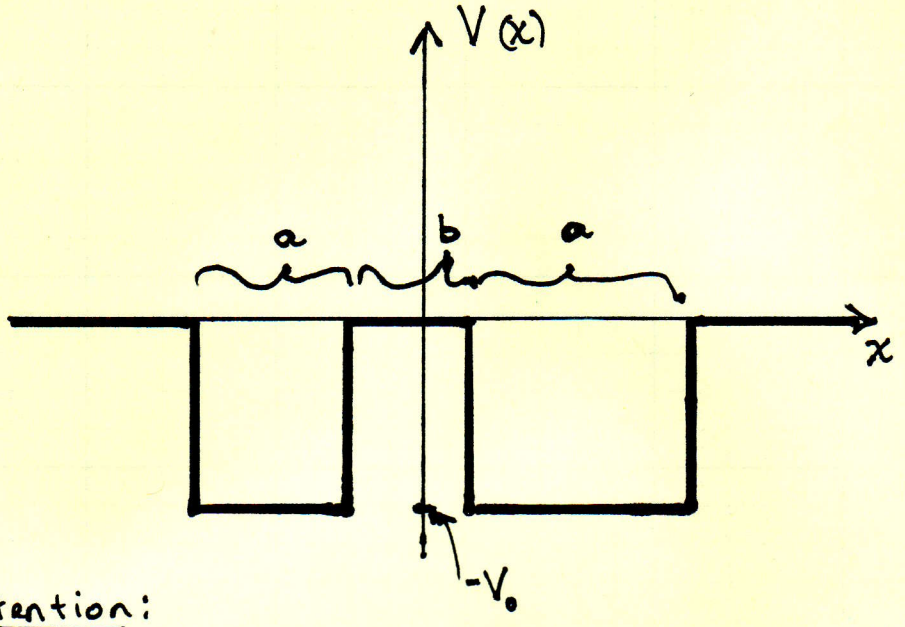
#7)



Attention:

→ This is strictly qualitative problems - no calculations allowed! Consider the "double square well" potential above. Suppose the depth V_0 and the width "a" are fixed, and large enough so that several bound states occur.

[A] Sketch the ground state wave function ψ_1 and the first excited state ψ_2, (i) for the case $b = 0$, (ii.) for $b \approx a$, and (iii.) for $b >> a$.

[B] Qualitatively, how do the corresponding energies (E_1 and E_2) vary, as "b" goes from 0 to infity? Sketch $E_1(b)$ and $E_2(b)$ on the same graph.

[C] The double well is a very primitive one-dimensional model for the potential experienced by an electron in a diatomic molecule (the two wells represent the attractive force of the nuclei). If the nuclei are free to move, they will adopt the configuration of minimum energy. In view of your conclusions in (b), does the electron tend to draw the nuclei together, or push them apart? (Of course, there is also the internuclear repulsion to consider, but that's a separate problem we are not going to consider).