

PASCO

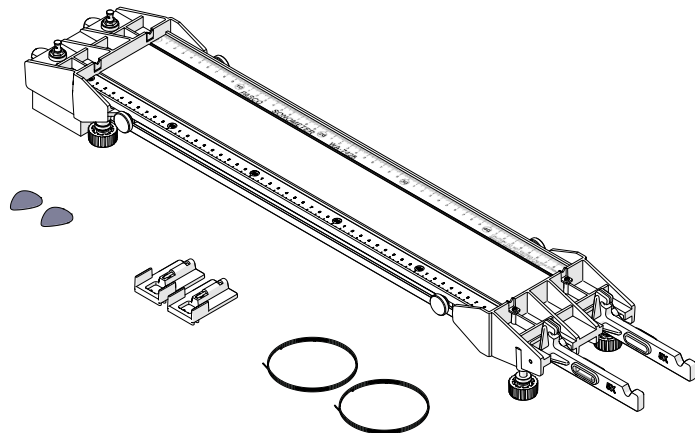
Sonometer

WA-7428

Product Guide
012-17145A

About the product

The Sonometer is an apparatus used for exploring the wave properties of vibrating strings. It includes two mounts to install strings of different linear densities. String length is varied by changing the position of a sliding bridge under the string. String tension is varied by hanging masses from the lever attached to the end of the string. To vibrate the strings, pluck them with a pick or use resonance by vibrating a tuning fork. Use a sound sensor with SPARKvue or PASCO Capstone to measure the frequency of vibration.



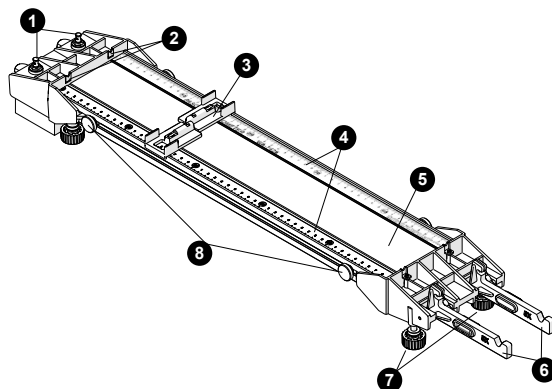
What's included

- Sonometer
- 2× Bridge
- 2× Guitar pick
- 4× 0.014-inch string
- 4× 0.018-inch string

Required items

- **Large Slotted Mass Set**
Hang the masses from the levers to apply tension to the strings. Use the ME-7589 Large Slotted Mass Set (2 kg Set) or the ME-7566 Large Slotted Mass Set.
- **Tuning Forks**
Resonate the strings with tuning forks. Use the SE-7342 Tuning Fork Set or the SE-7728 Tuning Fork Technical Set.
- **Sound Sensor**
Measure wave frequency with a sound sensor. Use the PS-3227 Wireless Sound Sensor or the UI-5101 Sound Sensor with Microphone.

Part names and functions



- 1 Tuning peg**
Turn the tuning peg to adjust the tension in the string until the tensioning lever is level.
- 2 String guide**
Make sure that the string is sitting in the string guide when applying tension to the string.
- 3 Bridge**
Slide the bridge along the ruler to vary the length of the string. Make sure to put the groove on the bridge onto the raised edge on the Sonometer. Use the indicator on the bridge to measure the length of the string.
- 4 Ruler**
Use the ruler with the bridges to measure the length of the string. The length of the string is defined as the distance between the string guide at the 0 cm mark and the indicator on the bridge.
- 5 Soundboard**
Put the base of a tuning fork on the soundboard to resonate the strings.
- 6 Tensioning lever**
Hang masses from the lever to provide tension on the string. The lever applies a tension equal to five times (5×) the mass weight. The lever includes a spirit level to determine when the lever is level.

⚠ CAUTION: Do not hang more than 3 kg of mass from each lever. Remove masses from the levers when storing the device.
- 7 Adjustable foot**
Turn each foot as needed to make the Sonometer level.
- 8 Thumbscrews**
Use the thumbscrews to secure the lever end and peg end to the soundboard during assembly.

Assemble the Sonometer

Before using the Sonometer, you need to attach each end to the soundboard and attach the strings.

