

Conical-Shaped Air Columns

Some wind instruments - e.g. whistles, recorders, flutes, oboe, bagpipes (chanter) have **conical-shaped** air columns: \approx more complicated organ pipes – one end open; one end closed...

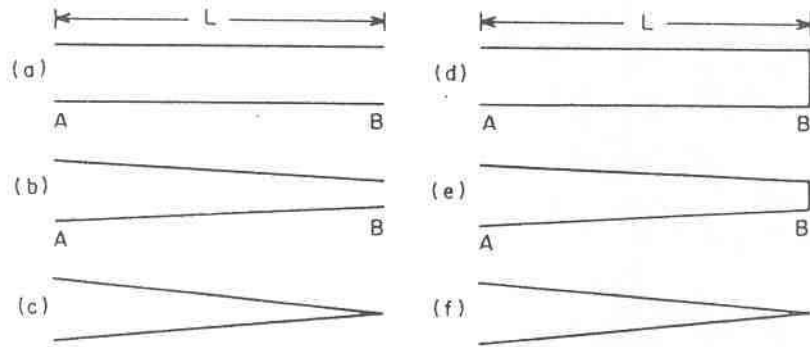


FIG. 10. (a), (b), (c) Going from an open tube to a cone. (d), (e), (f) Going from a closed tube to the same cone.

$$v = f_n \lambda_n$$

$$f_n = n f_1$$

$$\lambda_n = \frac{\lambda_1}{n} = \frac{2L}{n}$$

$$n = 1, 2, 3, \dots$$

A **complete** cone has the **same** mode vibration frequencies as that for an **open-open** tube of the **same** length – the **tip** of the cone reflects like the **open** end of a tube!!

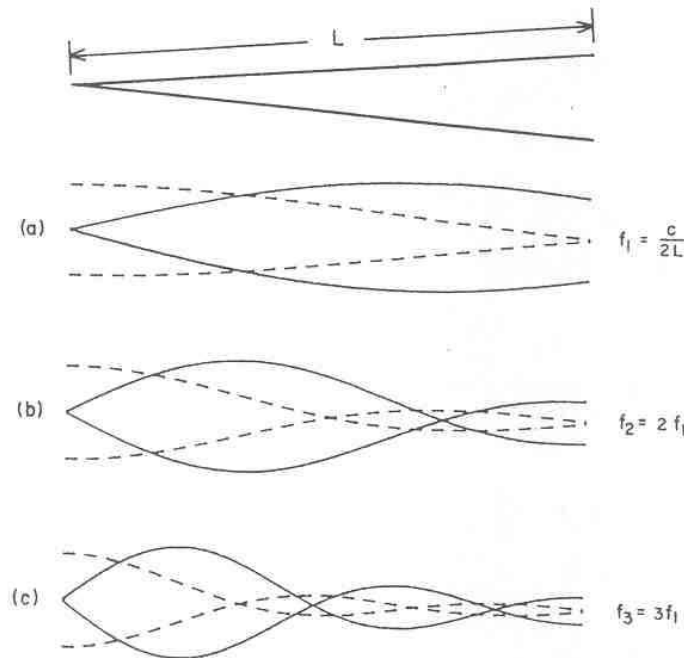


FIG. 11. First three vibration modes of a complete cone.