

Question 3.

A student obtained the following data during an investigation of the variation of the fundamental frequency f of a stretched string with its tension T . The length of the string was kept constant

T/N	15	20	25	30	35	40	45
f/Hz	264	304	342	371	402	431	456

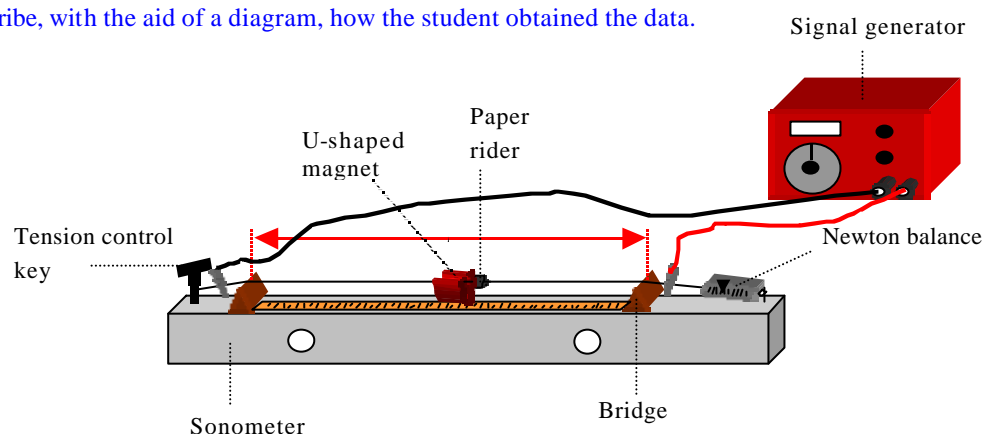
Describe, with the aid of a diagram, how the student obtained the data.

Why was the length of the string kept constant during the investigation?

Plot a suitable graph on graph paper to show the relationship between fundamental frequency and tension for the stretched string.

From your graph, estimate the tension in the string when its fundamental frequency is 380 Hz

Describe, with the aid of a diagram, how the student obtained the data.



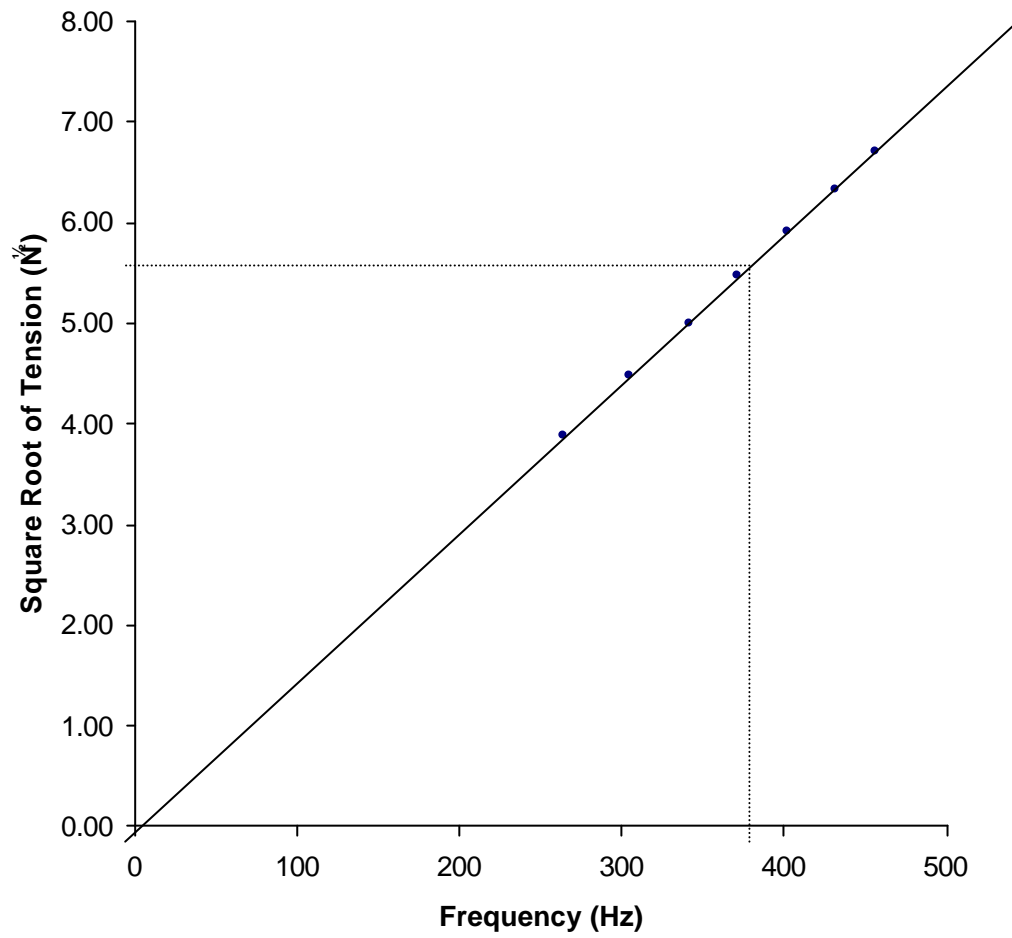
The tension in the string was adjusted by means of a tension control key and its value was read from the Newton meter. A varying electrical signal was then applied to the string by a signal generator and when its value matched the fundamental frequency of the string, resonance occurred, and the paper rider was seen to oscillate. The frequency was read from the signal generator. The tension was adjusted and the corresponding fundamental frequency was once again determined. It was repeated 6 times.

Why was the length of the string kept constant during the investigation?

Because the fundamental frequency also depends on the length of the string so it must be kept constant in the investigation.

Plot a suitable graph on graph paper to show the relationship between fundamental frequency and tension for the stretched string.

T/N	15	20	25	30	35	40	45
f/Hz	264	304	342	371	402	431	456
$T^{1/2}/\text{N}^{1/2}$	3.87	4.47	5.00	5.48	5.92	6.32	6.71



From your graph, estimate the tension in the string when its fundamental frequency is 380 Hz

When the fundamental frequency is 380 Hz, the square root of the tension has the value of 5.6, hence the tension, $T = 31.4 \text{ N}$