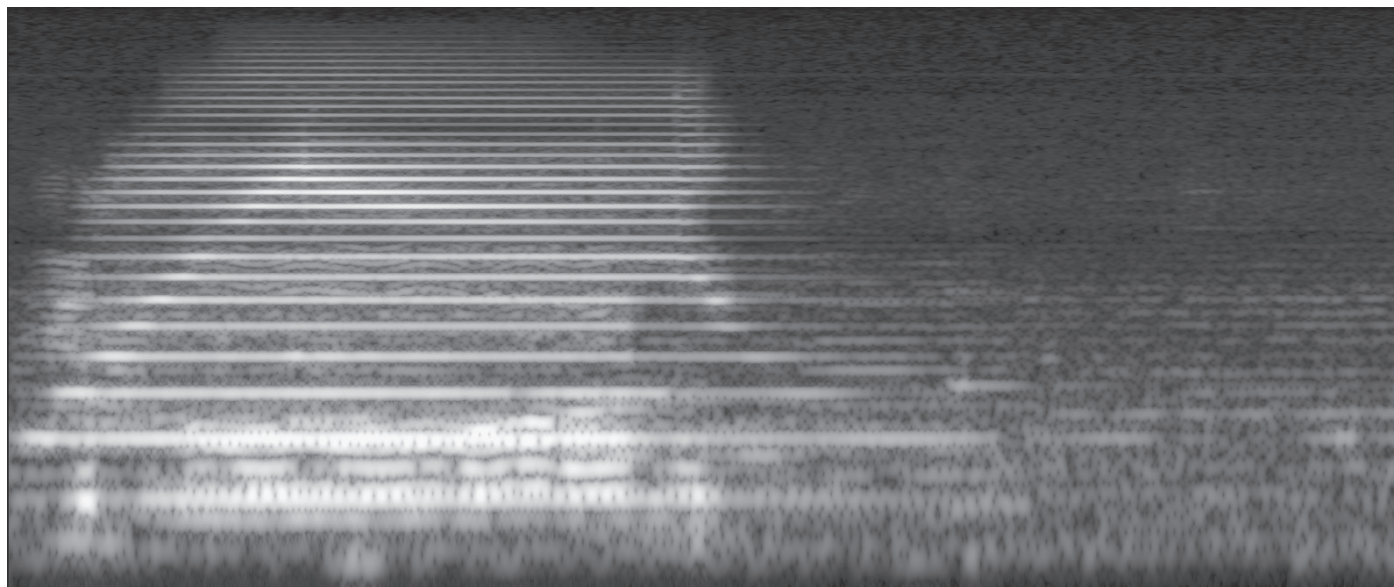


Handout - Spectrum



A spectrogram

With the exception of electronically produced “pure tones,” musical instruments and other objects produce more than one frequency at the same time. This is because when activated, they often vibrate at different rates. Imagine striking a cymbal: the outer edges of the cymbal will vibrate at a different rate than the center of the cymbal, thus producing multiple frequencies. Furthermore, because sound waves bounce off of different materials in different ways and interact with one another, the construction of the instrument plays a large role in which frequencies it produces are emphasized. This is partly why two acoustic guitars will never sound exactly the same - every aspect of their construction influences what frequencies the instrument produces.

The range of frequencies an instrument or object produces is known as its **Spectrum**. A sound’s spectrum is measured by the amplitude of every frequency the sound produces. Often this is represented by **spectrogram**. The harmonic series of an instrument can be adjusted electronically through an equalizer, which can adjust the volume of only particular frequency ranges, rather than the sound as a whole.

