Chapter 11 Study Guide

Physical Science—Waves and Sound

1. Waves and Energy
   1. Wave terminology
      1. Wave—a periodic back-and-forth motion or oscillation that transmits energy
      2. Medium—the substance through which a wave transfers its energy
      3. Types of waves
      4. Transverse waves—waves which oscillate at right angles to the direction of wave travel
         1. Crests-- High points in a wave
         2. Troughs—Low points in a wave
      5. Longitudinal waves—particles oscillate in the direction of the wave travel
         1. Compression pulse—area in which particles are compressed together
         2. Rarefaction pulse—area in which particles are spread out
   2. Wave attributes
      1. Wavelength—(λ) the length of a single wave
      2. Amplitude—a measure of how tall a wave is or how compressed it is; this determines how much energy a wave has or how strong it is
      3. Frequency—the number of waves that pass a fixed point in a certain amount of time; the SI unit for frequency is the *hertz* (frequency=number of wave cycles/t
      4. Speed—the rate of speed at which a wave travels (velocity=wavelength x frequency)
   3. Wave behavior
      1. Reflection—a change in direction that occurs when waves bounce off of an object
      2. Refraction—the “bending” of a wave due entering a different medium
      3. Diffraction—the spreading out of a wave after it passes through a narrow opening
      4. Interference—the reinforcement or cancellation that occurs when two or more waves collide with each other
         1. Constructive
         2. Destructive

## Noise-canceling technology:

* Phones and computers: <http://www.economist.com/node/15495918>
* Cars: <http://www.nydailynews.com/autos/ford-honda-noise-canceling-tech-new-cars-bmw-porsche-bring-noise-boosting-features-article-1.1168670>

1. Sound Waves—vibrations travelling through a **medium** in the form of longitudinal pressure waves
   1. Intensity—the strength of a sound wave;
      1. The intensity of sound is inversely proportional to the square of the distance
      2. Loudness--the way that we perceive the intensity of sound
      3. Decibel—the unit for the intensity of sound
   2. Pitch—the “highness” or “lowness” of sound is determined by the frequency of the sound
      1. Audible sound
      2. Infrasonic—below the range of the human ear
      3. Ultrasonic—above the range of the human ear
      4. The Doppler effect—change in frequency of sound due to an object’s motion
   3. Speed of sound—speed travels about 346 m/s or 774 mph at average temperatures
      1. Sound travels faster at hotter temperatures and slower at colder temperatures
      2. Sound travels about 4x faster in water and 15x faster in steel than in air
      3. Supersonic—speeds above the speed of sound
      4. Subsonic—speeds under the speed of sound
      5. Shock wave—a violent compression pulse that produces a strong physical vibration and a loud noise called a sonic boom
2. Behavior of Sound Waves
   1. Reverberation vs. echo—reverberation is the term used for any reflection of sound; an echo is specifically an sound that is reflected distinctly enough to be recognized
   2. Sonar—using sound to create images
   3. Absorption—the process of dissipating the energy of sound waves
   4. Acoustics—the study of sound
   5. Refraction, diffraction, and interference—all of these behaviors apply to sound waves
3. Music—a series of organized sound waves with specific pitches that have been deliberately arranged
   1. Difference between noise and notes: random noise vs. noise with a definite pitch
   2. Interference in music
      1. Consonance—when two notes interfere harmoniously
      2. Dissonance—two notes interfere in a disagreeable way
      3. Interval—the distance between two notes
      4. Beats—pulses of increased volume that occur when two notes of almost the same frequency create periodic moments of constructive interference
      5. Overtones—the range of pitches that an instrument or voice produces
         1. Fundamental—the most dominant pitch that an instrument produces, usually the lowest frequency
         2. Timbre—the distinctive sound that results from each instrument’s unique set of overtones
      6. Resonance—the amplification that occurs when sound waves build on each other in an enclosed space
   3. Musical instruments
      1. Strings
         1. Piano
         2. Violin
      2. Winds
         1. Organ
         2. Brass—trumpet, French horn, tuba
         3. Woodwinds—flute, clarinet, oboe
      3. Percussions
         1. Drums
         2. Bells