Quantum &Principle of Applied Spectroscopy

1. **Calculate the energies of levels for the unpaired electron in the ground state of an alkali metal atom, if j =3/2 or j = 1/2.**
2. **Calculate the normalizing for a molecular orbital Ψ in H2+, S= 0.59.**
3. **Calculate the moment of inertia of an H2O molecule around the axis defined by the bisector of the HOH bond angle. The HOH bond angle is 104.5o and the bond length is 95.7Pm.**
4. **Drive this equation ρ = AB / (e hv/kT - B- / B).**
5. **Comment on Frank –Condon principle.**
6. **The origin of the D lines in the spectrum of atomic sodium if ∆ῦ = 17.2 cm-1. Calculate the spin-orbit coupling constant for the upper configuration of the Na atom.**
7. **Judge whether N2+ is likely to have larger or smaller dissociation energy than N2.**
8. **Calculate the rotational energy level of A14NH3 molecule is a symmetric rotor with bond length 101.2Pm and HNH bond angle 106.7. If B = 9.977 Cm-1.**
9. **Drive Beer- Lambert Law I =Io 10 –ε[J]I**
10. **Comment on selection rules in symbols for electronic spectrtra.**
11. **Calculate the wavelength of the radiation necessary for excitation transition from n=11 to n=12, in the lycopene molecule. If the bond length=1.4angestrom.**
12. **Find the normalization constant for the harmonic oscillator wavefunctions.**
13. **Calculate the frequency of a molecular rotational transition for 1H 127I if the distance r = 160pm.**
14. **Calculate the energies and wavefution of a particle on a ring.**
15. **Find the first – order correction to the ground – state energy for a particle in a well .**
16. **d 2 Ψ / dt2 = - 4π2 v 2 Ψ .**
17. **C = ( 2/L ) ½ .**
18. **V = ½ π √ k/m .**
19. **Comment on the Scanning probe microscopy.**
20. **Comment the transition and dipole moment .**
21. **Estimate the length of light if θ = 2.15o and the distance between hole is 0.03 mm while the order number is 2.**
22. **Calculate the wavelength of an electron under the influence of 100V. Assume that electrical transfer to kinetic energy.**
23. **Calculate the wavelength of radiation emitted for Balmer series from n = ∞ and 3 to n =2.**
24. **Calculate the relative probability of finding the electron inside a region of volume 1pm3, located at (a) the nucleus, (b)at distance ao from the nucleus, (c) normalize the wavefunction.**
25. **Suppose the speed of a projectile of mass 1 g is known to within 1 μms -1. Calculate the minimum uncertainty in its position.**
26. ******
27. **V2 = Z2 e4 / 4εo n2h2.**
28. **d 2 Ψ / dx2 = 2m / ћ2 ( E – V ) Ψ .**
29. **Explain the behavior of a heated iron bar glowing red hot becomes whit hot when heated further .**
30. **Comment on the spectrum of atomic Hydrogen.**
31. **Comment on the evaluating a commutator to show that the operator for position and momentum do not commute .**
32. **Writ the postulates of quantum mechanics.**
33. **Writ identity matrix I3.**
34. **Estimate each of threshold frequency and the work function of the incident light on a metal if the frequency is 1x1015 HZ while the kinetic energy is 1.78 ev.**
35. **Estimate the wavelength of electrons that have been accelerated from the rest through a potential difference of 40kV.**
36. **What is the linear momentum of a particle described by the wave function if : a) B = 0, b) A = 0.**
37. **Calculate the tunneling in the quantum mechanical harmonic oscillator.**
38. **E = 1/2kA2.**
39. **A = me e4 / 8 εo2 h2**
40. **Ḧ Ψ ( x , t ) = E Ψ ( x , t).**
41. **d2 Ψ / dx2 = - P2 Ψ/ ћ2 .**
42. **Comment on the Einstein formula.**
43. **Comment on the Hermitian operators.**
44. **Comment on the debroglie equation.**
45. **Comment on the stationary state and energy.**
46. **Comment on the schrodinger equation for two quantum number ml, and l.**
47. **This equation for eigenvalue Ψ = e ax2.**
48. **The equation for Ψ = A ( e ikx + e –ikx ) for expectation value .**
49. **The equation Ψ = A e ikx +B e –ikx, prohibits when and x=0.**
50. **Write Zero matrix 02,3**
51. **Estimate each of threshold frequency and the work function of the incident light on a metal if the λ is 350 nm while the kinetic energy is 1.3ev.**
52. **Calculate the ionization energy and its wavelength for hydrogen atom from n = 1 to n = ∞.**
53. **Select the amount of error in speed of electron if you know it is exist within the interval 50 pm.**
54. **Calculate the probability density for a particle in a definite angular momentum on a ring.**
55. **Ek = F2 τ2/ 2m.**
56. **ao = εo h2/π me e2**
57. **ǀΨǀ =4 ǀAǀ2 cos2 kx.**
58. **ᴧ2 Ψ = - ε Ψ**
59. **Comment on the Plank distribution.**
60. **Comment on the Born interpretation of the wavefunction.**
61. **Comment on the superposition and expectation value.**
62. **Writ the form of Hamiltonian operator for a quantum harmonic oscillator..**
63. **Comment on the Quantum dots.**
64. **What is the possibility of the Ψ for body position in infinity dx at x-axis?**
65. **The equation Ψ = e ax .**
66. **The acceptable value for equation Ψ = A e ikx +B e –ikx.**