

1.  $V = f\lambda = 400 \text{ Hz} \times 13.0 \text{ m} = 5200 \text{ m/s}, 5.20 \times 10^3 \text{ m/s}, 5.20 \text{ km/s}$

2. Crest to crest time is the period  $T$ , wavelength = 12m  
8.0s

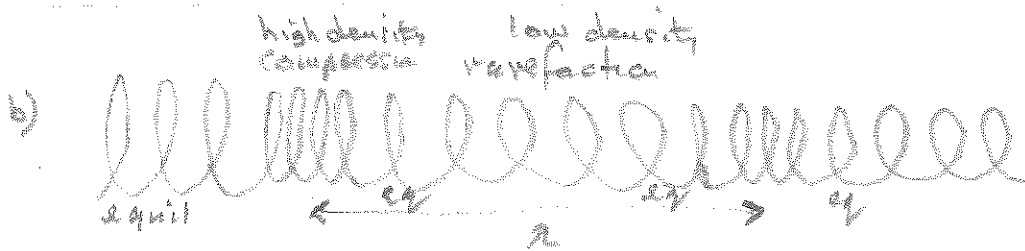
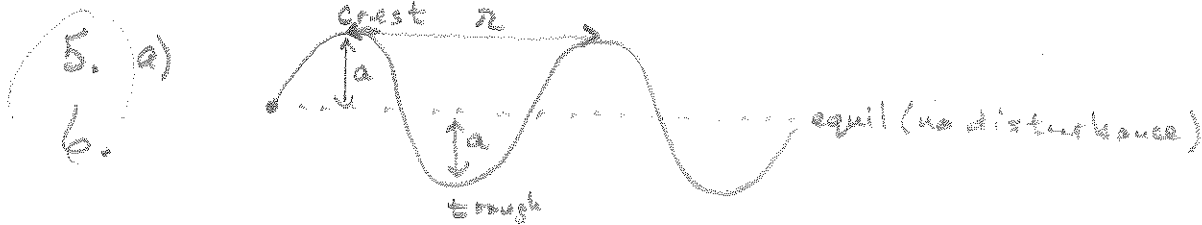
$$V = f\lambda \quad \text{or} \quad V = \frac{\lambda}{T}$$

$$f = \frac{1}{8} \text{ Hz}$$

$$V = \frac{12 \text{ m}}{8.0 \text{ s}} = 1.5 \text{ m/s}$$

3. 20 - 20000 Hz, 5.0 Hz, 100000 Hz  
high freq  $\rightarrow$  short  $\lambda$   
low freq  $\rightarrow$  long  $\lambda$   
rhino - longest  $\lambda$  (68.6m)  $\lambda = \frac{V}{f}$   
bat - shortest  $\lambda$  (0.0034m)

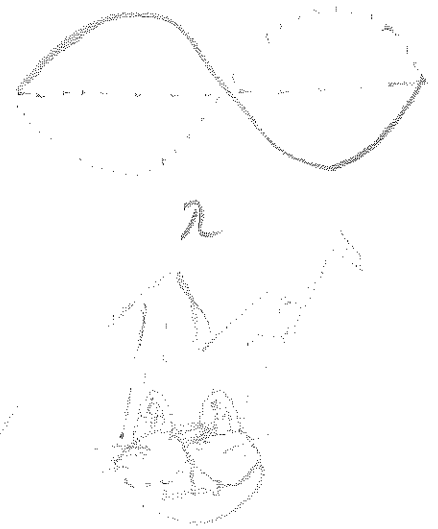
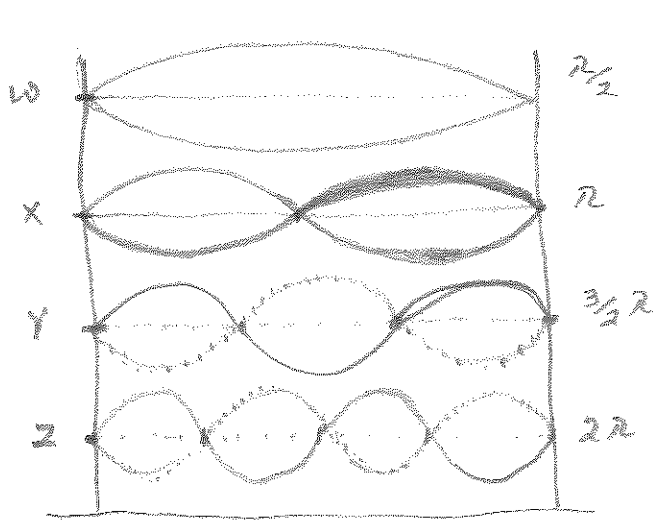
4. "there and back" time is 5.0s (or 2.5s one way)  
 $d = vt$   $d = 1450 \text{ m/s} \times 2.5 \text{ s} = 3625 \text{ m} \rightarrow 3.6 \text{ km}$



