Started on	Wednesday, 9 February 2022, 2:13 PM
State	Finished
Completed on	Wednesday, 9 February 2022, 2:58 PM
Time taken	45 mins 1 sec
Grade	

Question **1**

Correct

Mark 2.00 out of 2.00

A sinusoidal plane wave is described as $\Psi_1 = A\, e^{i(2x + 4y - 4z - 5t)}$. Another wave which is travelling perpendicular to Ψ_1 is written as $\Psi_2 = A\, e^{i(4x + 60y + \boldsymbol{c}z - 5t)}$. The value of $\boldsymbol{c}$ is:

Answer: 62 ✔

The correct answer is: 62.00

Question **2**

Mark . out of 2.00

Consider a sinusoidal plane wave with $\omega = 2\pi \times 10^2\ \mathrm{s}^{-1}$ and $\vec{k} = (1.3\hat{i} + 2.8\hat{j} + 4.1\hat{k}) \times 2\pi\,\mathrm{m}^{-1}$. Calculate the phase velocity of the wave. Give your answer in units of ms^{-1} to at least one percent accuracy.

Answer:

The correct answer is: 19.48

Question **3**

Mark out of 2.00

Consider a sinusoidal plane wave

$$a(\vec{r}, t) = A\ \cos[\omega t - \vec{k} \cdot \vec{r}]$$

with $\omega = \pi[1.5]^{-1}\mathrm{s}^{-1}$ and $\vec{k} = (3\hat{i} + 1.5\hat{j}) \times 2\pi\,\mathrm{m}^{-1}$. We have $a(\vec{r}, t) = A$ for $t = 0$ at the point $(x, y, z) = (0, 0, 0)\,\mathrm{m}$. Calculate the smallest time interval $t = T$ for which $a(\vec{r}, t) = A$ at the point $(x, y, z) = (2, 3, 4)\,\mathrm{m}$. Give your answer in units of second (s) to at least one percent accuracy.

Answer:

The correct answer is: 1.50

Question **4**

Mark out of 2.00

In a Newton's ring experiment using wavelength $\lambda = 500$ nm, the radius of the 4th dark ring is measured as $r_4 = 2$ cm. Next keeping the apparatus undisturbed, the light source is replaced by another source of unknown wavelength. If the radius of the 4th dark ring is now measured to be $r'_4 = 2.21$ cm, calculate the wavelength of the source. Give your answer to at least one percent accuracy in units of nm.

Answer:

The correct answer is: 610.51

Question **5**

Mark out of 2.00

In a Michelson interferometer arrangement, the light source has a doublet wavelength of $(20 * 33 - 10)$ nm and $(20 * 33)$ nm. The least order of interference at which the fringe patterns from doublet will overlap.

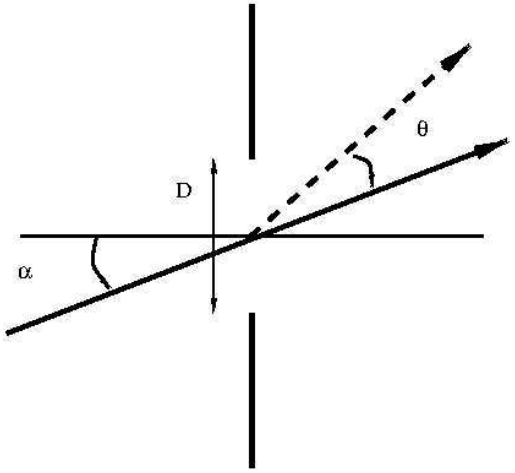
Answer:

The correct answer is: 33

Question **6**

Mark out of 2.00

A plane wave of wavelength $\lambda = 500\,\mathrm{nm}$ is incident on a slit of width $D = 0.1\,\mathrm{mm}$ making an angle of $\alpha = 39^\circ$ to the normal as shown in the figure. Calculate the angle θ (refer to the figure) corresponding to the first minima (dark fringe) of the diffraction pattern. Give your answer to atleast one ppercent accuracy in units of arc-minutes. Note that one degree is equal to 60 arc-minutes.

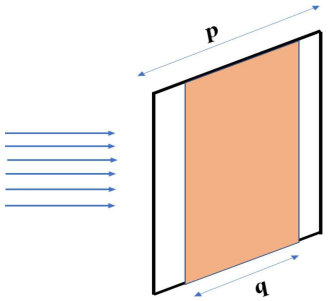


Answer:

The correct answer is: 22.18

Question **7**

Mar ut of 2.00



A slit of width ***p*** = 36 units is illuminated with a monochromatic light so that a Fraunhofer diffraction pattern is observed on a screen. An opaque object of width ***q*** = 32 units is placed exactly in the middle of the slit as shown in the figure so that a two slit diffraction pattern is now observed. The total number of bright fringes that are present inside the central diffraction maxima is:

Answer:

The correct answer is: 33

Question **8**

Mark ut of 2.00

A diffraction grating has 3 $\times 10^2$ lines (slits), Calculate the smallest order m of the maxima at which it will be possible to resolve the two Sodium lines which has wavelengths 589.0 nm and 589.6 nm respectively.

Answer:

The correct answer is: 4.00

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Test 3 ►