

02Objectives, equations and vocabulary-Waves

$f = 1/T = \text{cyc/sec}$ $v = f \lambda$ $x = v t$ $2^{(1/12)} = 1.05946$ $A_0 = 27.5 \text{ Hz}$	$M = V_0/v_{\text{sound}}$ $v_{\text{sound}} = 331 + 0.6T(^{\circ}\text{C})$ $v_{\text{sound}} \sim 340 \text{ m/s}$ $e = 1.60 \times 10^{-19} \text{ C}$ $k = 9.0 \times 10^9 \text{ Nm}^2/\text{C}^2$ $Q = ne$	$V = W/q = J/C$ $i = \Delta Q/\Delta t$ $\Delta V = i R$ $P = E/t$ $P = iV$ $P = V^2/R$	$I \Delta$ inversely with r^2 $\Delta: +10 \text{ dB} = 2x \text{ Vol} = 10x I$ Beats = $ f_1 - f_2 $ Series $R_e = R_1 + R_2$ Parallel $1/R_e = 1/R_1 + 1/R_2$ $N_1/V_1 = N_2/V_2$	$F = k \frac{q_1 q_2}{r^2}$ $E = \frac{F}{q} = \frac{kq}{r^2}$
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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 wave anatomy, wave types and the difference between movement of mass and energy
4. The student understands can distinguish between mechanical waves and electromagnetic waves
5. The student recognizes that some kind of restoring force is necessary for wave and vibrations
6. The student understands and can use equations for frequency, speed and wave speed equation, including echo problems
7. The student knows how the speed of sound is affected by density and air temperature
8. The student understands corresponding slinky and sound concepts
9. The student understands wave speed depends upon properties of the medium and is independent of frequency
10. The student understands how standing waves are made including the concepts of harmonics, which harmonics are supported by closed-closed systems, reflection boundaries and constructive and destructive interference
11. The student knows the effect of length and tension (restoring force) on natural frequency
12. The student can observe lightning or fireworks and estimate their distance in miles
13. The student understands what Audacity does and uses it to analyze wave frequency and amplitude and determine the frequency of an unknown sound
14. The student understands that only certain energy wave frequencies may be absorbed. This includes but is not limited to: microwave ovens, cell phones, Wi-Fi, remote controls, and radio/television tuners. Further, the student can relate this to natural frequencies and resonance.
15. The student understands the Doppler Effect including its use in estimating the speed of moving objects and in our understanding of the Big Bang theory. The student can further apply this concept to understand shockwaves and bow waves
16. The student understands how beats are formed and can compute the numeric value for beats
17. The student can investigate the major variety of light bulbs and choose the optimal light bulb for a given situation
18. SK: The student can make a particular slinky wave on command with a particular frequency and wave speed
19. SK: The student can make a voice sound on command with a fundamental frequency of between 100 and 400 Hz (teacher gives two options in that range)

New Vocabulary list

<ol style="list-style-type: none"> 1. waves 2. medium 3. mechanical waves 4. EM waves 5. period 6. frequency 7. hertz (Hz) 8. pitch 9. wavelength 10. wave speed 11. equilibrium line 12. crest, trough 13. amplitude 14. transverse wave 15. longitudinal wave 	<ol style="list-style-type: none"> 16. Mach number 17. pulse waves 18. continuous waves 19. reflection 20. fixed end 21. free end 22. interference 23. Superposition principle 24. beats 25. constructive interference 26. destructive interference 27. standing waves 28. node 29. antinode 30. harmonics 	<ol style="list-style-type: none"> 31. natural frequencies 32. fundamental 33. timbre 34. Doppler effect 35. shock waves 36. Big bang 37. red shift 38. blue shift 39. Edwin Hubble 40. shock waves 41. bow waves 42. resonance 43. harmonics 44. sympathetic vibration 45. forced vibrations 	<ol style="list-style-type: none"> 46. dead spots
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