

Answer on Question #63848-Physics-Other

The 88 keys on a standard piano correspond to strings that have fundamental frequencies ranging from 27.5 Hz (known by musicians as A0) up to 4186 Hz. Assume a piano is strung only using strings that are each under a tension of 710 N and have a linear density of 0.00647 kg/m. How long will the longest and shortest strings be?

Solution

The fundamental frequency of string is

$$f = \frac{v}{2L}.$$

Since the wave velocity is given by

$$v = \sqrt{\frac{T}{\mu}}$$

the length of string is

$$L = \frac{1}{2f} \sqrt{\frac{T}{\mu}}.$$

$$L_1 = \frac{1}{2f_1} \sqrt{\frac{T}{\mu}} = \frac{1}{2(27.5)} \sqrt{\frac{710}{0.00647}} = 6.02 \text{ m}.$$

$$L_1 = \frac{1}{2f_1} \sqrt{\frac{T}{\mu}} = \frac{1}{2(4186)} \sqrt{\frac{710}{0.00647}} = 0.0396 \text{ m}.$$

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