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5. What does the transparency window mean (in case E greater than U0) for a rectangular barrier and the conditions for its appearance?

In our case where we have more energy than is needed to transition trough the barrier (E greater than U0) the trasparancy window is a a situanion where our particle at certain energy values passes trough the barrier without being reflected at all, even tough in quantum mechanics we would expect some energy to be lost during the transition in the form of reflection. To call forth this fenomina we need to satisfy the condition of k' * a = n*pi , where k' = sqrt(2m(E-U0)) / hcovered , a is the height of teh barrier and n is an integer.

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11.Why the solution for quantum number n=0 must be ignored? Give a physical justification.

The situation of n = 0 is not allowed since it gives us k = 0 and fii I = 0. All this comes from the equation the previous equation from if n is 0 it means k is 0 and from there we get that fii I is 0 which would mean we have no particles, thus we need to ignoew the solution of n=0.

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18.Should the wave function inside the walls of a finite potential well be a complex number or a real number? What is your opinion, why?

The function can be described bith ways. In my own opinion I would rather choose a real form over a complex one because everything is real and nothing is imaginary and thun everything is also easier to understand, calculaet and use in ther equations.

Not a very clear explanation.

One of possible explanation is as follows:
For a finite potential well, particles cannot create a particles flow inside the well wall (probability current density is equal to zero). But this is only possible if the wave function is real.

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19.Why asymptotical solution of Schrodinger equation for harmonic oscillator is looks like so psi (xi)= e**(xi**2/2) ? Why the option psi (xi)=e**(xi**2/2) should be ignored?

The equation looks liek that becuase we want to find out if there are finite solutions if xi tends to infinity and thus we need psi(xi) to tend to 0 to find that out. so if xi is much greater than lambda we have the equation -psi"(xi)+xi**2 * psi(xi) = 0 and from there we can verify that the approximate solution that tends to zero is psi(xi)= e**(-(xi**2)/2). As for the reason (xi)=e**(xi**2/2) should be ignorewd is that yes it is a solution but it isn't physical because it increases infinetly.

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35.How the average value of the principal quantum number for harmonic oscillator depends on temperature. Please explain from a physical point of view the behavior of this function in the region of zero temperatures.

The average value depends on temperature as follows, if our oscillator is at zero degrees it will be in it's base state of n=0. Now if we increase its temperature we allow it to start occupying higher energy levels. Afters some time of doing so those levels will be populated according to Boltzmanns distribution (P(n) about e**(-(En)/kb*T)) and with it all our quantum number (n) goes up as well

The Boltzmann distribution function cannot be used to calculate the principal quantum number for a harmonic oscillator in the quantum approach for nonzero values of T. Why?
At T=0 the corresponding function gives us n=0 and energy of harmonic oscillator should be equal to 0. But according to quantum mechanical calculations in the ground state n=1 and energy is equal to energy of zero-vibrations.

The best choice is to use instead of Boltzman function so called Bose-Einstein distribution function (suitable for Bose partical).