

**SUVA SANGAM COLLEGE**

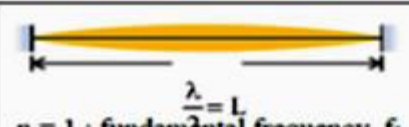

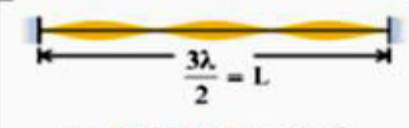
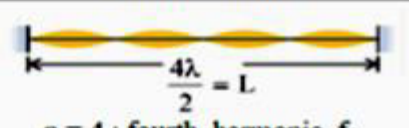
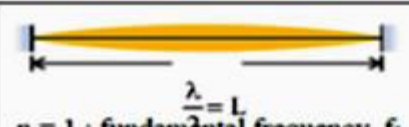

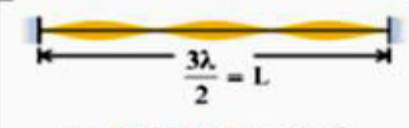
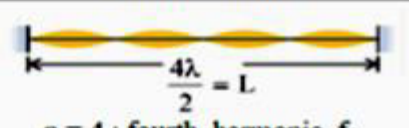
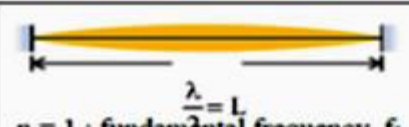

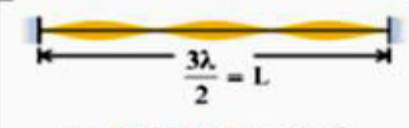
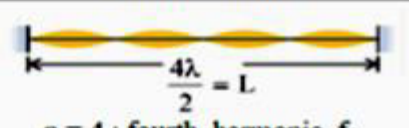
**YEAR 13**

**PHYSICS**

**WORKSHEET 9**

|                     |             |
|---------------------|-------------|
| Strand 3 P13.3      | Waves       |
| Reference from Text | Pg 66 to 85 |

