

Exercise Sheet 3 due 2 November1. *finite potential well*

Consider a potential well of width L and depth V_0 . Find all eigenenergies $E_n < 0$ for $V_0 = 4$ eV and $L = 2$ nm. Compare the eigenenergies $E_n + V_0$ measured from the bottom of the well with the eigenenergies for an electron in an infinite potential well of the same width.

2. *tunneling current*

Consider a barrier of width L and height V_0 .

- i. For electrons of energy $E < V_0$, calculate the transmission probability, i.e., the ratio of the transmitted current and the incoming current.
- ii. Plot the transmission probability for $V_0 = 2$ eV and $E = 1.9$ eV as a function of L for widths up to 10 \AA .
- iii. In a scanning tunneling microscope (STM) the tunneling current is used to determine the distance L between the tip and the sample. Is the tunneling current (transmission probability) sensitive to the distance L ? How does it vary when L gets large?