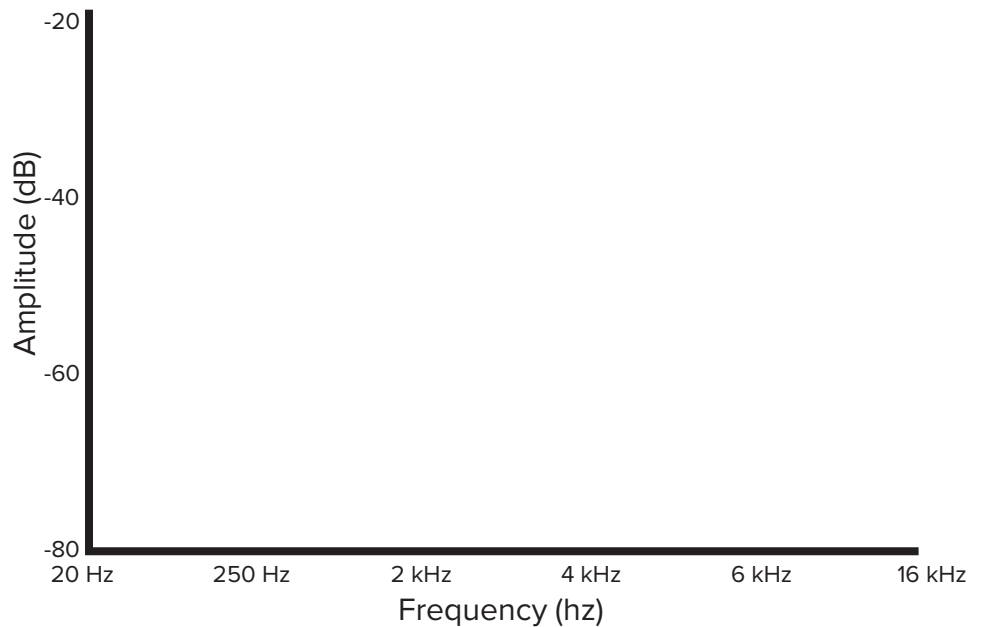
Algebra Featuring Mickey Hart Graphing Activity:

Because there are essentially an infinite number of frequencies possible in a sound, audio engineers often examine and manipulate a range or “band” of frequencies within a sound. The most common 6 frequency bands are: Sub-Bass (16-60 Hz); Bass (60-250 Hz); Low Mids (250-2000 Hz); High Mids (2000-4000 Hz); Presence (4000-6000 Hz); and Brilliance (6000-16000 Hz).

Plot the frequency information below for each instrument in the provided chart to create a spectrogram of the instrument.

