Started on	Wednesday, 16 March 2022, 4:07 PM
State	Finished
Completed on	Wednesday, 16 March 2022, 4:52 PM
Time taken	45 mins
Grade	**16.00** out of 16.00 (**100**%)

Question **1**

Correct

Mark 2.00 out of 2.00

Natural light travels from the air and gets reflected from a substrate of refractive index 3.58. If the reflected light is completely polarized, find the refraction angle in degrees. Give your answer to at least one percent accuracy.

Answer: 15.60662 ✔

The correct answer is: 15.61

Question **2**

Correct

Mark 2.00 out of 2.00

The natural light of the intensity 140 W/m^2 passes through three polarizing filters. The second filter is aligned at an angle α with respect to the first filter, and the third filter is aligned at an angle α with respect to the second filter. If the intensity of light after the third filter is 1.6 W/m2, then find the value of α in degrees.

Answer: 67.11852 ✔

The correct answer is: 67.12

Question **3**

Correct

Mark 2.00 out of 2.00

Find the de Broglie wavelength (in **Angstrom**) of an electron which has a kinetic energy of **6.8 eV**. Assume charge and mass of electron as $\mathbf{1.6\times10^{-19}}$ C and $\mathbf{9.1\times10^{-31}}$ Kg and Planck's constant $\boldsymbol{h}\mathbf{=6.625\times10^{-34}}$ J-S. Write your answer with at least **1%** accuracy.

Answer: 4.707992 ✔

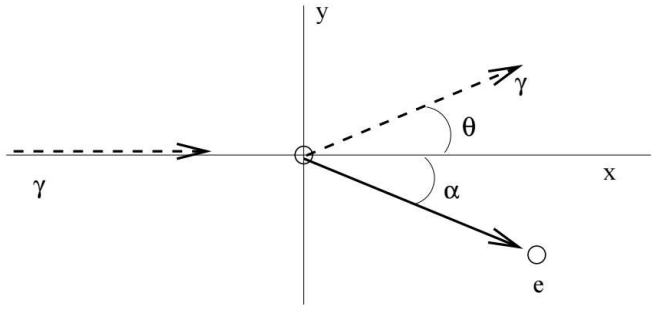
The correct answer is: 4.71

Question **4**

Correct

Mark 2.00 out of 2.00

An incident photon of wavelength $\lambda = 7.2 \times 10^{-12}\ \mathrm{m}$ undergoes Compton scattering from an electron at rest and the photon scatters at $\theta = 90^{\circ}$. Calculate the angle α at which the electron emerges. Give your answer in degrees to at least one percent accuracy. Given the Compton Wavelength $\lambda_c = 2.4 \times 10^{-12}\ \mathrm{m}$.



Answer: 36.86989 ✔

The correct answer is: 36.9

Question **5**

Correct

Mark 2.00 out of 2.00

In a photoelectric experiment, when a beam of ultraviolet light of wavelength **80 nm** falls on a lead surface whose cutoff frequency **10^{15} Hz**, produces photoelectrons with maximum kinetic energy **11.39 eV**. Now for an unknown ultraviolet light used in this setup, if the stopping potential is measured as **5.2 volts**, then calculate the wavelength in **nm** up to one decimal and with 1% accuracy. You may use Planck's constant **h=6.626×10^{-34} J-s** , electronic charge **e=1.6×10^{19} C** and speed of light as **3×10^{8} m/s**.

Answer: 132.9987 ✔

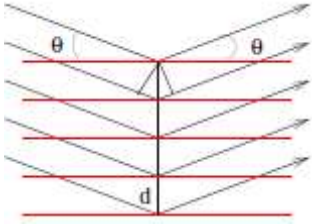
The correct answer is: 133.0

Question **6**

Correct

Mark 2.00 out of 2.00

In a proton diffraction experiment, when **1.9 eV** protons are diffracted from a crystal, the **5^{th} maxima** of intensity is observed at an angle of $\theta = 30^0$. Calculate the crystal's interplanar separation d. Assume the mass of proton m_p =**1.67×10^{-27} kg**, electronic charge **e =1.6×10^{19} C** and Planck's constant h = **6.626×10^{-34} J-s** . Report your answer in units of **10^{-2} nm** and with 1% accuracy.



Answer: 10.39708 ✔

The correct answer is: 10.40

Question **7**

Correct

Mark 2.00 out of 2.00

A particle of mass *m* moving freely between $x = 0$ and $x = L$ inside an infinite potential well has the following wavefunction

$$\psi(x) = \sqrt{\frac{2}{L}}\,\sin\left(\frac{14\pi x}{L}\right)$$

Calculate the expectation value $\langle p^2 \rangle$. Give your answer in units of $(h/L)^2$ to at least one percent accuracy.

Answer: 49 ✔

The correct answer is: 49.00

Question **8**

Correct

Mark 2.00 out of 2.00

Consider an experiment where a particle in an infinite potential box with walls at x = 0 and x = L has the following wavefunction at some initial time:

$\Psi(x) = A[9 \sin(\pi x/L) + 6.7 \sin(3\pi x/L)]$,

where A is some normalization constant. Calculate $P_1 \times 100$ where P_1 is the probability of finding the particle in the ground state. Give your answer to at least one percent accuracy.

Answer: 64.34188 ✔

The correct answer is: 64.34

◄ Test 4

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