Waves 10

① closed air column, $\therefore L = \frac{\lambda}{4}, \frac{3\lambda}{4}, \frac{5\lambda}{4}$, etc.

a) $L_1 = \frac{\lambda}{4}$ $\quad (L_2 = 51\text{ cm})$

$17 = \frac{\lambda}{4}$

$\lambda = (4)(17) = \boxed{68\text{ cm}}$

b) $L_3 = \frac{5\lambda}{4}$

$= \frac{5(68)}{4} = \boxed{85\text{ cm}}$

② a) $L_1 = 32\text{ cm}$

$L_1 = \frac{\lambda}{4}$

$32 = \frac{\lambda}{4}$

$\lambda = (4)(32)$

$\lambda = 128\text{ cm}$

$L_2 = \frac{3\lambda}{4}$

$= \frac{3(128)}{4}$

$L_2 = \boxed{96\text{ cm}}$

$L_3 = \frac{5\lambda}{4}$

$= \frac{5(128)}{4}$

$L_3 = \boxed{160\text{ cm}}$

② b) open air column, so $L = \frac{\lambda}{2}, \lambda, \frac{3\lambda}{2}$, etc.

$L_1 = \frac{\lambda}{2}$

$32 = \frac{\lambda}{2}$

$\lambda = (2)(32)$

$\lambda = 64$ cm

$L_2 = \lambda$

$L_2 = \boxed{64 \text{ cm}}$

$L_3 = \frac{3\lambda}{2}$

$= \frac{3(64)}{2}$

$L_3 = \boxed{96 \text{ cm}}$

① $L_3 = \frac{5\lambda}{4}$

$95 = \frac{5\lambda}{4}$

$\lambda = \frac{4(95)}{5}$

$\lambda = 76$ cm

$L_1 = \frac{\lambda}{4}$

$= \frac{76}{4}$

$L_1 = \boxed{19 \text{ cm}}$

$L_2 = \frac{3\lambda}{4}$

$= \frac{3(76)}{4}$

$L_2 = \boxed{57 \text{ cm}}$

④ $L_2 = \lambda$

$64 = \lambda$

$\lambda = 64$ cm

$L_1 = \frac{\lambda}{2}$

$= \frac{64}{2}$

$L_1 = \boxed{32 \text{ cm}}$

$L_3 = \frac{3\lambda}{2}$

$= 3\frac{(64)}{2}$

$L_3 = \boxed{96 \text{ cm}}$

⑤ In an open air column, the difference between 2 resonant lengths is always $\frac{\lambda}{2}$.

e.g. $L_2 - L_1 = \lambda - \frac{\lambda}{2} = \frac{\lambda}{2}$

$\therefore \frac{\lambda}{2} = 20.2$ cm

$\lambda = 2(20.2) = 40.4$ cm $= 0.404$ m

$v = 331 + 0.6T$

$= 331 + 0.6(27)$

$v = 347.2$ m/s

$f = \frac{v}{\lambda}$

$= \frac{347.2}{0.404}$

$f = \boxed{859.4 \text{ Hz}}$

⑥ a) $v = 331 + 0.6T$

$= 331 + 0.6(22)$

$v = 344.2 \text{ m/s}$

$\lambda = \frac{v}{f}$

$= \frac{344.2}{128}$

$\lambda = 2.689 \text{ m}$

$L_1 = \frac{\lambda}{2}$

$= \frac{2.689}{2}$

$L_1 = \boxed{1.34 \text{ m}}$

b) $L_1 = 1.34 \text{ m}$

$L_1 = \frac{\lambda}{4}$

$\lambda = 4(1.34) = 5.38 \text{ m}$

$f = \frac{v}{\lambda} = \frac{344.2}{5.38} = \boxed{64 \text{ Hz}}$

(7) $\frac{\lambda}{2} = 110 \text{ cm}$

$\lambda = 2(110) = 220 \text{ cm} = 2.2 \text{ m}$

$v = f\lambda$

$= (440)(2.2)$

$v = \boxed{968 \text{ m/s}}$