

Physics Demos for Open House

Ten bonus points will be granted to students who will come in and do demos for the Open House. Students will need to sign up with Boom prior the Open House date. We shall need to be able to explain the principles involved with the demo that we do. *Visitors will need to be enlightened.*

Choose one demo that you would like to perform.

Here are the nine demos along with their principles:

Doppler Effect

The Doppler Effect is the change in pitch of a tone due to relative motion between the source and the listener.

Approaching is higher because we hear more waves/sec.
Receding is lower because we hear fewer waves/sec.

The Musical Hose resonates certain harmonics to give a steady tone.

This is an open tube resonator that reinforces even numbered harmonics.

As we swing the hose around, it alternately approaches and recedes from the listener.

Hence, one hears the tone becoming higher and lower.

Weee ooooo weee oooo

Archimedes, Combustion, and Methane Bubbles

Archimedes' Principle:

An immersed body is buoyed up by the weight of the displaced fluid.

The density of air is 1.0 gram/liter

The density of methane is 0.7 grams/liter

So the buoyant force of a liter of air is 1.0 gram and the downward force of the methane is only 0.7 grams so up goes the bubble. (The weight of the soap is negligible).

Ignition lowers the density still more, causes convection currents, and ROAR!



The Great Suckback!



small volume

large volume

When the flask is filled with live steam, the volume has increased 1500 times! So when we condense the steam back into liquid water, the 1500 times contraction will produce a "vacuum" in the flask.

Atmospheric pressure, 1 kg/cm² will PUSH water back into the flask! ROAAAAR! And Boiling BUBBLES due to the lowering of pressure. Boiling point is the temperature at which atmospheric pressure equals the vapor pressure.

Resonators, Forks, Harmonics, and the Speed of Sound!

The water controlled glass cylinder is a closed tube that will resonate odd numbered harmonics. The fundamental will be the strongest harmonic.

Raise and lower the water level until the loudest resonance is achieved. The speed of sound can be calculated:

The Closed Pipe wavelength, λ is roughly found by

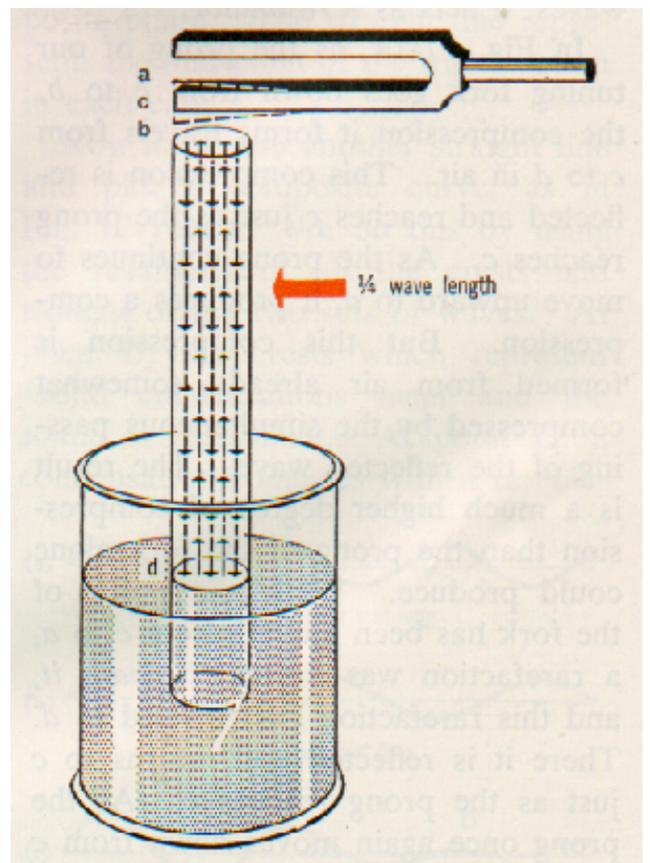
$$\lambda = 4(L)$$

where L is the length of the resonator in meters.

The speed of sound in meters/sec is found by

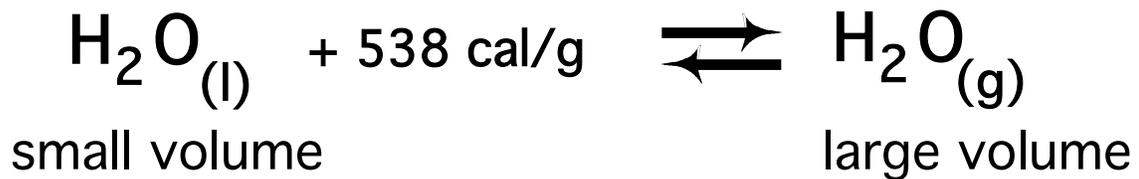
$$v = f\lambda$$

where f is the frequency of the fork in cycles/second.



