1. Loudness is determined by the amplitude of pressure variations, so A.
2. Pitch is determined by the frequency, so $\omega = 2\pi f$.
3. Use SI units: $v = \sqrt{5 \times 10^7/125} = 632$ [m/s].
4. $v = \sqrt{B/\rho} = \sqrt{BR/m}\ \sqrt{T/P}$, so at constant P velocity increases with temperature
5. $v_g < v_l < v_s$
6. Mode number n is the nth harmonic, so $f = 2v/2L = 1143$ [Hz]
7. The second overtone is $n = 5$, so $f = 5v/4L = 1429$ [Hz]
8. $\lambda = v/f = 0.25$ [m], so if the speakers are displacement antinodes you are at a displacement antinode, or a pressure node and don't hear anything
9. After stepping forward, you are no longer at a node, and hear the sound (you aren't at an antinode either)
10. $p(x,t) = -B\partial_x y(x,t) = BAk\sin(kx-\omega t)$, $v_y(x,t) = \partial_t y(x,t) = A\omega\sin(kx-\omega t)$, so $I = p(x,t)v_y(x,t) = BA^2\omega k\sin^2(kx-\omega t)$
11. $I_{\text{average}} = BA^2\omega k\int_0^\pi d\theta\ \sin^2(\theta)/\pi = BA^2\omega k/2 = 1$ [W]
12. $\beta = 10\log_{10}(I_{\text{average}}/10^{-12}) = 120$ [dB]
13. No, the beats frequency is $|f_C - f_A| = 178.37$ [Hz]
14. We use the Doppler formula:
$$f^L = \frac{v \pm v^L}{v \pm v^S} f^S = \frac{343+5}{343-15}150 = 159.1 \text{ [Hz]}$$
15. We use the Doppler formula:
$$f^L = \frac{v \pm v^L}{v \pm v^S} f^S = \frac{343+15}{343-5}300 = 317.8 \text{ [Hz]}$$