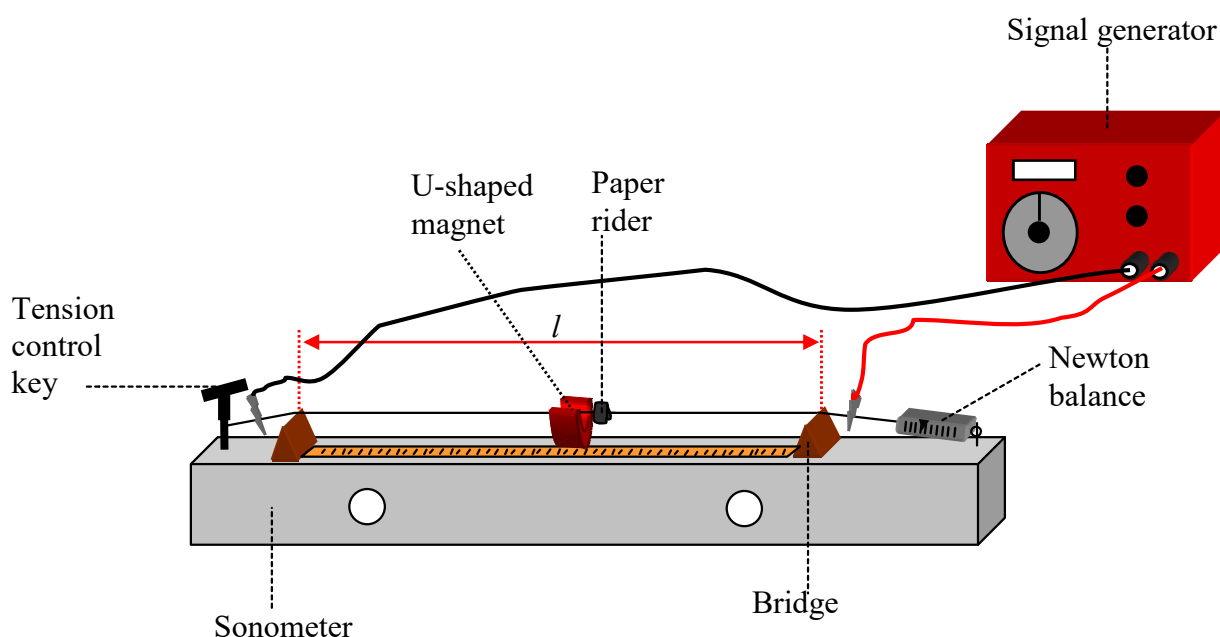


# INVESTIGATION OF THE VARIATION OF THE FUNDAMENTAL FREQUENCY OF A STRETCHED STRING WITH TENSION\*

## Apparatus

Signal generator, U-magnet, sonometer with a newton balance or tensionometer (0 to 50 N) and tension key.

**Safety note:** Wear safety goggles in case the sonometer wire snaps.



## Procedure

1. Place the sonometer wire between the poles of the U-magnet, positioned midway between the bridges.
2. Select a wire length  $l$  (e.g. 30 cm), by suitable placement of the bridges. Keep this length fixed throughout the experiment.
3. Set the tension at a low value (e.g. 4 N), so that the stationary waves set up at resonance have large amplitude and are easily visible.
4. Increase the frequency slowly from zero until resonance occurs.
5. Increase the value of the tension (in steps of 4 N, for example) and again increase the applied a.c. frequency until resonance occurs.
6. Record the frequency and tension values in a table.
7. Repeat the procedure to obtain at least six readings.
8. Plot a graph of frequency  $f$  against the square root of tension  $\sqrt{T}$ . Draw a straight line of best fit through the plotted points.

## Results

| $f/\text{Hz}$ | $T/\text{N}$ | $\sqrt{T}/\text{N}^{1/2}$ |
|---------------|--------------|---------------------------|
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## Conclusion

A straight line through the origin will verify a proportionality between the frequency  $f$  and the square root of the tension  $\sqrt{T}$ .

## Notes

Ensure that the breaking strain of the wire is greater than 50 N.

Use the low impedance output of the signal generator.

If the frequency cannot be read with reasonable accuracy from the signal generator, use a multimeter with a suitable frequency scale. Connect it across the signal generator.

Use the amplitude control on the signal generator to adjust the current flowing through the wire, to prevent overheating.

Keep the paper rider as light as possible. Use a small piece of cellotape to hold the paper in the form of a loop. This allows the rider to sit loosely on the wire without falling off. The movement of the paper is then easier to see and hence the position of resonance is easier to identify.

A short length of drinking straw can also be used as a very light rider. Slit the straw length-wise first; cut off a 0.5 cm piece and slip it onto the string. This rider can be moved along the string to detect the positions of nodes and antinodes when the string is vibrating at resonance.

Students may find the data easier to handle if the tension values 4 N, 9 N, 16 N, etc., are chosen.

A guitar string may be used instead of the sonometer wire.

A set of tuning forks may be used as an alternative to the signal generator and magnet.