Step 1: Attach the ends

1. Insert the tensioning lever end into the grooves at the 50-cm end of the soundboard. Tighten the thumbscrews.
2. Insert the tuning peg end into the grooves at the 0-cm end of the track. Tighten the thumbscrews.

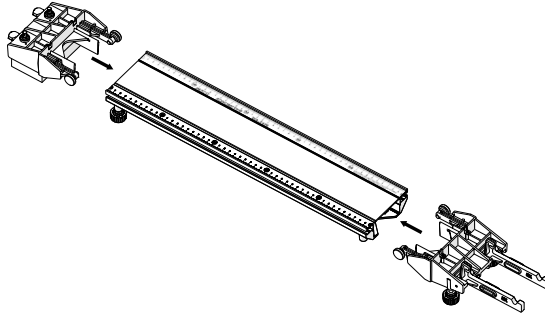


Figure 1. Installing the tuning peg and tensioning lever ends to the soundboard.

Step 2: Attach the strings

Note: Don't remove the strings after installation. The strings may break if you try to reinstall them.

1. Align the tuning peg hole with the string guide by turning the tuning peg knob.
2. Insert the ball end of the 0.014-inch string into the groove of the tensioning lever.
3. Insert the string through the tuning peg hole. Pull through until the lever arm tilts at its maximum position (Figure 2).

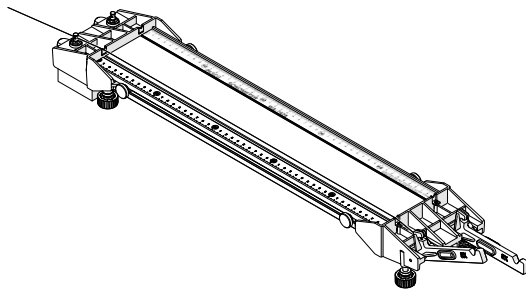


Figure 2. String pulled through the tuning peg with the tensioning lever at the maximum position.

4. Give the string 5 cm of slack, then bend the string at the peg (Figure 3).

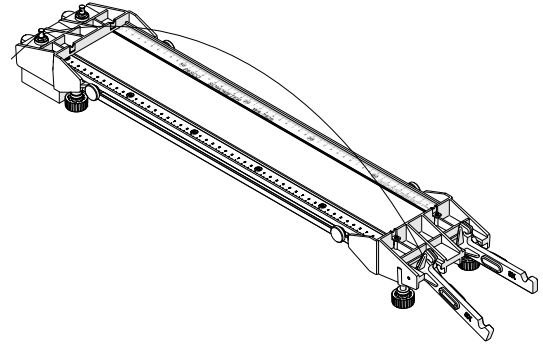


Figure 3. String bent at peg with 5 cm of slack.

5. Turn the tuning peg clockwise to wrap one turn of the string *above* the bend in the string.

Tip: Press down on the string between the tuning peg and string guide as you rotate the peg.

6. Wrap the rest of the string *below* the bend by rotating the tuning peg clockwise. Keep rotating the tuning peg until the lever reaches its maximum height.
7. Cut off the excess string.

Tip: Keep the excess string for students to measure the mass per unit length.

8. Repeat the entire procedure using the 0.018-inch string.

Using the Sonometer

Apply and measure string tension

Hanging masses from the tensioning lever applies tension to the strings. The string tension is equal to five times the weight of the masses, as indicated by the 5× on the lever.

1. Hang masses from the notch on the lever.

⚠ CAUTION: Do not exceed 3 kg per string. Keep feet and body clear of the area under the mass. Place a foam pad under the mass to protect the floor. As an added precaution, you can also hang the mass from a string to minimize the distance to the floor.

2. Turn the tuning peg key until the tensioning lever is level.
3. Multiply the total weight of the hanging masses by 5 to determine the tension on the string.

Set and measure the string length

Use the built-in ruler with the bridges to determine the length of the string.

1. Place a bridge on the Sonometer. Make sure to place the groove on the bridge onto the raised edge on the Sonometer.
2. Move the bridge to the desired position.
3. Read the measurement on the indicator mark on the bridge to determine the string length (Figure 4).

