the idea of particles.
* From eliciting student ideas, students understand that flexing causes items to break (i.e. one student showed how flexing his gum wrapper would tear like the glass did in the video by moving back and forth around a point.)

***STANDARDS***

Unit Title: Sound Energy

Grade: 4th

NGSS:

4-PS3-2: Make observations to provide evidence that energy can be transferred place to place by sound

AAAS 2061 Sci Benchmarks

By end 8th:

* Something can be "seen" when light waves emitted or reflected by it enter the eye—just as something can be "heard" when sound waves from it enter the ear.4F/M2
* Vibrations in materials set up wavelike disturbances that spread away from the source. Sound and earthquake waves are examples. These and other waves move at different speeds in different materials. 4F/M4

***EXPLANATION OF THE BIG IDEA***

***Phenomena***: Singer shatters wine glass

***Essential question****:* Why was the singer able to shatter the glass?

***Explanatory Model***:

**Sound energy is closely related to mechanical energy. When an object vibrates, such as vocal chords, the vibrations push the surrounding molecules** inevery direction**.** A medium is composed of molecules and can be solid, liquid, or gas. A medium is necessary for sound energy to be moved from one place to another because the sound travels by pushing molecules into each other in all directions emanating from the source, like dominoes. Each sound has properties like frequency and volume. Higher pitch sounds have higher frequency. This means that the vibration is pushing surrounding molecules in pulses at a high rate over time. If it also has high volume, then the vibration pushes the molecules harder at that rate. For low pitch, the sound wave has lower frequency. This means that the vibration is moving molecules at a slower rate (more time between pushes). Again, more volume is a push with more energy and the vibration will be larger but the rate of vibration will stay the same if it is the same pitch.

The singer uses muscles to make his vocal chords vibrate. The vibrating vocal chords push air molecules that are all around us and inside our trachea and lungs. The push is not constant, but pulsing (compression wave). These vibrations travel through air. Air molecules do not move across space but rather they push against neighboring air molecules. This domino effect eventually pushes air molecules into our ears. We hear these vibrations as sound. Our eardrums vibrate at the same rate as the original vibration so we can hear him (and feel if loud enough) singing the note. When the singer hits the particular note, the wine glass begins to vibrate, too. The singer listens to hear if the glass is making noise, too (resonating).You can find this note by tapping the glass or running your finger around the edge. The closer the singer is to this pitch, the more the glass vibrates. Then as the singer increases his volume on that same pitch, the wine glass really vibrates. The glass is flexing and wobbling. Air molecules are always bumping against the inside and outside of the glass. The glass flexes because air molecules bump into the outside of it with more force than usual (extra force comes from sound wave). The glass will stay together through a little bit of wobbling, but over time the flexing back and forth will break the glass. So the shape of the glass is important. The wine glass is thin and round. The tiny stem does not absorb a lot of the vibrations. A thicker glass could absorb the sound vibrations and would not wobble or flex as much so it wouldn’t break. The glass also has to be empty. The empty glass will flex and wobble at a certain pitch. However, if there were water in the glass, the water would help the glass keep its shape. The water would push on the sides of the glass and keep them from wobbling or breaking. The sound would travel through the water, too. Sound is a form of energy. Sound energy is all about vibrating air, water, wood, whatever material the vibration/mechanical motion is near.