

4.4: Some Consequences

There are a few good reasons why the dependence in the solution is on ka , κa and $\kappa_0 a$: These are all dimensionless numbers, and mathematical relations can *never* depend on parameters that have a dimension! For the case of the even solutions, the ones with $B_2 = 0$, we find that the number of bound states is determined by how many times we can fit 2π into $\kappa_0 a$. Since κ_0 is proportional to (the square root) of V_0 , we find that increasing V_0 increases the number bound states, and the same happens when we increase the width a . Rewriting κ_0 a slightly we find that the governing parameter is

$$\sqrt{\frac{2m}{\hbar^2} V_0 a^2} \quad (4.4.1)$$

so that a factor of two change in a is the same as a factor four change in V_0 .

If we put the two sets of solutions on top of one another we see that after every even solution we get an odd solution, and vice versa. There is always at least one solution (the lowest even one), but the first odd solution only occurs when $\kappa_0 a = \pi$.

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