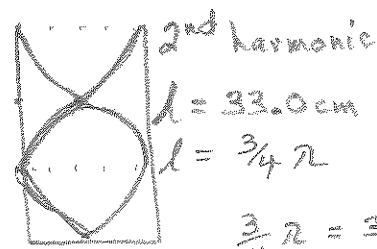
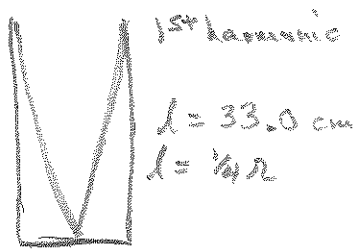
7. Concepts: Sound waves are longitudinal (compressions/rarefactions)  
Interference = constructive antinodes - loud volume  
- destructive nodes - quiet zones

8. - Light travels to your eyes instantaneously or close to 0.0s to reach you  
- Sound travels at 343m/s  $\rightarrow$  0.343km/s  
-  $\frac{\text{time to thunder}}{5} = \# \text{ miles from storm}$   
- Example: in 5s delay, time sound travels  $\frac{5 \text{ s} \times 0.343 \text{ km/s}}{5} = 1.7 \text{ km} \approx 1 \text{ mile}$

9.



10.



$$v = f \lambda$$

$$= 775 \text{ Hz} \times 0.44 \text{ m}$$

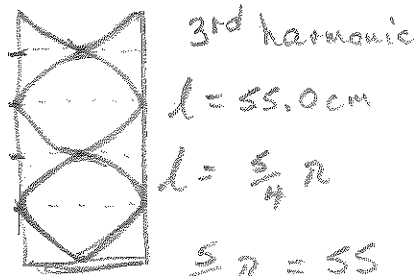
$$= 341 \text{ m/s}$$

$$\frac{3}{4} \lambda = 33$$

$$\lambda = 33 \times \frac{4}{3} = 44 \text{ cm}$$

$$= 0.44 \text{ m}$$

11. a)



b)

$$\frac{5}{4} \lambda = 55$$

$$\lambda = 55 \times \frac{4}{5}$$

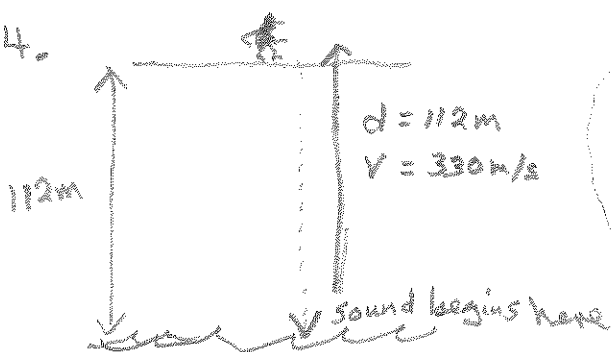
$$\lambda = 44 \text{ cm (again?)}$$

$$0.44 \text{ m}$$

$$v = f \lambda$$

$$= 775 \text{ Hz} \times 0.44 \text{ m} = 341 \text{ m/s}$$

14.



$$t = \frac{d}{v} = \frac{112 \text{ m}}{330 \text{ m/s}}$$

$$t = 0.339 \text{ s from time it hit the water}$$

time for rock to fall 112m.

$$d = v_i t + \frac{1}{2} g t^2$$

$$112 = 0 t + \frac{1}{2} (-9.8) t^2$$

$$t = 4.778 \text{ s}$$

total time = 5.12 s

15.  $f = \left( \frac{v}{v - v_s} \right) f_s$

$$f = \left( \frac{340}{300} \right) 660$$

$$f = \left( \frac{340}{340 - 40} \right) 660$$

$$f = 748 \text{ Hz}$$

16. Mach 1 = speed of sound