Mandatory Experiments
(Sound)

Sound 1	**Speed of Sound in Air**
Sound 2	**Sonometer – Variation of Frequency with Length**
Sound 3	**Sonometer – Variation of Frequency with Tension**

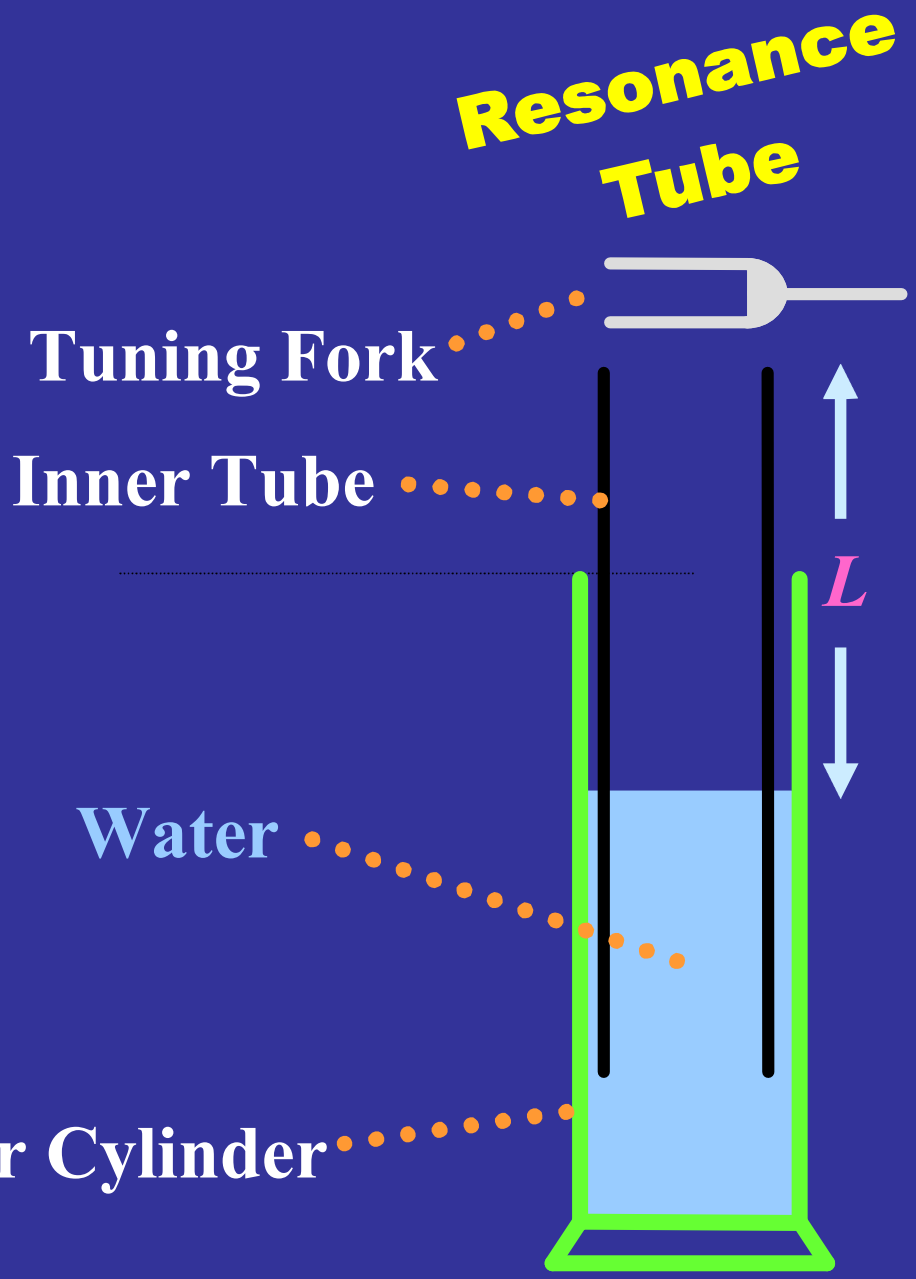
Sound 1

Measure Speed of Sound in Air

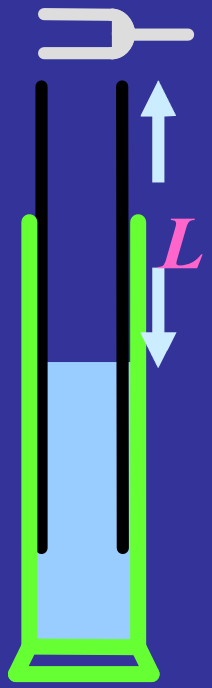
Speed of Sound

Apparatus

- Resonance Tube
- (Inner Tube)
- (Outer Cylinder)
- (Water)
- Tuning Fork
- Metre Stick



