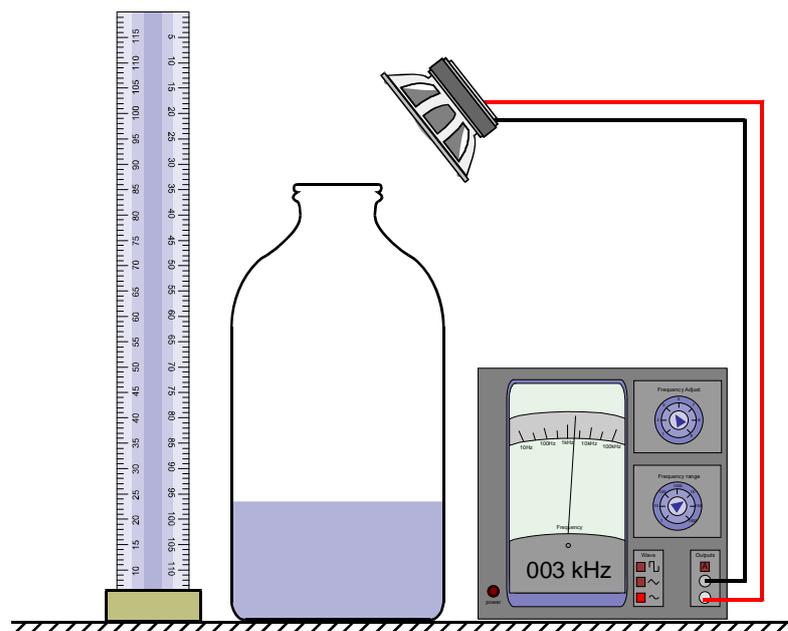


TAP 307- 4: Resonance of a milk bottle

You will need

- ✓ audio oscillator or signal generator
- ✓ milk bottle or 'stubby' beer bottle
- ✓ loudspeaker, 50 mm diameter with cut-off filter funnel attached to 'funnel' sound

What to do



1. Take a milk bottle or beer bottle and fill it from the tap.
2. If you filled the bottle before reading this line, stop and start again! This time listen carefully to the sound you hear as the water fills the bottle. How would you describe the changes in pitch (or frequency) and loudness as the bottle fills?
3. Put a centimetre or two of water in the bottom of the bottle. Starting with a frequency of about 50 Hz gradually raise the pitch of the speaker whilst pointing the filter cone towards the open neck of the bottle. At a frequency in the range 100 to 400 Hz you will hear the amplitude of the sound rise markedly. At this point the air in the bottle is resonating.
4. Put a little more water into the bottle and find the resonance point again. Repeat this process until the bottle is full.
5. Plot your results (frequency at resonance / height of air in bottle) as you go.
6. Try to explain the observations you made when filling the bottle and listening to the sound in the light of the data.

You have seen

1. When the amount of air in a bottle decreases the resonant frequency goes up.
2. The splashing water must produce notes of many frequencies. The bottle selectively amplifies specific frequencies dependent on the depth of water.

Practical advice

This demonstration shows the resonant effects of a volume of air. Rather than just asking the students to listen to one resonance point, the initial puzzle brings out the frequency-matching nature of resonance. All sorts of frequencies are present in the splashing water, but the bottle selectively amplifies only specific frequencies – which is why the pitch of the note rises as the water level decreases.

250 ml or 500 ml beer bottles work nicely with this, but of course standard conical flasks or round-bottomed flasks can be used if preferred.

Alternative approaches

Students may suggest other resonating systems for exploration.

Social and human context

At a basic level the tuning by resonance is analogous to the tuning of electrical circuits in radios. There are electromagnetic waves of many frequencies all around, but the radio circuit tunes to a specific one through electrical resonance.

External reference

This activity is taken from Advancing Physics chapter 10, 330E