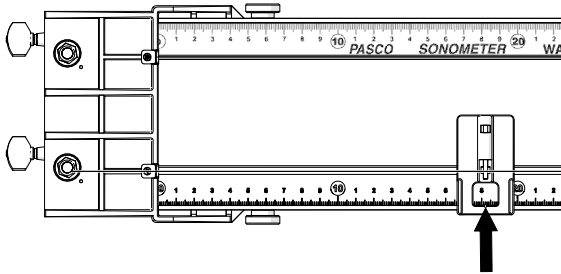


Figure 4. Use the indicator on the bridge to determine string length.

Resonate a string with a tuning fork

Place the base of a vibrating tuning fork on the soundboard to resonate a string. Use paper riders to see the string vibrations more easily.

1. Hang masses from the tensioning lever to apply tension to the string. Turn the tuning peg until the tensioning lever is level.

⚠ CAUTION: Do not exceed 3 kg per string. Keep feet and body clear of the area under the mass. Place a foam pad under the mass to protect the floor. As an added precaution, you can also hang the mass from a string to minimize the distance to the floor.

2. Cut multiple 2 mm × 2 cm pieces of paper to make string riders.
3. Fold each rider in half and place them at various locations on the string (Figure 5). The riders move when the string vibrates.
4. Place the bridge near the 50 cm mark.
5. Vibrate a tuning fork and place the base of the tuning fork on the soundboard.

💡 Tip: Place a finger on string located on the *other side* of the bridge to keep it from vibrating.

6. Slowly move the bridge to the 0 cm end until the paper riders start vibrating.

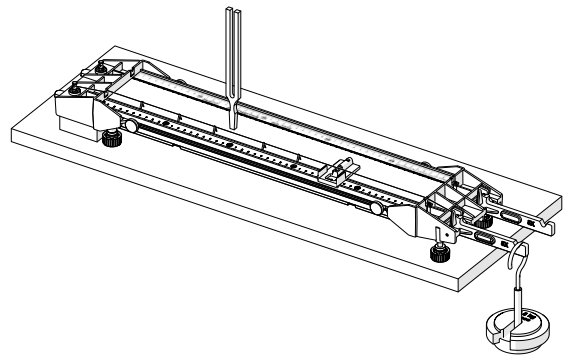


Figure 5. The base of a tuning fork placed on the Sonometer with paper riders on the string.

Measure frequency with a sound sensor

Measure the frequency of a vibrating string with a sound sensor and an FFT display in SPARKvue or PASCO Capstone.

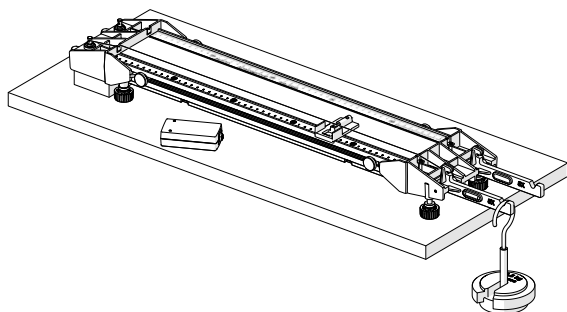


Figure 6. Place the sound sensor on the table under the Sonometer.

1. Hang masses from the tensioning lever to apply tension to the string. Turn the tuning peg until the tensioning lever is level.

⚠ CAUTION: Do not exceed 3 kg per string. Keep feet and body clear of the area under the mass. Place a foam pad under the mass to protect the floor. As an added precaution, you can also hang the mass from a string to minimize the distance to the floor.

2. Put the sound sensor on the table facing the soundboard. You may also mount the sensor on a stand or put it on a stack of books.
3. Set up SPARKvue or Capstone with an FFT display.
4. Using a pick, pluck the section of string located *between the peg end and the bridge* to vibrate the string.

💡 Tip: Place a finger on string located on the *other side* of the bridge to keep it from vibrating.

5. Start recording data to measure the frequency.

Additional resources

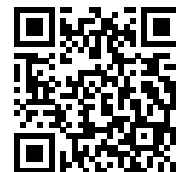
Experiments

Print-ready experiment worksheets are available to download from the PASCO website. Go to pasco.com/freelabs and enter WA-7428 in the Part No. field.

Product information

Visit the product web page at pasco.com/product/WA-7428 for additional information including:

- Specifications
- Buying Guide
- Experiments
- Documents



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