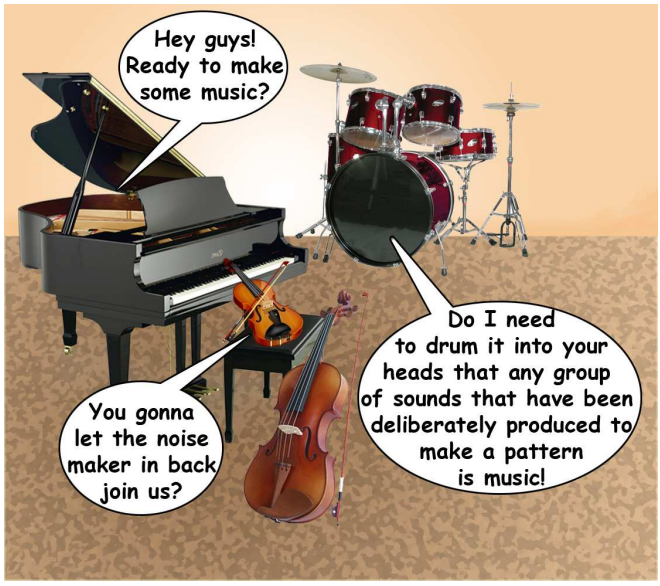
Physics: Form WS8.6.1A Name _____

SOUND Date _____ Period _____

# The Sound of Music




From classical music to hip hop, a wide array of genres are considered music. By definition, music is a group of sounds that have been deliberately produced to make a pattern. The definition does not leave room for taste or preference in its application. Music is sound, and as such, it is caused by vibrations. Musical instruments are objects that vibrate to produce the desired sound. Different objects vibrate at different frequencies depending on the size, shape, and material of which they are composed. The frequencies at which an object will vibrate are called its **natural frequencies**. Many objects vibrate at one or more natural frequencies when they are struck or disturbed. Musical instruments use the natural frequencies of strings, columns of air in pipes, or drum heads to produce different notes. **Resonance** occurs when an object is made to vibrate at its natural frequencies by absorbing energy from a sound wave or another object vibrating at these frequencies. Musical instruments use resonance to amplify sound. The combined vibrations of the sound source and other parts of the instrument vibrating at the same frequency produce a wave with a greater amplitude. For example, the strings are the sound source for a guitar or violin, but the body of the instrument plays an important role in the sound we hear when the strings vibrate. Most objects have more than one natural frequency. As a result they produce sound waves of more than one frequency. Some objects, such as tuning forks, produce a single frequency known as a **pure tone**. The lowest frequency produced by a vibrating object is the **fundamental frequency**. The fundamental frequency is the note that you hear. The vibrating object also produces higher frequencies. The higher frequencies are called **overtones**. Overtones are integral multiples of the fundamental frequency. The number and intensity of the overtones give each musical instrument its unique sound. Musical instruments produce notes that are parts of a musical scale. A musical scale is a sequence of 8 notes (an octave) with certain frequencies. The frequency doubles after the eight successive notes of the scale are played.

**Answer the questions below based on the reading above and on your knowledge of physics.**

1. People may disagree about what *good* music is but the definition of music from the point of view of physics is not a matter of taste. Why? _____

   _____

   _____

2. The strings of a guitar are tuned to six different notes. What two **bold-faced** terms above could be used in place of the word “notes?” _____

   _____

(Continued on the next page.)

3. What role does resonance play in the way musical instruments function? _____

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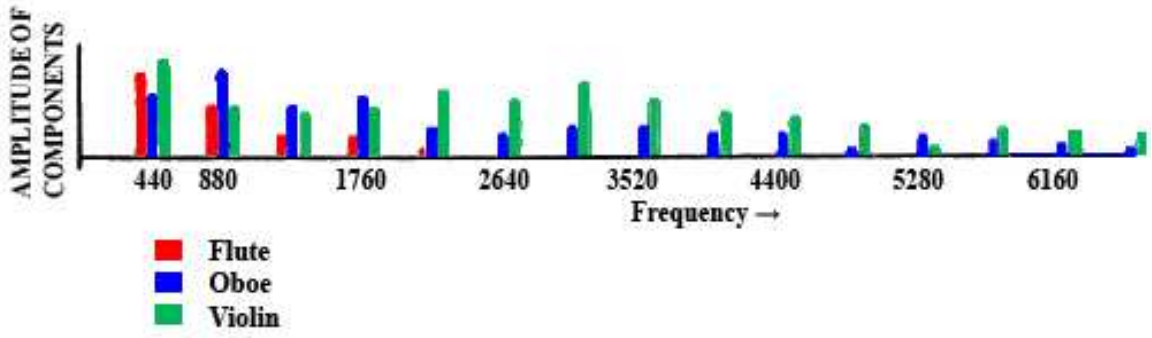
4. Refer to the graph below showing the amplitude of the harmonics for different instruments playing the same note:




a. How does the graph show that all the instruments are playing the same note? _____

_____

b. If all the instruments are playing the same note, why do they sound different? _____

_____

_____

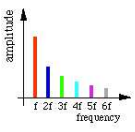
5. The note *middle C* has a frequency of approximately 262 Hz. What is the frequency of the note *C*:

a. 1 octave higher? _____

b. 2 octaves higher? _____

6. The wave form of a pure tone looks like a sine wave, but the wave form a sound with overtones is often a saw toothed wave. (See below.)

a. What happens to the amplitude of the overtones as frequency increases? _____

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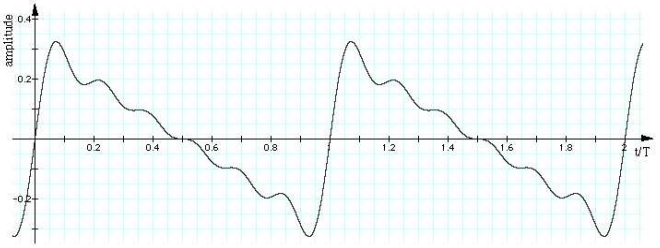


b. What causes the saw toothed wave form?

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