5. 32, 33, 36  Hint on 5-32: in your integral you will have $\exp(-bx^2)$. Make the substitution $u = bx^2$, and then use the integrals in the integral table on our website.

A. An electron is in the well shown. In the sketches, if you cannot illustrate a principle clearly, make notes with arrows to help

1. Sketch on the diagram the wavefunction for the ground state, which is at $E=1\ eV$
2. Sketch the wavefunction for the $7^{th}$ lowest state, which is at $E=5\ eV$.
3. What is the value of $k$ for the wavefunction for the $E=5\ eV$ state, in the region where $V=3\ eV$?
4. Find the value of the decay length $\alpha$ for the $E=1\ eV$ state, in the region where $V=7\ eV$.
5. How far will electrons in 4) penetrate into the $7eV$ barrier before the probability of finding them at that $x$ drops to 1% of what it was at the edge of the barrier?
6. If many electrons come from the far right at $10\ eV$, what approximate fraction $R$ will be reflected back at the $V=0$ to $V=7\ eV$ potential step, never entering the well? Use $R$ given in notes.

B. Electrons responsible for conduction in aluminum have an energy of about $4\ eV$ below the vacuum (the work function), as shown. An electron, traveling along an aluminum wire, finds that there is a gap in the wire that is $1\ nm$ wide.

1. What are the chances that the electron will “tunnel” through the gap?
2. Find the width of the gap for which the transmission probability is $10^{-3}$