Speed of Sound

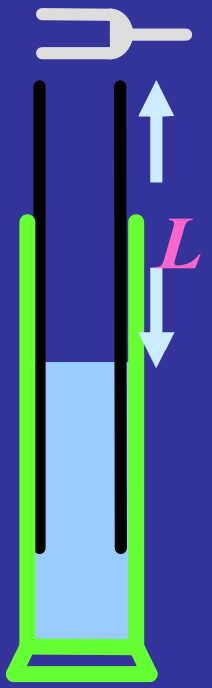


Procedure

- Fork vibrating … $L = 0$ …

  … increase L until resonance (a loud sound).
- Measure (3) ...
- How are these measured?
- Repeat .. other … Why repeat?

Speed of Sound



Procedure

- Fork vibrating … $L = 0$ …

  … increase L until resonance (a loud sound).

- Measure (3) ... f L d

- L = from water surface to top of tube

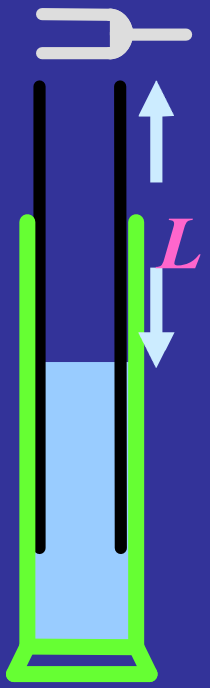
  f = frequency of tuning fork

  d = inner diameter of inner tube

- Repeat .. other tuning forks…

  Why repeat? … to get average c

Speed of Sound



Results

$$c = f\lambda$$

$$\frac{\lambda}{4} = (L + 0.3d)$$

$$\Rightarrow c = 4f(L + 0.3d)$$

Calculate average *c*

Speed of Sound

Precautions / Questions

1. Give two precautions taken to ensure an accurate result.
2. Why is the experiment repeated using different tuning forks?
3. Errors can occur in getting the best resonance position. What could you do to ensure that you had found the best position? (2)
4. What error can occur when using the metre stick?
5. Why is the use of a retort stand recommended?
6. Why is the diameter of the tube measured?

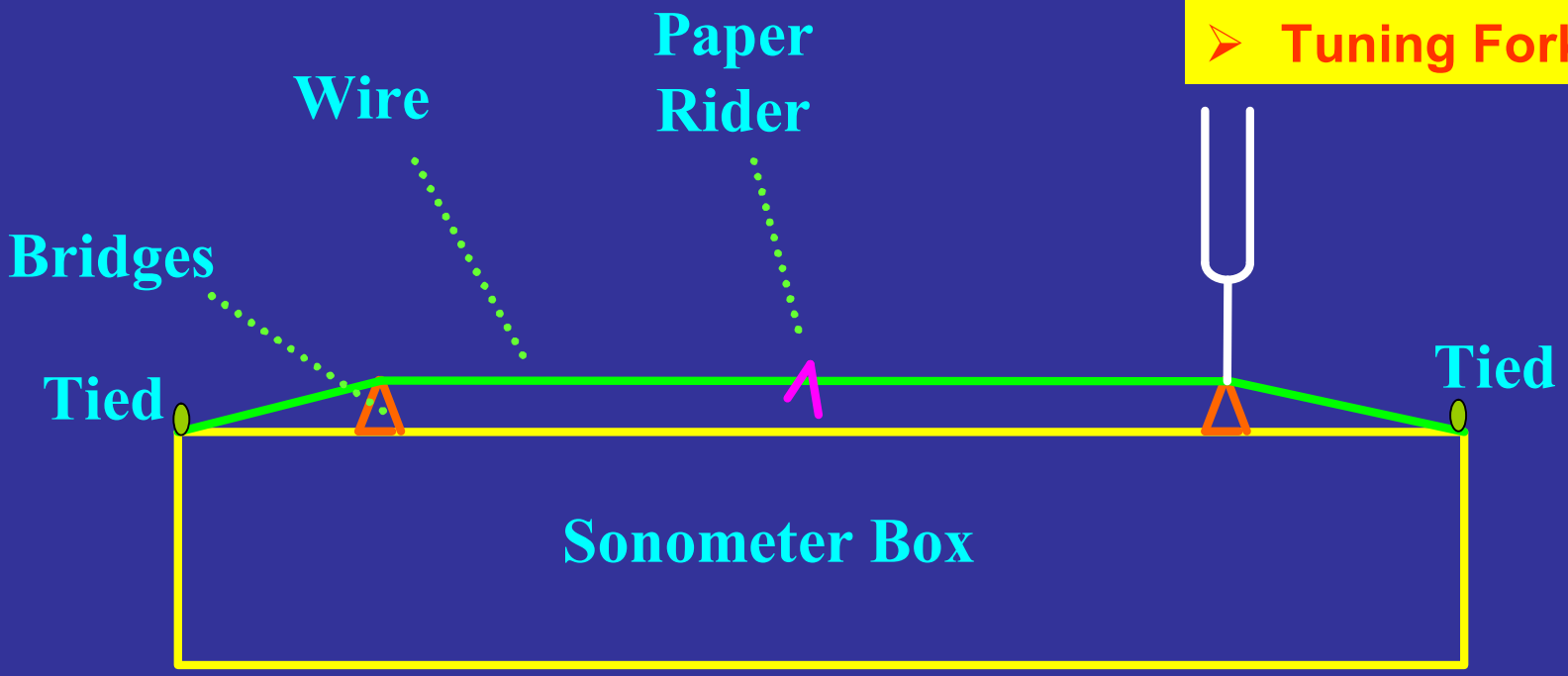
Sound 2

Sonometer $f \propto \frac{1}{l}$

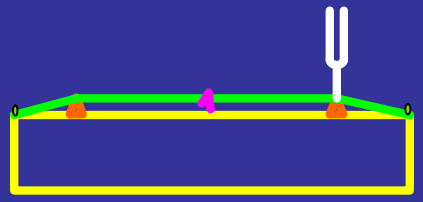
Sonometer $f \propto \frac{1}{l}$

- **Sonometer**
  (Sonometer box)
  (Stretched string)
  (Tied at both ends)
  (Bridges x2)
- **Paper rider**
- **Tuning Fork**

Apparatus



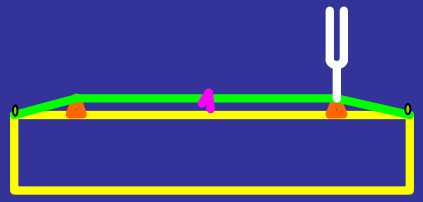
Sonometer $f \propto \frac{1}{l}$



Procedure

- Vibrating fork on bridge … adjust length by moving … resonance
- Measure (2) ...
- How are these measured?
- Repeat … other … Why repeat?

Sonometer $f \propto \frac{1}{l}$



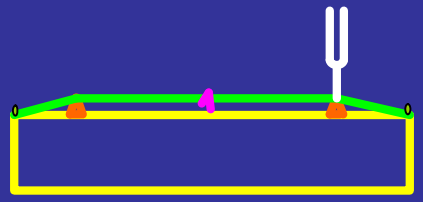
Procedure

- Vibrating fork on bridge … adjust length by moving … resonance
- Measure (2) ... *f* & *l*
- *f* = frequency of fork

  l = length from bridge to bridge
- Repeat … other forks

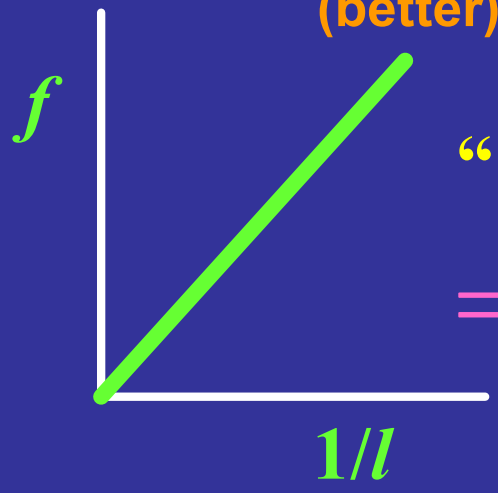
  Why repeat? … to graph

Sonometer $f \propto \frac{1}{l}$



Results

Method 1 (better)



"SLTO"

$\Rightarrow f \propto 1/l$

Method 2

$f\,l$ = a constant

$\Rightarrow f \propto 1/l$

Sonometer $f \propto \frac{1}{l}$

Precautions / Questions

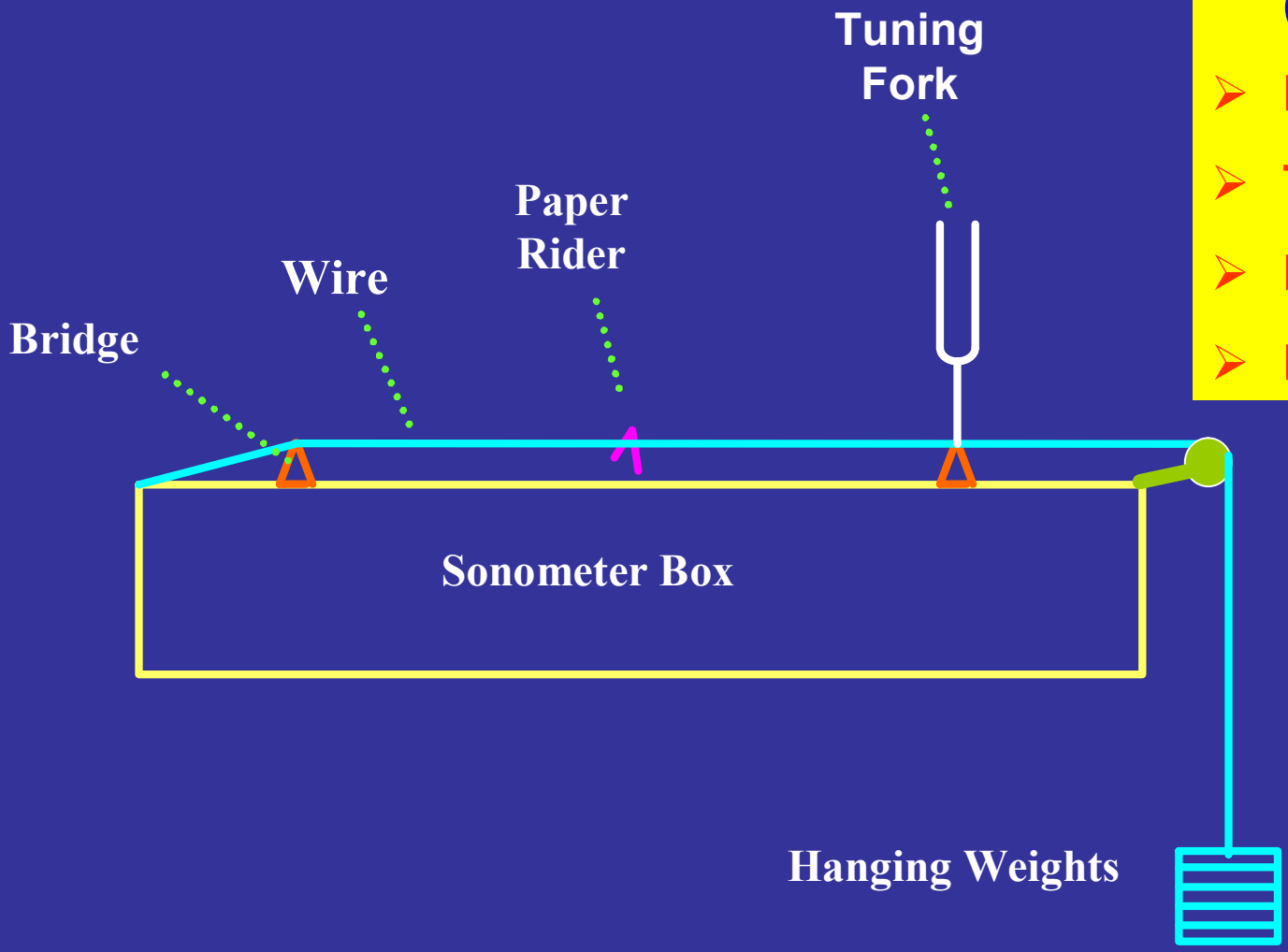
1. Give two precautions taken to ensure an accurate result.
2. Why is the tension kept constant during the experiment?
3. Give two ways of applying this tension to the wire.
4. Why is the paper rider used and why is it placed in the centre of wire?
5. Between what two things does resonance occur? What are equal when resonance occurs?
6. Between what points is the length measured. (Show this on a diagram.)
7. From where is the frequency of the wire read? Explain.
8. The length of the wire is doubled, keeping the tension constant. What happens to the frequency of the wire?
9. How might the graph be used to measure the frequency of a tuning fork of unknown frequency?
10. How is the mass per unit length of the wire measured from the slope of the graph?

