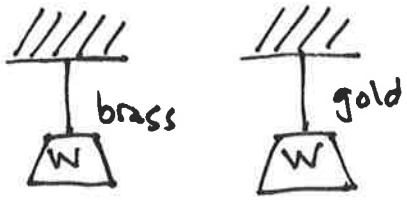
ASG v2 Ex 5.2 (Suspended weights)



W = 50 lbs

a) Since both wires are the same length, have the same mass (or weight), and are subject to the same tension (suspended weight), their vibrational frequencies must be the same. They emit the same pitch note.

b) To increase the frequency of vibration of the gold string by one octave, once could quadruple the tension, since $f \propto \sqrt{T}$. This would require the 50 lb weight be replaced by a 200 lb weight.

c) One could also quarter the weight of the string itself, since $f \propto \frac{1}{\sqrt{w}}$. Since the string's weight is proportional to its volume, which is proportional to the cross-sectional area (keeping the length unchanged), which is proportional to the diameter squared, we could halve the diameter:

$\frac{1}{2}$ dia $\rightarrow$ $\frac{1}{4}$ area $\rightarrow$ $\frac{1}{4}$ volume $\rightarrow$ $\frac{1}{4}$ weight $\rightarrow$ double freq.