

## Chapter 17

## Problem 82

Voice production - treat as resonant pipe  
closed at one end.

a) What is the fundamental frequency of the tube?

$$L = 0.240 \text{ m} \quad T = 37.0^\circ \text{C}$$

The velocity of the wave is

$$v = 331 \text{ m/s} \sqrt{\frac{T}{273}} = 331 \text{ m/s} \sqrt{\frac{273+37}{273}} = 353 \text{ m/s}$$

The wavelength is

$$\text{closed end pipe } \lambda_n = \frac{4L}{n} = \frac{4(0.240 \text{ m})}{1} = 0.960 \text{ m}$$

$n=1$

From the equation  $v = \lambda \cdot f$

$$f = \frac{v}{\lambda} = \frac{353 \text{ m/s}}{0.960 \text{ m}} = \boxed{368 \text{ Hz}}$$