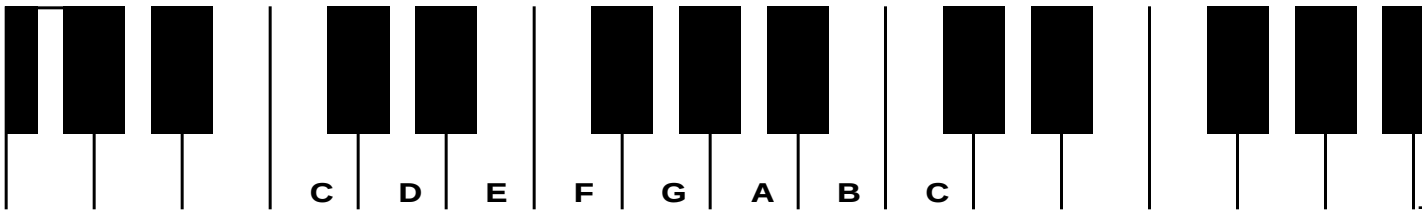
NAME: _____, Sect. #_____

Physics 109 **Homework #6** due Monday Oct. 22, 2001



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

Reminder: for the next octave above, you would need to multiply all the numbers by two. For the next octave below, you would need to multiply at the numbers by 1/2.

Reminder: to divide by a fraction, you multiply by the reciprocal.

Reminder: the freq. ratios 5/4 and it's reciprocal 4/5 represent the same interval

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1a) **Standard A = 440 Hz is called A_4.** One octave above is called A_5 etc.

What is the frequency of A_5 ? _____ What is the frequency of

A_6, two octaves above A_4 ? _____

What is the frequency of A_2 two octaves below A_4 ? _____ Hz

b) A tone is said to be "a fifth" above the other, when it's frequency is (3/2)-times greater. What is the frequency of a tone a fifth above A_4 ? _____Hz

what is the name of this tone? _____

What is the frequency of a tone a fifth below A_4 ? _____

show work:

what is the name of this tone? _____

2) In just tuning, if **A_4** is tuned to 440 Hz, to what frequency should D_4 be tuned? (Hint: first find the frequency ratio between the two tones in the just scale)

$f(D_4)$ = _____Hz

3. This exercise shows that in the so-called just tuning not all intervals are just ("just" means a simple number ratio like 3/2 = 1.500)

interval C_4 - G_4 has a frequency ratio _____. Is it "just"? _____

work here:

interval D_4 - A_4 has a frequency ratio _____. Is it "just"? _____

work here:

interval G_4 - C_5 has a frequency ratio _____. Is it "just"? _____

what is this interval called? _____

4. If you start on G_4 = 3/2 (relative to C_4 = 1) and ascend (i.e. go up in frequency) by a fifth, what frequency do you get to (relative to C_4 =1) ? _____

what is the name of this tone? _____.

If you go another fifth, what frequency ratio do you get to? _____

what is the name of this tone? _____.

5. The bugle and the trumpet played in Bach's time have no keys, and thus play only the "natural scale" i.e. frequencies which are multiples of the fundamental. Suppose the trumpet plays C_1 in the fundamental mode, what other notes can you play? Mark an **X** when a mode does not fit into the just scale.

mode: 1 2 3 4 5 6 7 8 9 10

tone C_1 , C_2 , ____ , ____, ____ , ____ , ____ , ____ , ____ , ____

(hint: go down from the higher modes in octaves (multiply by 1/2) until you can identify the tone on the just frequency table given on top of this homework. Then decide what the tome is called).

work here: