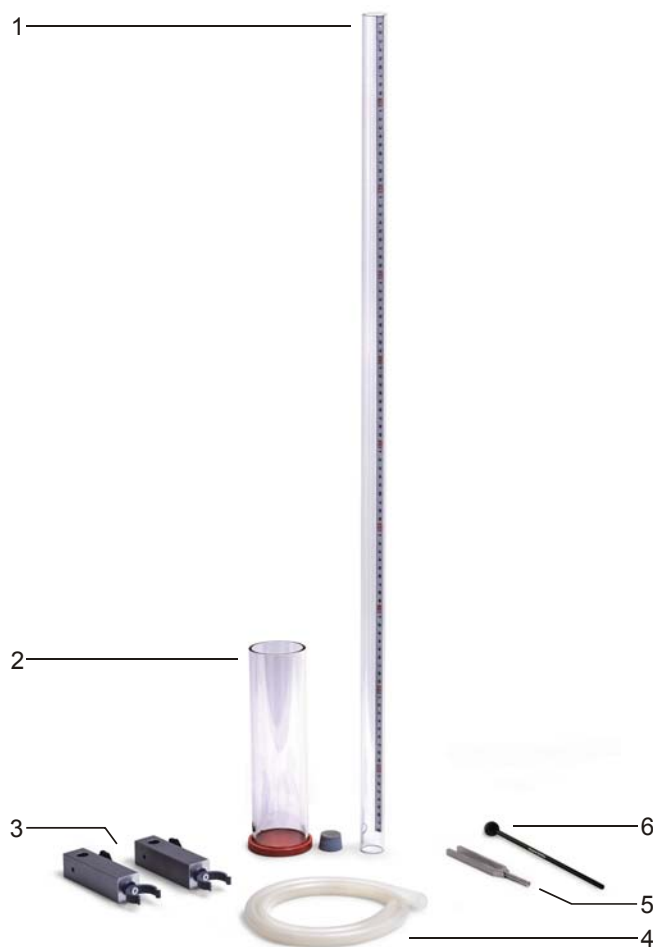


## Quincke's Resonance Tube 1018475

### Instruction manual

10/14 TL/UD



- 1 Resonance tube with scale and rubber stopper
- 2 Adjustment vessel
- 3 Horizontal clamps
- 4 Silicone tubing
- 5 Tuning fork
- 6 Beater

### 1. Safety instructions



- Quincke's resonance tube is filled with water when in use. The openings in the tube and the adjustment vessel are sealed solely by the silicone tubes. Both components are made of breakable plastic.
- Do not operate electrical equipment on the same table top as Quincke's resonance tube.
- Carefully insert the silicone tube at least 10 mm into the openings of the resonance tube and the adjustment vessel.
- Avoid excessive mechanical stress, e.g. due to impacts and strikes.
- Do not use the apparatus if you can see cracks or other damage to it.

## 2. Contents

- 1 Resonance tube with scale and rubber stopper
- 1 Adjustment vessel
- 1 Silicone tube
- 2 Horizontal clamps
- 1 Standard tuning fork,  $a^1$ , 440 Hz
- 1 Beater

## 3. Additionally required equipment

- 1 Stand rod, 1000 mm, 12 mm diam. 1002936
- 1 Stand base, A-shaped, 200 mm 1001044
- 1 Universal clamp 1002830

## 4. Technical data

Height of resonance tube	1 m
Diameter of resonance tube:	3 cm
Height of adjustment vessel:	24 cm
Diameter of adjustment vessel:	7 cm
Weight (not including accessories and stand apparatus):	3.3 kg approx.

## 5. Description

Quincke's resonance tube is designed to demonstrate interference of sound waves. The apparatus consists of a resonance tube with a scale which is connected via a silicone tube to another vessel with which the height of the water column can be adjusted. When in use, the resonance tube is set up vertically with the opening at the bottom sealed by a rubber stopper. The adjustment vessel is filled with water.

Lifting the adjustment vessel means that the height of the water in the resonance tube can be increased and the length of the air column reduced, as seen in Fig. 1. The column of air is excited to oscillate by means of a tuning fork beaten with a hammer (or optionally a loud-speaker). The source of sound is located above the open end of the tube and the sound waves propagating from there are superimposed on waves reflected from the surface of the water in the tube, resulting in either constructive or destructive interference. Audible resonances occur when the length of the oscillating air column corresponds to an odd multiple of one quarter of the wavelength of the sound.



Fig. 1: Quincke's resonance tube in operation.

## 6. Set-up

- Secure the stand rod in the base in such a way that the overall height of the apparatus is about 105 cm.
- Attach the two horizontal clamps to roughly the upper third or lower third of the stand rod.
- Set up the resonance tube vertically in front of the stand and push it carefully into the two horizontal clamps with the scale facing forwards.
- Depending on the length of the tuning fork, clamp the universal clamp to the top of the stand rod as shown in Fig. 2 or Fig. 3.
- Clamp the tuning fork into the universal clamp, as shown in Fig. 2 or Fig. 3, in such a way that both ends of the tuning fork tines are positioned as close to the opening of the resonance tube as they can be.

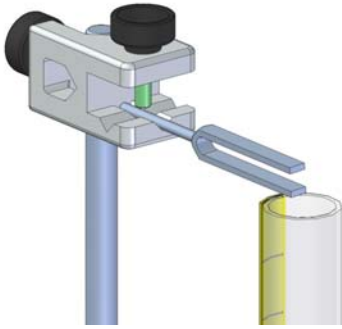


Fig. 2: Attachment of tuning forks with short shaft.

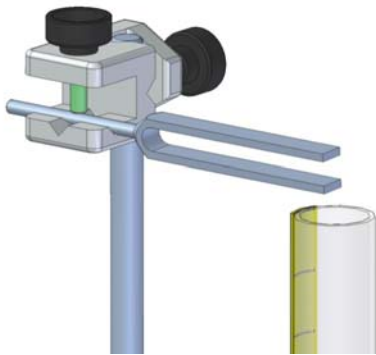


Fig. 3: Attachment of tuning forks with long shaft.

- Place the adjustment vessel close to the resonance tube and insert the two ends of the silicone tube at least 10 mm into the corresponding openings in the resonance tube and the adjustment vessel.

## 7. Operation

- Fill the adjustment vessel to about 4 cm below the brim.
- Strike the tuning fork with the beater and lift up the adjustment vessel (Fig. 1).
- Find resonances by increasing the height of the adjustment vessel step by step. In each case, read off the length of the air column from the scale and make a note of it.
- The lengths of the oscillating air column read off in this way will correspond to odd multiples  $n$  of one quarter of the wavelength  $\lambda$ .
- Other resonances can be found at  $\lambda/4 + n \cdot \lambda/2$ .

## 8. Note

There are tuning fork and sound generator apps for mobile phones which are available free of charge. These display the pitch and frequency and output the corresponding tone over the phone speaker. The experiment can equally well be carried out using such apps.



Smartphones can be damaged by water.

## 9. Storage, cleaning, and disposal

- Keep the apparatus in a clean, dry, dust-free place.
- Do not use aggressive cleaning agents or solvents to clean the apparatus.
- In order to clean the equipment, use a soft, damp cloth.
- The packaging should be disposed of at local recycling centres.
- If the equipment itself is to be disposed of, it must not be included with normal household waste. Local regulations are to be obeyed.



