PYL100: Electromagnetic Waves and Quantum Mechanics (I Semester, 2016-17)

Exercise Sheet No.9

QM applications: One-dimensional problems involving the Schrödinger Equation

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1. Estimate the maximum potential seen by an alpha particle formed in a nucleus of mass number A=216 and Z=82. Assume the radius of a nucleus to be $R = R_o A^{1/3}$, where $R_o = 1.4$ fm. [**Ans.**: 22 MeV].

2. Suppose a particle of mass m is subject to a potential $V(x) = -\lambda\,\delta(x)$, where λ is a positive constant. The potential is zero everywhere except at x=0 where it goes to $-\infty$. Find out the energy eigen values and wave function solutions for a bound state problem.[**Ans.**: $E = -\frac{m\lambda^2}{2\hbar^2}$, only one bound state with even parity].

3. An electron moves in a finite well potential extended from *x=-L/2* to *L/2*. The energy of the particle is 2 eV less than the top of the well. The wavefuntion at the edge *x=L/2* is ψ_0. Find the length x_o so that $\psi(L/2 + x_0) = \psi_0 / e$.