Practice Questions

• What were the shortcomings of Rayleigh-Jeans law? How Planck's law was able overcome those shortcomings?

• What is a blackbody? Mention its characteristics. Draw Blackbody radiation spectrum curves for three different temperatures for a range of wavelengths.

• Mention assumptions made by Max Planck in formulation of Planck's radiation law to explain Blackbody radiation spectrum curve.

• Explain how uncertainty principle was a consequence of de Broglie's hypothesis.

• What were the major observations and outcomes of Compton scattering experiment. Explain in detail with suitable diagrams.

•What is ultraviolet catastrophe? Explain how Planck's formulation helped to explain the black body radiation curve?

• How did de Broglie's hypothesis prove the angular momentum quantization postulate of Bohr's theory?

•Discuss the implications of Heisenberg's Geadnken Experiment in detail.

•Show that particle velocity of a moving particle is equal to the group velocity of the associated matter waves.

• Why concept of phase velocity is not applicable for matter waves?

• Explain the construction and working principle of a scanning tunnelling microscope with suitable diagrams.

• What are nanomaterials? How does the material property change upon reducing the dimensions in the nanoscale?

• What is quantum confinement? Classify nanomaterials based on quantum confinement.

• Write down in detail any two experiments/phenomena which classical physics couldn't explain.

•Define probability density and probability in context of quantum mechanical wave function.

• Why energy of a particle confined in a 1-dimensional box is quantized?

• Find and sketch the first two eigenvalues and eigen function of a particle trapped in a one-dimensional potential box.

• Arrive at Schrödinger time-independent equation using wave function.

•Arrive at Schrodinger time dependent wave equation.

• Write the properties of the wave function.

• Explain the Compton scattering with suitable diagrams.

• Discuss the de Broglie hypothesis and its experimental verification.

•A small object of mass 1.00 mg is confined to move between two rigid walls separated by 1.00 cm. Calculate the minimum speed of the object.

• For a quantum mechanical particle confined in a 1-D box, obtain the wave function and particle's energy formulae.

• Draw the wave functions and probability densities for first three quantum states. Also write the expressions of both wave function and probability density for each state.

•Determine the ratio of 4^{th} excited state to the ground state energies of a proton trapped in a 1-D box of length 2 nm.

• X rays of wavelength 0.24 nm are Compton-scattered, and the scattered beam is observed at an angle of 60 degrees relative to the incident beam. Find the wavelength of the scattered X-rays.