**TUTORIAL QUESTIONS_SUPERPOSITION**

**Question 1**

Which quantity, if increased, would cause the separation of the fringes to increase?
a.) width of the slit
b.) separation of the slits
c.) distance from the slits to the screen
d.) frequency of the wave

**Question 2**

In a Young's double slit experiment, a small detector measures the intensity of illumination of E at the centre of the fringe pattern. If one of the two (identical) slits is now covered, the measured intensity will be

a.) E b.)E/√2 c.) E/2 d.) E/4

**Question 3**

A diffraction grating has 300 lines per mm. When it is illuminated normally by light of wavelength 530 nm,
a.) calculate the angle between the $1^{st}$ and 2 nd order maxima.
b.) what is the highest order maximum that can be obtained?
c.) the total number of bright fringes that can be seen?

**Question 4**

If a laser light of wavelength 632.8 nm is shone through a pair of narrow slits a distance of 0.420 mm apart, what will be the separation of the spots on a screen placed at right angles to the initial direction of the light at a distance of 3.00 m from the slits?

**Question 5**

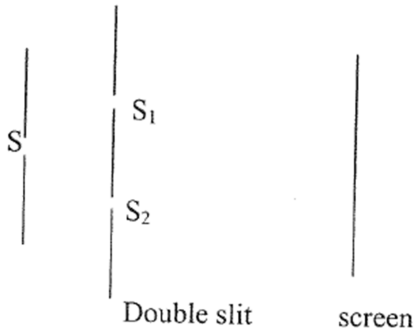
In Young's double slit experiment using a laser of wavelength 638 nm, the screen is placed 2.5 m from the double slit. If the slit separation is 0.50 mm, calculate the distance between fringes.
If the red laser is replaced, and the fringes are now observed to be separated by a distance of 2.6 mm, calculate the wavelength of the light emitted by the new laser.

**Question 6**

A narrow beam of monochromatic light falls at normal incident on a diffraction grating. Thrid-order diffracted beams are formed at angles of 45° to the original direction. What is the highest order of diffracted beam produced by this grating?

**Question 7**

S is a source of white light. Which of the statements is correct?




a.) the fringes on screen are all white.
b.) the blue fringes are further apart than the red fringes.
c.) the light from S is not diffracted at $S_1$ and $S_2$.
d.) The centre of the fringe pattern is white.

**Question 8**

A beam of microwaves of wavelength 3.1 cm is directed normally through a double slit in a metal screen and interference effects are detected in a plane parallel to the slits and at a distance of 40 cm from them. It is found that the distance between the centres of the $1^{st}$ maxima on either side of the central maximum in the interference pattern is 70 cm. Calculate an approximate value for the slit separation.

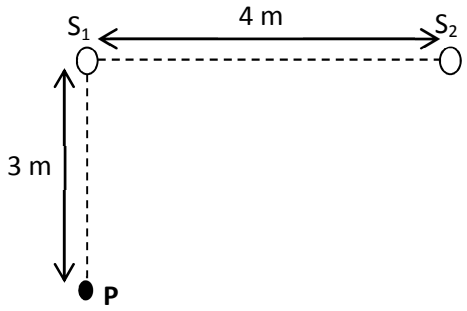
**Question 9**

In a double slit experiment, a screen is positioned at a distance of 0.80 m from the two slits. Light of wavelength 590 nm is directed at the slits normally to give an interference pattern on the screen with five fringes spaced over a distance of 4.8 mm. Calculate the slit spacing.

**Question 10**

Which one the following statements must be true about two waves of monochromatic light arriving at a point on a screen if the waves are coherent?
a.)They are in phase.
b.) They have a constant phase difference.
c.) They have both travelled paths of equal length.
c.) They have approximately the same amplitude.
e.) They interfere constructively.

**Question 11**




Water waves of wavelength 4 m are produced by 2 generators, $S_1$ and $S_2$ as shown. Each generator, when operated by itself, produces waves which have an amplitude A at **P**, which is 3 m from $S_1$ and $S_2$. When the generators are operated in phase,

a.) what is the amplitude of oscillation at **P** in term of A?
b.) what is the amplitude of oscillation at **P** in term of A, if the wavelength is now 2 m?

