Physics 105 - Sound and Music - Homework Review questions:2

1. What is the intensity range between the threshold of pain and the threshold of audibility?
ans: 10^{-12} Watts/meter^2 to 1 Watt/meter^2
2. What is the frequency range between the highest and lowest frequencies we can hear?
ans: 20 Hz to 20,000 Hz
3. What physical parameter is mainly responsible for pitch?
ans: frequency
4. What is a logarithm?
ans: The power to which 10 must be raised to give the number.
5. What reference level is used to measure sound intensity level?
ans: $I_o = 10^{-12}$ Watts/meter^2
6. What is the basic unit in most musical scales and what frequency ratio does it represent?
ans: The octave with frequency ratio 2:1
7. What is the frequency of A_4, according to the International pitch standard?
ans: 440 Hz
8. What pitch will generally be heard when overtones of 800, 1000, and 1200 Hz only are present in the tone?
ans: the virtual pitch of 200 Hz(missing fundamental)
9. What is the maximum number of beats between two tones that can be heard?
ans: about 10 Hz
10. What are the two most consonant musical intervals and what are their frequency ratios?
ans: The octave with frequency ratio of 2:1 and the perfect fifth with frequency ratio of 3:2
11. Define musical scale.
ans: a sequence of tones or notes arranged in ascending or descending pitch usually within any octave
12. What frequency ratio gives an interval of a perfect fourth?
ans: The frequency ratio of 4:3 gives an interval of a perfect fourth.
13. What two intervals (in order from lowest note) are found in a major triad?
ans: major third plus a minor third
14. What two intervals (in order from lowest note) are found in a minor triad?
ans: a minor third plus a major third
15. Write out definitions for the following:

critical band: *a band of frequencies that causes a large overlapping response to the cells of the basilar membrane.*

decibel: *The unit of loudness level defined as 10 log (I/I_o) or 20 log (P/P_o)*

intensity: *The power per Area of sound waves.*

intensity level: *10 log (I/I_o), where I is intensity and $I_o = 10^{-12}$ W/m^2*

sound power leve1: *10 log (W/W_o), where W is sound power and $W_o = 10^{-12}$ W*

sound pressure leve1: *20 log (p/p_o)* , where p = sound pressure and $p_o = 2 \times 10^{-5}$ N/m^2

harmonic: *A whole number (integer) multiple of a fundamental frequency.*

octave: *Two tone interval with a frequency ratio of 2:1*

partial: *Any frequency component of a complex tone (includes fundamental or any overtone).*

pitch: *The audible sensation of highness or lowness of a tone*

virtual pitch: *The pitch of a complex tone at the frequency of a missing fundamental.*

spectrum: *A recipe listing the amplitudes and frequencies of the components of a complex vibration.*

timbre: *The quality of a tone which makes it different from another tone of the same pitch*

beats: *An amplitude modulation arising from sounding two tones together whose frequency differs by less than about 10 Hz.*

semitone: *On the tempered scale, a frequency interval having a frequency ratio of 1/12 of an octave. or* $2^{1/12}$ *or 1.0594...*

cent: *On the tempered scale, a frequency ratio of 1/100 semitone. or* $2^{1/1200}$ *or 1.000578.*

scale: *See answer to question 11 above*

major diatonic scale: *A seven tone scale with frequency ratios corresponding to those of the white keys of a keyboard from C to C.*

chromatic scale: *A scale consisting of 12 semitones.*

pentatonic scale: *A scale made up of 5 tones. Usually with frequency ratios corresponding to the black keys of keyboard*

pythagorean tuning: *The tuning of scale notes based on perfect fourths and fifths.*

just tuning: *The tuning of scale notes using ratios of low integers where major triads have frequency ratios of 4:5:6*

tuning of equal temperament: *A tuning in which each semitone is represented by a frequency ratio equal to 1/12 octave or* $2^{1/12}$.

triad: *Three tones sounded together consisting of intervals of major third and minor third.*