
PHYS 1210 Discussion 12. Sound

1. The lowest note on a grand piano has a frequency of 27.5 Hz. The string is 2 meters long (more or less; let's just assume it is exactly 2.000 m) long, and its tension is 1000 N (again, more or less, so let's say it's exactly 1000. newtons).
 - A. What must the length density μ (mass per unit length, in units of kg/m or g/m) of the string be to have the desired fundamental frequency?
 - B. If the string is to be made of steel, which has a density $\rho = 7800 \text{ kg/m}^3$, what must the diameter of the string be?
 - C. Is this "string" likely to flex like a string?
 - D. How are the low strings on a piano actually constructed to give them the proper length densities while maintaining flexibility?

2. A spectator at a Formula 1 race (with proper hearing protection) notices that the sound from an approaching car has a frequency of 380 Hz, while the sound from the same car driving away has a frequency of 240 Hz. (The sound from a car is a combination of many frequencies and phases, but 380 and 240 Hz are the intensity maxima.) The speed of sound in air is 342 m/s.
 - A. What is the speed of the car? Assume that it has the same speed when it is driving toward the spectator as when it is driving away.
 - B. What is the frequency of the sound emitted by the car?