**Question 12**

With n, being an integer, a dark fringe occurs when the phase difference between the 2 waves is

a.) nπ rad b.) (n + ½) π rad c.) 2nπ rad d.) (2n + 1) π rad

**Question 13**

If a dark fringe occurs at a point P, which of the following gives possible phase differences for light waves arriving at the point from two slits?

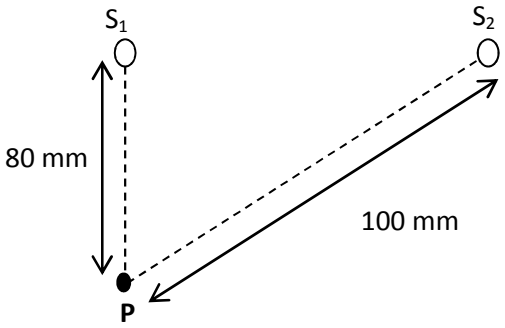
a.) 2π, 4π, 6π … b.) π, 3π, 5π … c.) π, 2π, 3π … d.) π/2, 3π/2, 5π/2 …

**Question 14**

Sound from 2 coherent loudspeakers reaches a point P. The two paths differ in length by 1.2 m. When the frequency of the sound is gradually increased, the resultant intensity at P goes through a series of maxima and minima. A maximum occurs when the frequency is 1000 Hz and the next maximum occurs at 1200 Hz. What is the speed of sound in that medium?

a.) 240 $ms^{-1}$ b.) 480 $ms^{-1}$ c.) 1200 $ms^{-1}$ d.) 1440 $ms^{-1}$

**Question 15**




The diagram on the left shows two sources $S_1$ and $S_2$ in a ripple tank. The sources oscillate in phase and produce similar circular ripples of wavelength 40 mm. What is the phase difference between the disturbances experienced at P, a distance 80 mm from $S_1$ and 100 mm from $S_2$?

**Question 16**

An organ pipe of effective length 0.6 m is closed at one end. Given that the speed of sound in air is 300 $ms^{-1}$, find its two lowest resonant frequencies.

**Question 17**

A boy blows gently across the top of a piece of glass tubing, the lower end is closed by his finger so that the tube gives its fundamental note of frequency f. While blowing, he removes his finger from the lower end. The note he then hears will have a frequency of approximately

a.) f/4 b.) f/2 c.) f d.) 2f. e.) 4f

**Question 18**

A microwave transmitter emits waves which are reflected from a metal plate to produce stationary waves. **R, S** and **T** are three successive points at which the meter shows zero intensity. The distance between **RS** and **ST** is equal to 1.5 cm. What is the frequency of the waves?

**Question 19**

A resonance tube open at both ends and responding to a tuning fork always has

a.) a central node.
b.) a central antinode.
c.) an odd number of nodes.
d.) an odd number of antinodes.
e.) an odd number of nodes + antinodes.

**Question 20**

A taut wire is clamped at two points 1.0 m apart. It is plucked near one end. Which are the three longest wavelengths present on the vibrating wire?

a.) 1.0 m, 0.50 m, 0.25 m
b.) 1.0 m, 0.67 m, 0.50 m
c.) 2.0 m, 0.67 m, 0.40 m
d.) 2.0 m, 1.0 m, 0.50 m
e.) 2.0 m, 1.0 m, 0.67 m

**Question 21**

A sound source of frequency 2500 Hz is placed several metres from a reflecting plane wall in a large chamber containing gas. A microphone, connected to a cathode ray oscilloscope, is used to detect nodes and antinodes along the normal from the source to the wall. The microphone is moved from one node through 20 antinodes to another node, a distance of 1.90 m. What is the speed of sound in the gas in $ms^{-1}$?

