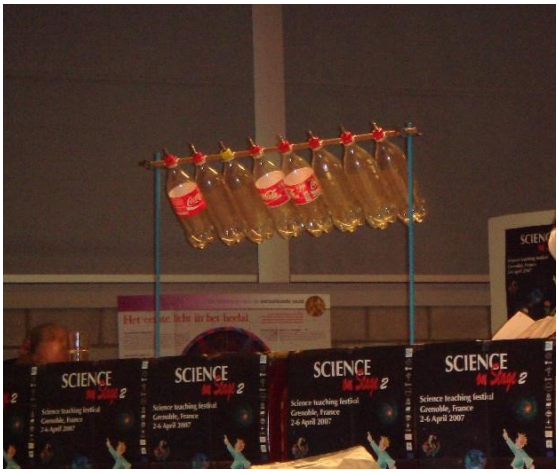
The Xylophone

Material:

- 8 small bicycle air tube valves, and a piece of air tube.
- 8 big identical PET bottles with the bottle caps.
- 8 nuts of the same diameter than the valves
- One bicycle pump (preferably a foot-operated pump)
- 2 stands and 2 clamp holders.
- One bar of one meter length
- String
- One wooden hammer with rubber head.



Procedure:

1. Drill a hole in a bottle cap, whose diameter corresponds to the diameter of the valve base.
   Cut 2 rubber slices of 1,5 cm diameter into the air tube piece. Using a die cutting, drill a hole in each slice, slightly bigger than the diameter of the valve base. Make each valve passing through one rubber slice, then through the cap, then again through a rubber slice, and finally tighten using a nut. Screw the cap onto the bottle. The valve must be outside of the bottle. Repeat the same operation for all the bottles.
   Secure a clamp holder at the top of each stand.
2. Securely attach every bottle on the bar (for example, by making a lashing). Keep a gap of about 1 cm between each bottle.
   Attach the bar to the clamp holder of the 2 stands.
3. Use the pump to inflate each bottle using different pressures in order to obtain the 7 basic notes (+ 1) of one octave: do, re, mi, fa, sol, la, si, do. (13 to 14 pump strokes are required to obtain the do, 8 to 9 additional strokes to obtain the re, and so on)
   From the sol, the pressure supplied by a small (bicycle) pump is so high that it is nearly impossible to obtain the next notes. You must then use a foot-operated pump.
   Hit with the hammer - or with another object - to obtain the different sounds thanks to each bottle. Adjust the pressure in each bottle and check if the scale is correct.
4. You can now play xylophone!

Explanation:
The propagation velocity of the sound depends on the pressure:

$$v=\sqrt{\frac{1{,}4.p}{\rho}}$$

where v is the velocity, p the gas pressure and ρ the gas density.

The wavelength of the sound depends on the length of the bottle.

Yet, the frequency = $\frac{\text{velocity}}{\text{wavelength}}$

The frequency of the sound emitted by the different bottles depends on the air pressure inside the bottle.