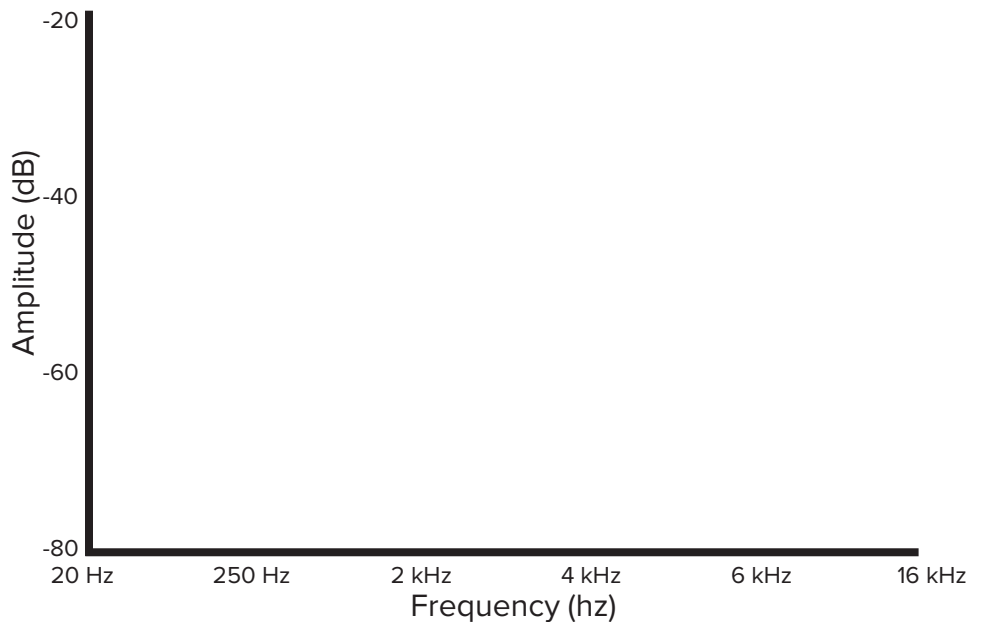
Cymbal

Frequency	Average dB
Sub-Bass (16-60 Hz)	-62
Bass (60-250 Hz)	-53
Low Mids (250-2000 Hz)	-40
High Mids (2000-4000 Hz)	-44
Presence (4000-6000 Hz)	-33
Brilliance (6000-16000 Hz)	-64



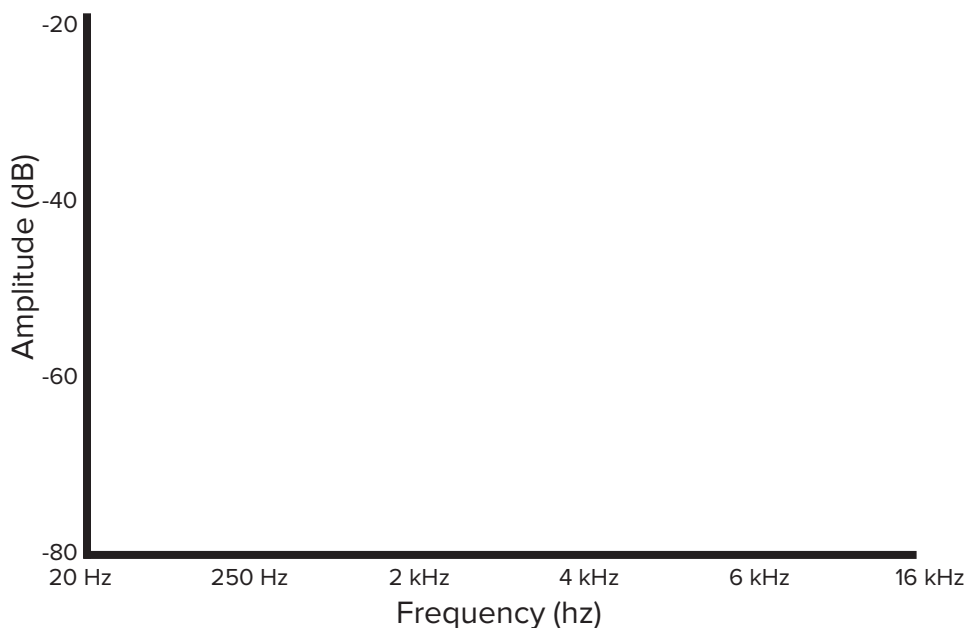
Piano

Frequency	Average dB
Sub-Bass (16-60 Hz)	-58
Bass (60-250 Hz)	-52
Low Mids (250-2000 Hz)	-40
High Mids (2000-4000 Hz)	-38
Presence (4000-6000 Hz)	-55
Brilliance (6000-16000 Hz)	-70



Saxophone

Frequency	Average dB
Sub-Bass (16-60 Hz)	-59
Bass (60-250 Hz)	-44
Low Mids (250-2000 Hz)	-39
High Mids (2000-4000 Hz)	-46
Presence (4000-6000 Hz)	-51
Brilliance (6000-16000 Hz)	-68



Bass Guitar

Frequency	Average dB
Sub-Bass (16-60 Hz)	-37
Bass (60-250 Hz)	-36
Low Mids (250-2000 Hz)	-52
High Mids (2000-4000 Hz)	-59
Presence (4000-6000 Hz)	-63
Brilliance (6000-16000 Hz)	-67

