

### 03 Objectives, equations and vocabulary-Sound

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| $f = 1/T = \text{cyc/sec}$<br>$v = f \lambda$<br>$x = v t$<br>$2^{(1/12)} = 1.05946$<br>$A_0 = 27.5 \text{ Hz}$ | $M = V_0/v_{\text{sound}}$<br>$v_{\text{sound}} = 331 + 0.6T(^{\circ}\text{C})$<br>$v_{\text{sound}} \sim 340 \text{ m/s}$<br>$e = 1.60 \times 10^{-19} \text{ C}$<br>$k = 9.0 \times 10^9 \text{ Nm}^2/\text{C}^2$<br>$Q = ne$ | $V = W/q = J/C$<br>$i = \Delta Q/\Delta t$<br>$\Delta V = i R$<br>$P = E/t$<br>$P = iV$<br>$P = V^2/R$ | $I \Delta$ inversely with $r^2$<br>$\Delta: +10 \text{ dB} = 2x \text{ Vol} = 10x I$<br>$\text{Beats} =  f_1 - f_2 $<br>$\text{Series } R_e = R_1 + R_2$<br>$\text{Parallel } 1/R_e = 1/R_1 + 1/R_2$<br>$N_1/V_1 = N_2/V_2$ | $F = k \frac{q_1 q_2}{r^2}$<br>$E = \frac{F}{q} = \frac{kq}{r^2}$ |
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#### **Waves:**

*Students should understand the objectives below well enough to apply them to novel situations.*

1. The student understands vocabulary and objectives from previous units.
2. The student understands all vocabulary, demos and class discussions.
3. The student understands the concept of fundamental frequency and harmonics as they relate to music and the human voice
4. The student can apply the wave speed equation with harmonics for closed-closed systems (strings, etc.)
5. The student understands and can apply the Western Musical System including note notation as is shown on a piano scale
6. The student understands changes in  $f$  between harmonics and octaves and which is man made
7. SK: Using only a calculator and a blank piece of paper, the student can produce a particular note using their voice. The student gets to pick which octave.
8. The student has a practical understanding of the dB scale including normal and extreme values in real world situations
9. The student can apply changes in  $r$  with corresponding changes in any sound amplitude measure used and any amplitude change converted to any other system
10. The students knows about hearing loss development, especially that it is usually irreversible and the role improper use of ear buds can play
11. The student knows how a tuning fork can be used to tune a piano or guitar
12. SK: The student can use their voice to produce a decibel reading based upon their distance from a decibel meter. In other words, the student gets to choose how loud they want to be and the location from which they make their sound.
13. PR: The student can create a musical instrument that produces at least three notes and optimal sound amplitude and can demonstrate this in a public recital and presentation including an Audacity paper printout and an analysis of one of the notes during recital

#### New Vocabulary list

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| <ol style="list-style-type: none"> <li>1. Sound</li> <li>2. Beats</li> <li>3. Harmonics</li> <li>4. Timbre</li> <li>5. Fundamental (frequency)</li> <li>6. Note</li> <li>7. Western Musical System</li> <li>8. Octaves</li> <li>9. Closed-closed</li> </ol> | <ol style="list-style-type: none"> <li>10. Open-open</li> <li>11. Closed-open</li> <li>12. Sound amplitude</li> <li>13. Intensity</li> <li>14. Decibels (dB)</li> <li>15. <math>r</math></li> <li>16. Volume (sound)</li> <li>17. Hearing loss</li> <li>18. Compression</li> </ol> | <ol style="list-style-type: none"> <li>19. Rarefaction</li> <li>20. Noise cancelling</li> <li>21. Tune</li> </ol> | <ol style="list-style-type: none"> <li>22.</li> </ol> |
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