

p 348 25, 27, 32, 34 (speed of sound 343 ms^{-1})

(25) (a) fundamental

$$L = \frac{\lambda}{4}$$

$$\lambda = 4L = 4(1.12 \text{ m}) \\ = 4.48 \text{ m}$$

$$v = f\lambda$$

$$f = \frac{v}{\lambda} = \frac{343 \text{ ms}^{-1}}{4.48 \text{ m}} \\ = \underline{76.6 \text{ Hz}}$$

3rd

$$L = \frac{3\lambda}{4}$$

$$\lambda = \frac{4L}{3} = \frac{4(1.12 \text{ m})}{3} \\ = 1.49 \text{ m}$$

$$v = f\lambda$$

$$f = \frac{v}{\lambda} = \frac{343 \text{ ms}^{-1}}{1.49 \text{ m}} \\ = \underline{230 \text{ Hz}}$$

5th

$$L = \frac{5\lambda}{4}$$

$$\lambda = \frac{4L}{5} = \frac{4(1.12 \text{ m})}{5} \\ = 0.896 \text{ m}$$

$$v = f\lambda$$

$$f = \frac{v}{\lambda} = \frac{343 \text{ ms}^{-1}}{0.896 \text{ m}} \\ = \underline{383 \text{ Hz}}$$

7th

$$L = \frac{7\lambda}{4}$$

$$\lambda = \frac{4L}{7} = \frac{4(1.12 \text{ m})}{7} \\ = 0.64 \text{ m}$$

$$v = f\lambda$$

$$f = \frac{v}{\lambda} = \frac{343 \text{ ms}^{-1}}{0.64 \text{ m}} \\ = \underline{536 \text{ Hz}}$$

(b) fundamental

$$L = \frac{\lambda}{2}$$

$$\lambda = 2L = 2(1.12 \text{ m}) \\ = 2.24 \text{ m}$$

$$v = f\lambda$$

$$f = \frac{v}{\lambda} = \frac{343 \text{ ms}^{-1}}{2.24 \text{ m}} \\ = \underline{153 \text{ Hz}}$$

2nd

$$L = \frac{2\lambda}{2}$$

$$\lambda = L = 1.12 \text{ m}$$

$$f = \frac{v}{\lambda} = \frac{343 \text{ ms}^{-1}}{1.12 \text{ m}}$$

$$= \underline{306 \text{ Hz}}$$

3rd

4th

$$f = \underline{459 \text{ Hz}}$$

$$f = \underline{636 \text{ Hz}}$$

(27)

$$20 \text{ Hz}$$

$$v = f\lambda$$

$$\lambda = \frac{v}{f} = \frac{343 \text{ ms}^{-1}}{20 \text{ Hz}} = 17.15 \text{ m}$$

$$L = \frac{\lambda}{2} = \frac{17.15 \text{ m}}{2} = \underline{8.6 \text{ m}}$$

$$20 \text{ kHz}$$

$$\lambda = \frac{v}{f} = \frac{343 \text{ ms}^{-1}}{20 \times 10^3 \text{ Hz}} = 0.01715 \text{ m}$$

$$L = \frac{\lambda}{2} = \frac{0.01715 \text{ m}}{2} = \underline{8.6 \times 10^{-3} \text{ m}}$$

(32)

$$v = f\lambda$$

$$\lambda = \frac{v}{f} = \frac{343 \text{ ms}^{-1}}{294 \text{ Hz}} = 1.17 \text{ m}$$

$$L = \frac{\lambda}{2} = \frac{1.17 \text{ m}}{2} = \underline{0.58 \text{ m}}$$

(34)

(a) assume open

$$\frac{n f_0}{(n+1) f_0} = \frac{264}{440}$$

$$440n = 264n + 264$$

$$176n = 264$$

$$n = 1.5$$

can't have half values

∴ must be closed.

confirm closed.

$$\frac{n f_0}{(n+2) f_0} = \frac{264}{440}$$

$$440n = 264n + 528$$

$$176n = 528$$

$$n = 3$$

$$(b) 3f_0 = 264$$

$$f_0 = \frac{264}{3} = \underline{88 \text{ Hz}}$$