3. Key idea is that the string will resonate at only certain frequencys
a) determind by wave speed v on the string and the length L of the string. These resonant frequencies are $f = n\frac{v}{2L}$ $n = 1, 2, 3\ldots$

To set up the fourth harmonic ($n=4$), we need to adjust the right side of this equation. L is fixed. only to adjust v.

$$v = \sqrt{\frac{\tau}{\mu}} = \sqrt{\frac{mg}{\mu}}$$

$$\therefore \quad f = 4\sqrt{\frac{mg}{\mu}}/2L \Rightarrow m = 4L^2f^2\mu/n^2g$$

$$= \frac{4\cdot(1.2\,m)^2(120\,Hz)^2(0.0016\,kg/m)}{4^2(9.8\,m/s^2)}$$

$$= 0.85\,kg.$$

b) ~~the insert~~ key idea: n must be an integer

$\therefore$ with $m = 1.00\,kg$, ~~the~~ inserting into $f = n\frac{v}{2L} = \frac{n}{2L}\sqrt{\frac{mg}{\mu}}$

$$\therefore n = 2fL\sqrt{\frac{\mu}{mg}}$$

$$= 2\cdot(120\,Hz)(1.2\,m)\sqrt{\frac{0.0016\,kg/m}{1.00\,kg\,9.8\,m/s^2}}$$

$$= 3.7$$

$\therefore$ the string will be small, Perhaps even imperceptible.