NAME: _____, Sect. #_____

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Exam 2 (Monday, November 5) covers Pipes, Fourier Analysis, Scales, Instruments. Exam location same as last exam.

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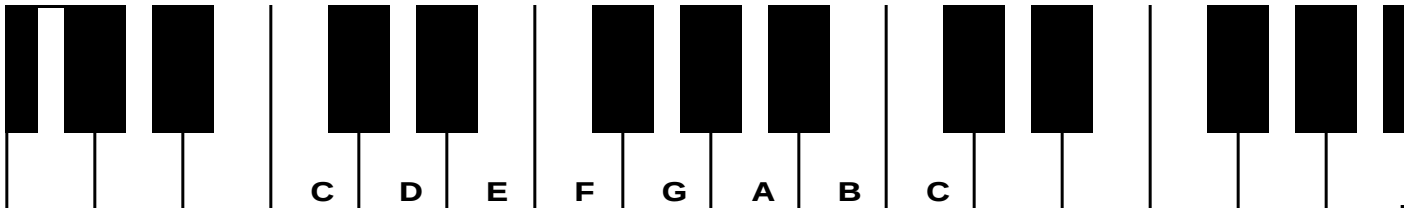
Physics 109 **Homework #7** due Monday Oct. 29, 2001



Just scale: 1 9/8 5/4 4/3 3/2 5/3 15/8 2

Tempered semitone ratio: 1.0595

Note: the names of intervals remain the same when you go from just to tempered tuning. Top find names of intervals you need NOT calculate the frequency ratio, but instead count the number of semitones. For instance, an interval of four semitones (two whole tones) is called a major third no matter what. Only if you want to know if it is a JUST interval, you need to check the actual frequency ratio, which would have to be 5/4 to be called a just major third.

Reminder: for strings and pipes: frequency is lower for larger length (in inverse proportion)

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1. The six strings of the guitar are tuned to E_2, A_2, D_3, G_3, B_3, E_4. Name the intervals between adjacent strings (NO calculation needed - instead look at keyboard and count semitones)

   intervals are : _____, _____, _____ ,_____ ,_____

2. Are the whole tone intervals all the same in just tuning? In tempered tuning? compare C-E and D-E.

   just tuning (work here):

   tempered (think rather than calculate!)

3. A 60 cm long guitar string is tuned to E_4. Where must I place a fret (i.e. how much must the string be shortened) to play a fourth above E? (Hint: the frets are adjusted for tempered tuning. First you need to get the frequency ratio for a tempered fourth - find the number of semitones and make use of semitone ratio. Then you relate frequency ratio to length ratio) See example done in lecture.
work here:

the frequency ratio for the tempered fourth is _____

the new string length is _____

What is the tone called? _____

4. A viola string is 80 cm long and is tuned to G_3. What tone will the string sound when the musician reduces the oscillating length to 60 cm by pressing a finger on the fingerboard? (hint: what is the length ratio? what is the frequency ratio? What interval does this ratio represent?) See example done in class.

what is the tone for 30 cm vibrating length?

5. Assume that the vibrating length of the air column in a brass instrument is 150 cm. Pressing a valve adds a certain length to the air column as explained in lecture. How many cm length should be added to the air column to lower the pitch by one tempered semitone? (hint: from the frequency ratio of the two tones, find the length ratio. Then find new length for the lower tone)