**Physics Assignment no. 2 (quantum mechanics)**

1. *Give* ***d****e Broglie hypothesis about matter wave and give their experimental verification. (Davisson and Germer exp.)*
2. *Define group and phase velocity. Find the relation between group velocity (velocity of wave packet) and phase velocity (velocity of single wave within wave packet). What happen if the phase velocity is independent of frequency? Also prove that vg.vp = c2.*
3. *State Heisenberg’s uncertainty principle. Using uncertainty principle proves that (i) electron can’t exist within nucleus.*
4. *Derive Plank’s formula for distribution of energy in black body radiation. Explain the assumption made.*
5. *Write Plank’s radiation formula and on the basis of this derive Wien’s displacement law and Rayleigh- Jeans’s law.*
6. *Discuss the failure of classical idea of black body radiation and Describe distribution of energy in black body spectrum.*
7. *Describe Bohr’s quantization rule and confirm it on basis of de-Broglie idea ie. Circumference of Bohr’s orbit is integral multiple of wavelength.*
8. Derive time dependant Schrödinger wave equation and on the basis of that derive time independent *Schrödinger wave equation for free particle.*
9. What is the wavelength of (i) an electron (ii) a proton (iii) an α-particle which has been accelerated from rest through a potential difference of 100V? (Hint: mass of α-particle = 4xmass of proton, charge of α-particle = 2charge of proton).
10. A black body at 1127 degree Celsius radiates maximum wavelength of3 microns. If the wavelength of maximum emission is 20 microns, calculate the temperature of moon.
11. Compare the wavelength of a photon and electron if the two have the same momentum.
12. Calculate de-Broglie wavelength associated with a proton moving with velocity equal to 1/20 velocity of light.
13. Calculate de-Broglie wavelength associated with a neutron of energy 2 MeV.(firstly, MeV convert into joule)
14. Calculate the energy difference between ground state and first exited state for electron if the length of box is 10-8 cm.(calculate E2 –E1)
15. Determine the velocity and kinetic energy of proton having de Broglie wavelength 1.0 Å.
16. Calculate the de Broglie wavelength associated with nitrogen at 3.0 atmospheric pressure and 27OC. mass of nitrogen atom is 4.65 x 10-26kg. ( ans λ = 0.275A)
17. An electron has a speed of 600 m/s within the accuracy of 0.05%. Calculate the certainty in the position of electron.
18. A hydrogen atom is having the radius 0.53 Å. Estimate the minimum energy of an electron can have this atom.
19. *A particle is moving in one dimensional box described by*

*V=0 for 0< x< L*

*V = ∞ for x ‹ 0 and x › L*

*Write and solve its Schrödinger’s wave equation and obtain Eigen value (E = n2h2 / 8mL2) and Eigen function [ψn =Sin ]. Prove that energy of the matter particle is in quantized form.*

1. Write short notes on:

# Difference between matter waves and e.m. radiations. # Concept of wave packet.

# Definition and Properties of matter waves # properties of wave function.

# Significance of wave function # Eigen value(or energy value E) and Eigen

Function (*ψ)*