**Questions**

|  |   |   |  |  |                     |  |  |   |                      |
|--|---|---|--|--|---------------------|--|--|---|----------------------|
| <b>No.</b>   | <p><b>CONCEPT IN BRIEF:</b></p> <div style="border: 1px solid black; padding: 10px; margin: 10px auto; width: fit-content;"> <p align="center"><u>General Equation-Travelling wave</u></p> <table style="width: 100%; border-collapse: collapse;"> <tr> <td style="border: 1px solid black; padding: 5px;">Amplitude (m)</td> <td style="border: 1px solid black; padding: 5px; text-align: center;">Angular frequency (rad/s)<br/><math>\omega = 2\pi f = \frac{2\pi}{T}</math></td> </tr> <tr> <td colspan="2" style="border: 1px solid black; padding: 5px; text-align: center;"><math>y(x, t) = A \sin(\omega t \pm kx)</math></td> </tr> <tr> <td colspan="2" style="border: 1px solid black; padding: 5px; text-align: center;">Wave number: <math>k = \frac{2\pi}{\lambda} = \frac{\omega}{v}</math> (rad/m)</td> </tr> </table> </div>  | Amplitude (m)   | Angular frequency (rad/s)<br>$\omega = 2\pi f = \frac{2\pi}{T}$  | $y(x, t) = A \sin(\omega t \pm kx)$  |                     | Wave number: $k = \frac{2\pi}{\lambda} = \frac{\omega}{v}$ (rad/m) |  |   |                      |
| Amplitude (m)  | Angular frequency (rad/s)<br>$\omega = 2\pi f = \frac{2\pi}{T}$   |   |  |  |                     |  |  |   |                      |
| $y(x, t) = A \sin(\omega t \pm kx)$                                |   |   |  |  |                     |  |  |   |                      |
| Wave number: $k = \frac{2\pi}{\lambda} = \frac{\omega}{v}$ (rad/m) |   |   |  |  |                     |  |  |   |                      |
| 1.   | <p>A wave travelling through a string along the x-axis has the equation: <math>y = 0.03\sin(0.3x + 5t)</math>.</p> <p>(a) State the direction of wave.</p> <p>(b)</p> <p>(c) Calculate the value of:</p> <p>(i) Amplitude (A)</p> <p>(ii) Frequency (f)</p> <p>(iii) Wavelength (<math>\lambda</math>)</p> <p>(iv) Velocity of wave (v)</p>   |   |  |  |                     |  |  |   |                      |
|  | <p><b>CONCEPT IN BRIEF: Standing Waves in a string</b> <math>f_n = \frac{nv}{2L}</math></p> <table border="1" style="width: 100%; text-align: center; border-collapse: collapse;"> <tr> <td style="width: 15%;"><math>f_1 = \frac{v}{2L}</math></td> <td style="width: 35%;"><br/><math>\lambda = L</math><br/>n = 1 : fundamental frequency, <math>f_1</math></td> <td style="width: 35%;"><br/><math>\lambda = L</math><br/>n = 2 : second harmonic, <math>f_2</math><br/>( first overtone)</td> <td style="width: 15%;"><math>f_2 = \frac{v}{L}</math></td> </tr> <tr> <td><math>f_3 = \frac{3v}{2L}</math></td> <td><br/><math>\frac{3\lambda}{2} = L</math><br/>n = 3 : third harmonic, <math>f_3</math><br/>( second overtone)</td> <td><br/><math>\frac{4\lambda}{2} = L</math><br/>n = 4 : fourth harmonic, <math>f_4</math><br/>( third overtone)</td> <td><math>f_4 = \frac{2v}{L}</math></td> </tr> </table> | $f_1 = \frac{v}{2L}$  | <br>$\lambda = L$<br>n = 1 : fundamental frequency, $f_1$ | <br>$\lambda = L$<br>n = 2 : second harmonic, $f_2$<br>( first overtone) | $f_2 = \frac{v}{L}$ | $f_3 = \frac{3v}{2L}$  | <br>$\frac{3\lambda}{2} = L$<br>n = 3 : third harmonic, $f_3$<br>( second overtone) | <br>$\frac{4\lambda}{2} = L$<br>n = 4 : fourth harmonic, $f_4$<br>( third overtone) | $f_4 = \frac{2v}{L}$ |
| $f_1 = \frac{v}{2L}$   | <br>$\lambda = L$<br>n = 1 : fundamental frequency, $f_1$  | <br>$\lambda = L$<br>n = 2 : second harmonic, $f_2$<br>( first overtone)            | $f_2 = \frac{v}{L}$  |  |                     |  |  |   |                      |
| $f_3 = \frac{3v}{2L}$  | <br>$\frac{3\lambda}{2} = L$<br>n = 3 : third harmonic, $f_3$<br>( second overtone)  | <br>$\frac{4\lambda}{2} = L$<br>n = 4 : fourth harmonic, $f_4$<br>( third overtone) | $f_4 = \frac{2v}{L}$   |  |                     |  |  |   |                      |
| 2.   | <p>The diagram shows a string of length 2 m and mass 20 g attached to a tuning fork which is vibrating at a frequency of 400 Hz. The tension applied to the string causes it to vibrate in its</p>  |   |  |  |                     |  |  |   |                      |

fourth harmonic mode.



- Draw the pattern that would be observed for this mode.
- Calculate the wavelength of the standing wave formed in the string.
- Calculate the speed of the wave along the string.

**CONCEPT IN BRIEF:** Interference bands in reflected light can be observed by illuminating a wedge shaped film

$$\Delta x = \frac{L\lambda}{2t}$$

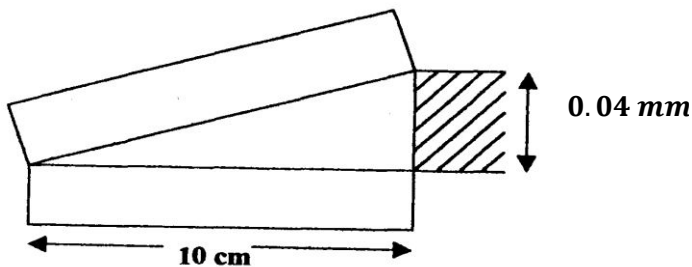
$\Delta x$  = distance between dark fringes

$L$  = length of air wedge

$t$  = thickness

$\lambda$  = wavelength

- An air wedge is formed by two 10 cm long glass slides placed in contact at one end and separated by a 0.04 mm thick paper at the other.



Find the distance between the adjacent dark fringes formed as a result of the interference of light of wavelength 700 nm incident on it.