CL1_Q1.With suitable examples explain the significance of gradient, divergence and curl operators on fields.

Cl1_Q2. Magnetic monopoles do not exist. Justify.

Cl1_Q3. What is the physical meaning of gradient of a scalar function?

Cl1_Q4: Estimate the energy per unit volume in a magnetic field.

CL3_Q1. Differentiate between circular and elliptical polarization states of electromagnetic waves.

CL3_Q2. Find the energy density of electromagnetic wave, if the electric field of amplitude 6.2 V/m oscillates with a frequency of 2.4 X 10^{10} Hz.

Cl3_Q3. Discuss the energy density in electromagnetic waves and how is it related with the Poynting vectors?

Cl3_Q4. Give expressions for two electric field wave functions that can produce circular polarization.

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CL4_Q1. Describe the characteristics of a black body spectrum.

Cl4_Q2. Find the average energy of an oscillator of frequency $5x10^{12}$/s at 300 K treating the oscillator as Planck's oscillator.

Cl4_Q3. Using the quantum theory, derive the expression for energy density of blackbody radiation.

CL4_Q4. What was Planck's crucial contribution in explaining Black body spectrum?

CL5_Q1. How does classical theory fail to explain the results of Compton's experiment?

CL5_Q2. What are the angles at which the Compton shift is minimum and maximum? What are the conclusions drawn from these angles?

CL5_Q3. Calculate the energy that a photon must possess if it has to have a momentum equal to that of a 10MeV proton. In Compton Effect did you understand why the original peak at $\boldsymbol{\lambda}$ remained in the spectrum of the scattered radiation?

CL5_Q4. What is Compton shift? According to classical theory, the scattered X rays have the same frequency as the incident wave. Explain.

CL6_Q1. The central mystery of quantum mechanics lies in the single particle quantum interference. Do you understand why $|\psi_1 + \psi_2|^2$ is the resultant intensity?

CL6_Q2. If an electron and a proton have energy of 10 MeV, calculate their de Broglie wavelength.

CL6_Q3. Give a brief account of the Fourier transform.

CL6_Q4. An electron accelerated through some potential difference, crosses two points separated by a distance of 3m in 1μs with a steady state velocity. Calculate the de-Broglie wavelength of the accelerated electron and hence calculate the potential difference through which it has been accelerated.

CL7_Q1. Write an expression for a travelling wave explaining each term.

CL7_Q2. Derive a relation between group velocity and phase velocity.

CL7_Q3. When does group velocity become equal to phase velocity? Give an example.

CL7_Q4. How are phase and group velocity related for a monochromatic wave?

CL8_Q1. State any three forms of the Heisenberg's Uncertainty Principle.

CL8_Q2. Demonstrate using Heisenberg's Uncertainty Principle that an electron can't exist inside a typical nucleus.

CL8_Q3. An atom in an excited state of life time $\Delta t=10^{-8}$s makes a transition to a lower state emitting a photon of frequency of 3×10^{14}Hz. Estimate the uncertainty in the frequency of the emitted photon.

CL8_Q4. State Heisenberg's uncertainty principle. Use the Gamma ray thought experiment to arrive at the principle.

CL9_Q1. What is the significance of a quantum wave function?

CL9_Q2. What is the difference between probability density and probability?

CL9_Q3. How do you determine the value of the amplitude of a wave function?

CL9_Q4. Determine the probability of finding an electron in the limits ***x=0 to x= 0.5a*** when it is bound in a 1D box of length ***a***.

CL10_Q1. Describe an Eigen value equation explaining each term.

CL10_Q2. Write any five operators associated with dynamical variables.

CL10_Q3. Define Expectation value.

CL10_Q4. Determine the expectation value of position of a particle bound between *x=0 to x=3* and described by the wave function $\psi = 2\sqrt{x}$

CL12_Q1. Why is Schrodinger's equation referred to as a linear equation?

CL12_Q2. Set up Schrödinger's time dependent wave equation as an Eigen value equation and time independent wave equation from Schrodinger's time dependent wave equation.

CL12_Q3. Schrodinger's equation is an operator equation. Explain.

CL12_Q4: Write the three dimensional Schrodinger wave equation.

CL12_Q1. A free particle is a classical entity. Justify.

CL12_Q2: Describe the state of a particle for the case of a free state, bound state and scattering state.

CL12_Q3. What is step potential in quantum mechanics?

CL12_Q4: What are the similarities and differences between the reflection of light from an air-glass boundary and the reflection of an electron from a potential step?