Suggested Investigations

- Using the signal generator input try different waveforms taking care if you use the square wave.
- By using a microphone and amplifier you could call up some standing waves of your own making!
- Explanation of Standing Waves. The wavelength of a standing wave can be calculated by measuring the distance between two anti-nodes and doubling this value.
- Calculation of the Speed of Sound in gas (methane): velocity (v) = $f.\lambda$ (The frequency is known from the signal generator and the wavelength can measured as above. It should come out around 490m/s for Methane gas)

Packing the Unit Away

- After use, switch off the gas supply to the Rubens Tube and leave it to cool. This also allows the residual gas in the tube to dissipate.
- Disconnect the Bunsen tubing and the leads to the loudspeaker and store the tube in a safe place. You may wish to use the cardboard tube it was supplied with.



RUBENS TUBE



Code: SES250913



SLS Select Education Wilford Industrial Estate, Ruddington Lane, Nottingham, NG11 7EP Tel: 0115 982 2022 Fax: 0115 945 5379 Email: sales@science2education.co.uk Website: www.science2education.co.uk

OPERATING INSTRUCTIONS

The SLS Rubens' Tube

Please ensure that you have read these instructions thoroughly and have undertaken a suitable risk assessment prior to using the Rubens' Tube.

Additional Equipment Required

- Irwin Signal Generator with Power Amplifier (SLS Code SEEA0030) or similar
- Red Rubber Bunsen Style Tube (C758-8)
- 1m Ruler or tape measure to measure the wavelength
- Power Amplifier Board (SE08004) to allow MP3 Input

Health and Safety

- The Rubens Tube is designed for teacher demonstration and is not a practical that should be carried out by pupils.
- The tube will become hot during use, particularly the aluminium tube. Avoid touching the tube use and allow it cool down after use before putting it away. Do not attempt to move the tube whilst hot.
- The Rubens Tube has the capacity to hold a large volume of gas. Ensure it is used in a well-ventilated area and left for 20-30 minutes after use to allow the residual gas to dissipate.
- To prevent the aluminium tube from overheating do not use it for more than 10-15 minutes at a time.
- Be wary of using high volume inputs (for example music that has a prominent bass line). This can extinguish some of the flames on the tube. Ensure that all of the flame holes are lit during use otherwise there is a risk of gas being released out of the tube
- Avoid the combination of low gas pressure and high sound pressure
- when air can be drawn into the tube.
- Always conduct a full risk assessment prior to use.

Operating Instructions

- Position the tube in a well-ventilated part of the laboratory close to a gas supply (the Ruben tube can use both Natural and Butane gas).
- With the unit switched off connect the low impedance output of the signal generator to the sockets on the loudspeaker.
- Set the wave form to Sine wave (N.B. square wave forms are liable to blow flames out!).
- Connect the gas inlet of the Rubens Tube to your gas supply (preferably a gas tap) using red rubber or "Bunsen style" tubing
- Turn on the gas supply and using a lit splint or piezo lighter ignite the gas starting with the holes situated closest to the inlet end of the tube and lighting all of the other holes in turn.
- Use the gas tap to adjust the height of the flames start with a flame height of 4-5cm. If the flames are too high the effect of the wave form can be reduced. A higher flame height can be used but avoid flickering
- Turn on the signal generator with a low amplitude (volume) setting to start with. A good frequency to start with is in the region between 100 Hz and 2kHz. Start at the lower end of this range and gradually increase the frequency until the wave form is observed in the flame this is called a standing wave
- Resonance and standing wave patterns occur at several specific frequencies which are separated by a fixed frequency interval. Using this interval students should be able to predict where the next standing wave pattern will be found



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