

15. (a) Building on the theory developed in §18 – 4, we set $\Delta L/\lambda = \frac{1}{2}(\text{odd numbers})$ in order to have destructive interference. Since $v = f\lambda$, we can write this in terms of frequency:

$$f = \frac{(\text{odd number})v}{2\Delta L} = \begin{cases} 143 \text{ Hz} & \text{for } n = 1 \\ 429 \text{ Hz} & \text{for } n = 3 \\ 715 \text{ Hz} & \text{for } n = 5 \end{cases}$$

where we have used $v = 343 \text{ m/s}$ (note the remarks made in the textbook at the beginning of the exercises and problems section) and $\Delta L = 19.5 - 18.3 = 1.2 \text{ m}$.

- (b) Now we set $\Delta L/\lambda = \frac{1}{2}(\text{even numbers})$ – which can be written more simply as “(all integers)” – in order to establish constructive interference. Thus,

$$f = \frac{(\text{integer})v}{\Delta L} = \begin{cases} 286 \text{ Hz} & \text{for } n = 1 \\ 572 \text{ Hz} & \text{for } n = 2 \\ 858 \text{ Hz} & \text{for } n = 3 \end{cases} .$$