

INTONATION CHARTING GUIDESHEET

An effective way to determine how well you play in tune is to chart your intonation with an electronic tuner such as the Peterson audio/visual tuner or the Korg chromatic tuner. Electronic tuners are highly accurate measuring devices that show deviation in pitch in relationship to an internal standard based on equal temperament – a compromise system of tuning in which the octave is divided into 12 equal semitones. The scientific unit of measurement used to calculate deviation in pitch is a “cent”. (Be sure that you do not confuse cents with frequencies or vibrations per second if the electronic tuner you are using shows both.) A cent equals 1/100th of a semitone. A semitone or half step equals 100 cents. The chromatic scale contains 1200 cents – C to C# = 100 cents, C# to D = 100 cents, and so on. A pitch that registers five or more cents sharp or flat on an electronic tuner is likely to be heard as being out of tune.

- Preparation:**
1. Thoroughly familiarize yourself with the electronic tuner that you will be using. Read the operating manual or ask your teacher for guidance.
 2. Read and follow the *General Procedures for Tuning the Instrument* given in the Tuning Guide for your instrument.
 3. Have the Intonation Chart for your instrument ready. The chart includes the chromatic scale (middle, low, and high registers), basic major and minor scales, and (for some instruments) random notes in various registers to check the pitch tendencies of different dynamics and mutes.

It is best to chart your intonation with a friend who will be your assistant. He or she operates the electronic tuner and records the intonation on the chart. *You should not look at the scope or meter while playing because this is likely to affect the accuracy of the charting.*

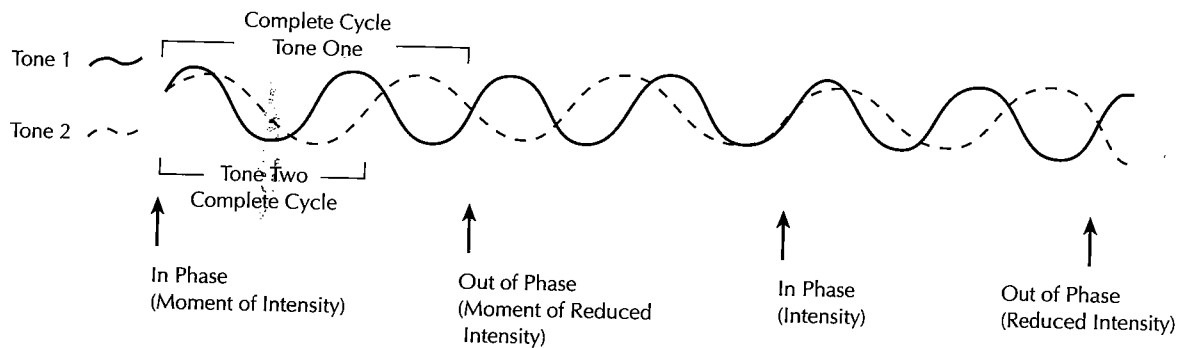
- Procedures:**
1. The first time through a scale, record the general intonation tendency of each pitch:
 (+) = sharp (0) = in tune (-) = flat
 2. The second time through a scale, record the degree of sharpness or flatness. For example: - 4, + 9, or 0 (in tune). To determine the precise deviation of pitch in cents on some electronic tuners, it is necessary to turn the cents knob and pointer in the same direction as that of the rotating disc until the disc is stabilized; then record the number indicated by the pointer. After recording the pitch deviation, return the cents knob back to zero before proceeding to the next note. With some hand held or portable tuners, one need only read and record the cents number to which the needle or indicator light is pointing.

Intonation charting takes time to complete. Familiarity with the process through repeated chartings will reduce the amount of time needed to complete the task. Please note that completion of the intonation chart provided for your instrument is only a beginning. To become proficient at playing in tune, you should periodically (quarterly or at least biannually) chart the intonation of *all* major and minor scales throughout the entire range of your instrument. Keep completed charts in a reference notebook or portfolio so that you can monitor progress.

NOTES ON ACOUSTICAL BEATS

The acoustical phenomenon resulting from the interference of two sound waves with slightly different frequencies is called beats (see illustration below). Acoustical beats are heard as small, yet clearly audible, intensifications of sound at regular intervals of time—a “wah” “wah” “wah” or pulsating effect. The presence of beats in two or more tones indicates faulty intonation. The number of beats occurring per second indicates the degree of faulty intonation. For example, a tone with a frequency of 440 vibrations per second and another tone with a frequency of 444 vibrations will produce exactly four acoustical beats or pulsations per second. When the sound waves of the two tones coincide (are in phase), they reinforce each other and produce a louder sound. When the sound waves are out of phase, they produce a partial cancellation of sound.

Sine Wave Diagram Illustrating Acoustical Beats



Beatless Tuning

The process of correcting faulty intonation in ensemble performance involves the constant listening for the presence of acoustical beats and quick elimination of the pulsations by adjustment techniques. Once beats are heard, you must determine if you are sharp or flat to the other player(s). If you are not sure, slowly start adjusting the pitch upward or downward using a physical and/or mechanical technique that is appropriate for your instrument and the note being played. If the beats begin to get faster, you are going in the wrong direction, reverse the adjustment. As soon as the sound becomes clear or resonant (beatless), you are in tune.

The beat elimination process just explained is a performance skill. Performance skills are mastered through diligent practice. You should practice using the mechanical and physical techniques for adjusting pitches while playing so that you will become proficient at eliminating acoustical beats in performance.