Q- Two strings are adjusted to vibrate at exactly 200 Hz and then the tension in one string is increase slightly. Three beats per second are heard now when the strings are vibrated simultaneously. What is the new frequency of the string that was tightened?

The beats are produced when the two sound waves of nearly same (but not equal) frequencies are moving in a medium simultaneously. The vibrating strings produce the sound waves of the frequency same as of their oscillation frequency. Because of superposition of such two waves at a point in the medium the intensity of sound varies with time repeatedly between the maximum and minimum. The time interval between two consecutive maximum or minimum is called a beat period. Number of beats heard per second is called beat frequency and is equal to the difference of the frequencies of the two waves.

The frequency of a vibrating string is given by

$$\nu = \frac{1}{2l}\sqrt{\frac{T}{\mu}}$$

Where *l* is its length, m is the mass per unit length and T is the tension in the string.

This shows that with increase in the tension the frequency of the string increases.

Now to our problem

The frequency of both strings is initially the same = 200 Hz say n

By stretching one wire its tension T increases and thus frequency will increase and becomes $n_1$ (>n).

As the beat frequency is three the difference of the frequencies of the two must be three hence

$$n_1 - n = 3$$

Gives $n_1 = 3 + n = 3 + 200 = 203$ Hz.