

# TSAAPT

## Texas Section of the American Association of Physics Teachers

Connecting physics teachers in the state of Texas

### Boom Whackers

#### What to do?

Hold a boom whacker in one hand at one end and hit the other end on a solid surface. You should hear a musical note.

#### What's going on?

When you hit the boom whacker you excite a longitudinal pulse of sound, which through interference settles into a standing wave pattern. Since the boom whacker is an open tube, the wavelength of the fundamental tone is twice the length of the pipe. The frequency (pitch) of the note then is given by  $\text{Frequency} = (\text{Speed of sound in air}) / (\text{Two times the length of the tube})$

#### How do I build it?

Materials: Polycarbonate tubing such as fluorescent bulb protectors.

Tools: You will need something to cut the tubing to the desired length. A mitre saw works well.

Assembly: Cut the tubing to the desired length. A suggested scheme is shown in the table below. It is a good idea to decorate the pipes so that they can be told apart. Wrap different color tape on each pipe or else spray paint them with paint designed for plastic. A suggested color scheme is given in the table as well.

Note	Frequency	Wavelength (cm)	Length of Tube (cm)	Suggested color
C <sub>4</sub>	261.63	131.1	65.6	White
D <sub>4</sub>	293.66	116.8	58.4	Red
E <sub>4</sub>	329.63	104.1	52.0	Orange
F <sub>4</sub>	349.23	98.2	49.1	Yellow
G <sub>4</sub>	392	87.5	43.8	Green
A <sub>4</sub>	440	78.0	39.0	Blue
B <sub>4</sub>	493.88	69.5	34.7	Purple
C <sub>5</sub>	523.25	65.6	32.8	Black or white

#### Enrichment

Have the students research the equally tempered scale and design the set of boom whackers themselves. Palm pipes and boom whackers complement each other as palm pipes are closed on one end and boom whackers are open at both ends.