Some Shocks of Vapor Pressure and Boiling Point!

The Principle of le Chatelier: *When a system at equilibrium is stressed, it will shift in the direction that will absorb the stress.*



The volume increases by 1500 times when liquid water becomes gas at room conditions.

Some Shocking discoveries:

Boiling at temps below 100°C in a vacuum.

Boiling cools! (When no burner is applied).

Big BLAMS of exploding bubbles when the equilibrium is tickled with heat or vacuum.

The BAM CAN!

Archimedes' Principle:

An immersed body is buoyed up by the weight of the displaced fluid.

The density of air is 1.0 gram/liter

The density of methane is 0.7 grams/liter

So the buoyant force of a liter of air is 1.0 gram and the downward force of the methane is only 0.7 grams so up goes the flow from the bottom of the can and out the 10mm hole at the top.

The mixture of methane and oxygen will ignite when the activation energy is reached. At first, the metal of the can will absorb enough heat to prevent ignition. Also, the fast flow at the beginning keeps the flame from entering the can.

As the oxygen concentration decreases, the flow rate decreases until the low flame does indeed enter the can igniting the remaining methane inside. BAAAMMMMM!

CAUTION: Be sure that no one is toooo close to the can!!!

Inertia and Clear the Table!

The Law of Inertia:

Every body either remains at rest or continues to move at a constant velocity in a straight line unless acted upon by an external force.

The Law of Acceleration:

The acceleration of a body is directly proportional to the force acting upon it and inversely proportional to its mass.

Warning:

A slick, low coefficient of friction cloth must be used.

No hem to catch things.

Jerk straight back.

Total commitment!

Transducers:

60-cycle Horn, and the Mighty Air Siren!

Transducers are devices that change electricity into sound waves or vice versa.

The 60 cycle HORN!

Sixty cycle alternating current will produce a 60 cycle alternating magnetic field in a coil of wire. This varying field will cause a steel diaphragm to vibrate thus producing compressions and rarefactions of sound waves.

The Pneumatic Air Siren:

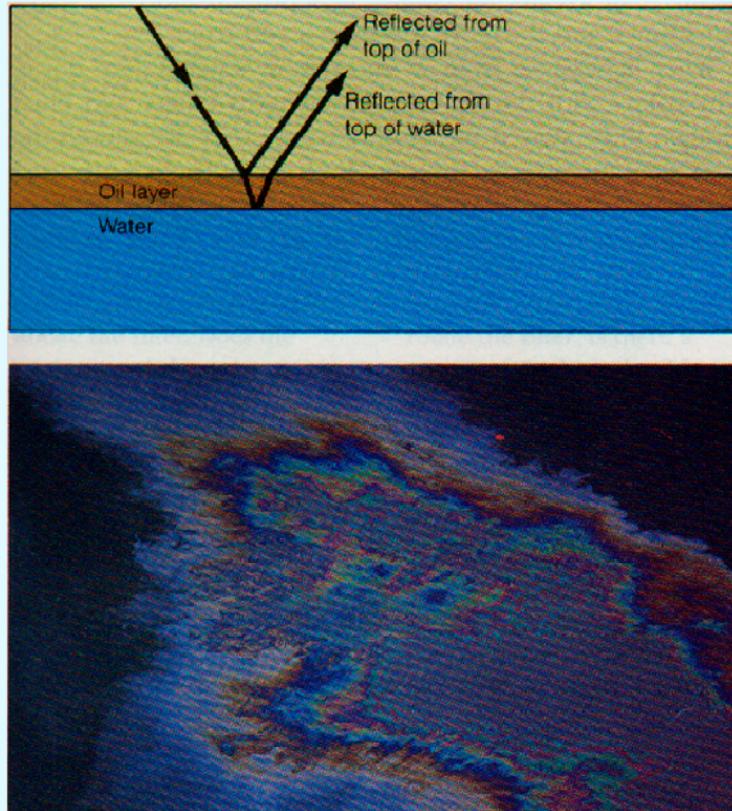
A centrifugal pump blows air through holes in the periphery of the case. The holes are alternately opened and closed to cause the air to be emitted in puffs or no-puffs. That is compressions and rarefactions of sound waves. The frequency of the pitch produced is determined by the speed of rotation of the siren.

Bubble Diffraction

Oil Slick and Bubble Diffraction

A ray of light is reflected from both the top and bottom layer of the oil slick. The two rays interfere with each other.

Boomlab:
Bubble diffraction.



The layer is only a few atoms thick.