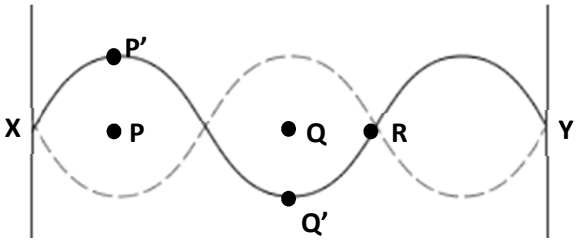
**Question 22**

A string of length L is stretched between two fixed points and is set into transverse vibration. The two lowest resonant frequencies are $f_1$ (fundamental) and $f_2$. Which one of the following correctly gives both $f_2 / f_1$ and v, where v is the speed of the transverse waves in the string?

| | $f_2 / f_1$ | v |
|---|---|---|
| a.) | 2 | $f_1L$ |
| b.) | 3 | $3f_1L$ |
| c.) | 2 | $f_2L$ |
| d.) | 0.5 | $f_2L$ |

**Question 23**

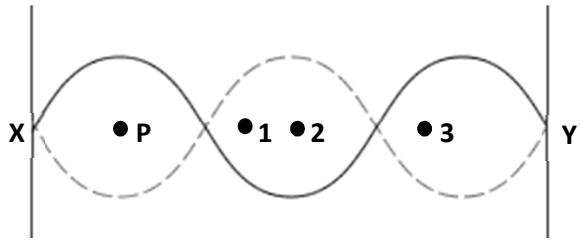
A string is stretched under constant tension between fixed points X and Y. The solid line shows a standing waves at an instant of greatest displacement. The broken line shows the other extreme displacement. Which one of the following statements is correct?




a.) The distance between P and Q is one wavelength.
b.) A short time later, string R will be displaced.
c.) The string at P' and string at Q' will next move in opposite directions to one another.
d.) At the moment shown, the energy of standing wave is all in the form of kinetic energy.
e.) This wave shown has the lowest possible frequency for this string stretched between X and Y.

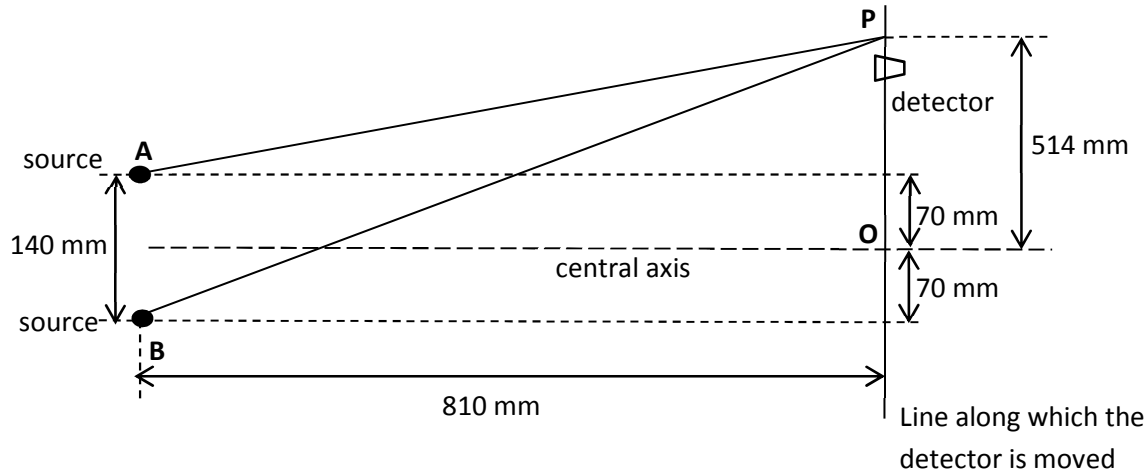
**Question 24**

A standing wave is set up on a stretched string **XY** as shown above. At which point(s) will the oscillation be exactly in phase with that at **P**?




a.) 1, 2 and 3 b.) 1 and 2 only c.) 2 only d.) 3 only e.) none

**Question 25**




Two microwave source **A** and **B** are in phase with one another. They emit waves of equal amplitude and of wavelength 30.0 mm. They are placed 140 mm apart and at a distance of 810 mm from a line **OP** along which a detector is moved, as shown above.

a.) Show that the distance **AP** is 923. 7 mm.
b.) Calculate the number of wavelengths between source **A** and point **P**.
c.) State what intensity of microwaves will be received by the detector when it is at **P**.
d.) How many maxima are detected as the detector moves from **P** to the point **O** on the central axis.