Sound 3

Sonometer $f \propto \sqrt{T}$

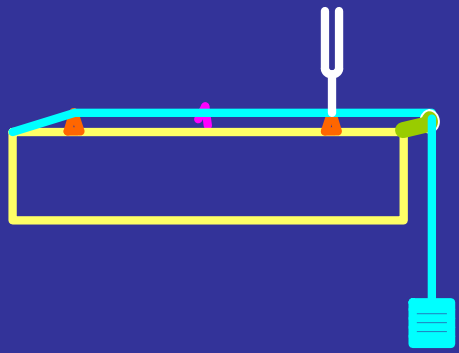
Sonometer $f \propto \sqrt{T}$

Apparatus



- Sonometer
  (Sonometer box)
  (Stretched string)
  (Tied at one end)
  (Bridges x2)
- Paper rider
- Tuning Fork
- Pulley
- Hanging Weights

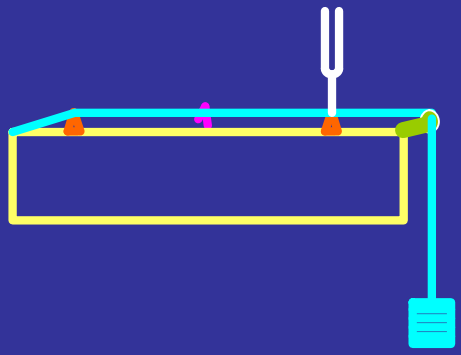
Sonometer $f \propto \sqrt{T}$



Procedure

- Vibrating fork on bridge … adjust tension by … resonance
- Measure (2) ...
- How are these measured?
- Repeat … other … Why repeat?

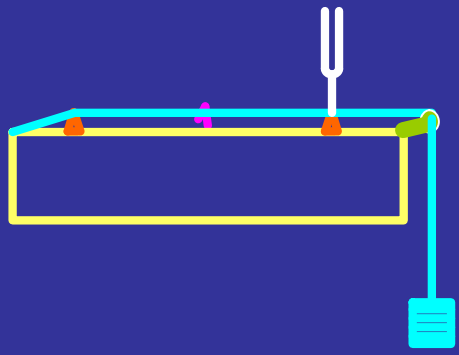
Sonometer $f \propto \sqrt{T}$



Procedure

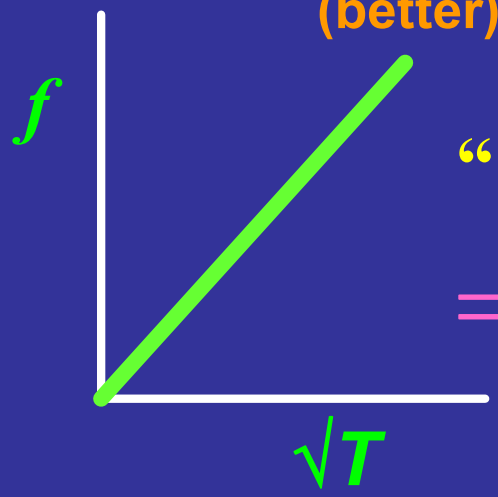
- Vibrating fork on bridge … adjust tension
  … by adding weights to … resonance …
- Measure (2) ... *f* & *T*
- *f* = frequency of fork
  T = hanging weights
- Repeat … other forks
  Why repeat? … to graph

Sonometer $f \propto \sqrt{T}$



Results

Method 1 (better)



"SLTO"

$\Rightarrow f \propto \sqrt{T}$

Method 2

$f \div \sqrt{T} =$ a constant

$\Rightarrow f \propto \sqrt{T}$

Sonometer $f \propto \sqrt{T}$

Precautions / Questions

1. Give two precautions taken to ensure an accurate result.
2. Why is the length kept constant during the experiment?
3. Give two ways of applying the tension to the wire. How is the tension measured?
4. Why is the paper rider used and why is it placed in the centre of wire?
5. Between what two things does resonance occur? What are equal when resonance occurs?
6. From where is the frequency of the wire read? Explain.
7. The tension of the wire is doubled, keeping its length fixed. What happens to the frequency of the wire?
8. How might the graph be used to measure the frequency of a tuning fork of unknown frequency?
9. How is the mass per unit length of the wire measured from the slope of the graph?