Started on	Wednesday, 16 March 2022, 2:16 PM
State	Finished
Completed on	Wednesday, 16 March 2022, 3:00 PM
Time taken	43 mins 50 secs
Grade	**16.00** out of 16.00 (**100**%)

Question **1**

Correct

Mark 2.00 out of 2.00

Consider an elastic wave

$$\xi(x,t) = \frac{1\,\mathrm{nm}}{1+(x-c_s t)^2}$$

propagating along a long rod of steel with density $\rho = 7.6 \times 10^3\,\mathrm{kg\,m^{-3}}$ and Young's modulus $Y = 200 \times 10^9\,\mathrm{N\,m^{-2}}$. Here c_s is the speed of the longitudinal elastic wave in steel. At what x do we have the maximum value of ξ for t =3.2 milliscond? Give your answer in meter units to at least one percent accuracy.

Answer: 16.41565 ✔

The correct answer is: 16.42

Question **2**

Correct

Mark 2.00 out of 2.00

For what value of s is the function

$$\xi(x,t) = \sin[x^2 + 2c_s xt + st^2]$$

a solution of the wave equation

$$\frac{\partial^2 \xi}{\partial x^2} - \frac{1}{c_s^2}\frac{\partial^2 \xi}{\partial t^2} = 0$$

where $c_s = 7\,\mathrm{m/s}$. Give your answer in units of $\mathrm{m/s}$ to at least one percent accuracy.

Answer: 49 ✔

The correct answer is: 49.00

Question **3**

Correct

Mark 2.00 out of 2.00

An electromagnetic wave with

$$\vec{E}(z,t) = E_0[\hat{i} + 2\hat{j}]\ \cos(\omega t - kz)$$

is incident on a linear polarizer whose pass axis is along $\hat{n} = [\cos(\theta)\hat{i} + \sin(\theta)\hat{j}]$ where $\theta = 6$ degrees. If the intensity of the incident and transmitted waves be I_0 and the I_1 respectively, calculate $(I_1/I_0) \times 100$ to at least one percent accuracy.

Answer: 28.9720 ✔

The correct answer is: 28.97

Question **4**

Correct

Mark 2.00 out of 2.00

A birefringent crystal of thickness d has its optic axis parallel to the surface of the crystal. What is the minimum value of d (in μm) for the crystal is to be a quarter wave plate for light of wavelength
λ = 493 nm? (n_e = 1.5334, n_o = 1.5443). Give your answer to at least 1 percent accuracy.

Answer: 11.30733 ✔

The correct answer is: 11.31

Question **5**

Correct

Mark 2.00 out of 2.00

In a Compton effect experiment, incident light of wavelength $1.4 \times 10^{-12}\ \mathrm{m}$ is scattered at 180° to the incident direction,. The electron from which the scattering occurred was initially at rest. Calculate the final momentum of the electron. Give your answer in units of $10^{-23}\ \mathrm{kg\,m\,s^{-1}}$ to at least one prcent accuracy. Compton wavelength $\lambda_c = 2.4 \times 10^{-12}\ \mathrm{m}$.

Answer: 58.10322 ✔

The correct answer is: 58.05

Question **6**

Correct

Mark 2.00 out of 2.00

The ground state energy of an electron in a 1-D infinite square potential well is 6.3 eV. Calculate the width of the well is in units of Angstroms. Write your answer to at least one percent accuracy. (Given, Planck constant $h = 6.63 \times 10^{-34}$ J-s; mass of electron $m = 9.11 \times 10^{-31}$ kg; electronic charge is $e = 1.6 \times 10^{-19}$ C)

Answer: 2.446127 ✔

The correct answer is: 2.45

Question **7**

Correct

Mark 2.00 out of 2.00

Consider a quantum particle whose wavefunction is

$$\psi(x) = A\, x\, e^{-\alpha x}\ ;\ x \geq 0$$
$$= 0\ ;\ x < 0$$

with $\alpha = 9.3$. Calculate the magnitude of A so that the wavefunction is normalized. Give your answer to at least one percent accuracy.

Answer: 56.72237(✔

The correct answer is: 56.72

Question **8**

Correct

Mark 2.00 out of 2.00

Find the uncertainty in x for a confined quantum particle in a1-D infinite potential box of width $L = 9.5$ nm whose ground state wavefunction is given as

$$\psi(x) = A\ \sin\frac{\pi\, x}{L}.$$

Give your answer in Angstrom units to at least one percent accuracy.

Answer: 17.17182 ✔

The correct answer is: 17.20

◄ Test 3

Jump to...

Test 5 ►