

Quantum Mechanics

Short Answer Type Questions

1. What are the failures of classical physics? or What was the need of quantum mechanics?
2. Explain de-Broglie hypothesis.
3. What are matter waves or de-Broglie waves?
4. Find speed of de-Broglie waves. ($u=v_p=c^2/v$; where c is speed of light in vacuum and v is the speed with particle is moving)
5. Find wavelength of de-Broglie waves associated with the motion of an electron which is moving (i) non-relativistically and (ii) relativistically.
6. Define wavefunction. Give its significance or what is Max Born's interpretation of wavefunction.
7. Define wave packet.
8. Explain Uncertainty principle.
9. Comment: Uncertainty principle is direct outcome of wave nature of particle.
10. Define phase velocity or wave velocity.
11. Define group velocity.
12. Find relationship between phase velocity and group velocity, also known as dispersion relation.
13. Discuss formation of wave packet.
14. Define normalization. Give its significance.
15. Write conditions for acceptable/well behaved wave function.
16. What is free particle?
17. What is restricted particle?
18. Write Time independent Schrodinger equation for 1-D motion and 3-D motion.
19. Write Time dependent Schrodinger equation for 1-D motion and 3-D motion.
20. Write applications of uncertainty principle.
21. Define eigen function and eigen value.
22. Express time independent Schrodinger equation in eigen equation form.
23. What is Hamiltonian?
24. What is photon?
25. Does photon have rest mass? If no then how do they have momentum?
26. Does photon have mass?

Long Answer Type Questions

1. Define wave packet and discuss its formation.
2. Explain Uncertainty principle and write applications of uncertainty principle.
3. Comment: Uncertainty principle is direct outcome of wave nature of particle.
4. Find relationship between phase velocity and group velocity, known as dispersion relation. Discuss various cases possible.
5. Prove that group velocity (v_g) is always equal to particle velocity (v).
6. Derive Time independent Schrodinger equation for 1-D motion and 3-D motion for (i) restricted particle and (ii) free particle.
7. Derive Time dependent Schrodinger equation for 1-D motion and 3-D motion for (i) restricted particle and (ii) free particle.
8. Discuss an application of time independent Schrodinger equation or Discuss the motion of particle in a box moving along 1-D.