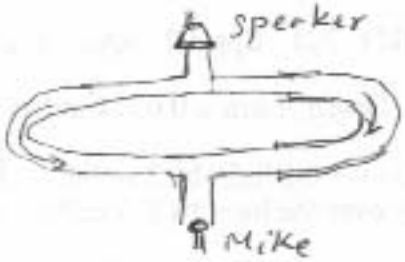
Ch. 17
C & J Ed. 5

#4

$f = 12.000$ Hz



$\Delta l = 2 \times .020$ m
$= .040$ m

Path length Difference $= .040$ m

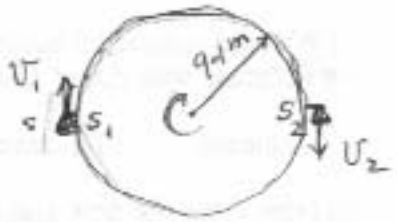
To change the loudness from maximum to minimum, this must be equal to $\frac{1}{2}\lambda$. (the first)

$$\frac{\lambda}{2} = .040\text{ m} \Rightarrow \lambda = .080\text{ m}.$$

$$v = \lambda f = (.080\text{ m})(12.000\text{ Hz}) = 960\text{ m/s}$$

54

$r = 9.1$ m
$f = 100.0$ Hz
$v_{sound} = 343.00$ m/s
$T = 20.0$ s



Velocities of speakers S_1 and S_2 are equal but opposite (as shown)

Mike or Listener

$$v_1 = v_2 = \frac{2\pi r}{T} = \frac{2\pi (9.1\text{m})}{20.0\text{ s}} = 2.86\text{ m/s}$$

S_1 is receding from the listner, its frequency heard by the listner is

$$f_1' = \frac{v}{v + v_s} f = \left(\frac{343}{343 + 2.86}\right) 100.0 = 99.17$$

S_1 is approaching the listner, its shifted frequency is

$$f_2' = \frac{v}{v - v_s} f = \left(\frac{343}{343 - 2.86}\right) 100.0 = 100.84$$

$$f_{beat} = f_2' - f_1' = 1.67\text{ Hz}.$$