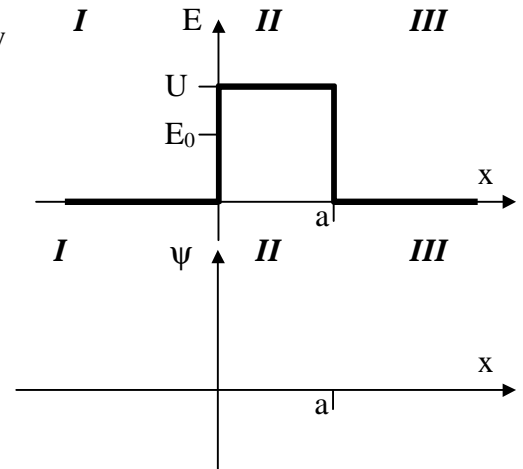


2. Consider a beam of electrons with energy E_0 incident from the left ($x < 0$) on a potential barrier of height U and width a (see energy diagram to the right). Three regions are indicated on the energy diagram as *I*, *II*, and *III*.

a. Sketch the shape of the total wave function of an electron in regions *I*, *II*, and *III* in the diagram to the right. Explain how you arrived at your answer.



Write equations for the wave function in each of the regions in the diagram. Leave normalization constants unspecified.

b. Compare the energy of electrons found in regions *I* and *III*. Explain how you arrived at your answer.

c. Could an electron be found at $x = a/2$? Explain how you know.

d. Write simple equations in terms of the normalization constants to describe the probability that a particle will be reflected and the probability that a particle will pass through the potential barrier.

e. Consider that the width of the potential barrier is decreased to one third its width ($a/3$).

i. Does the number of electrons in region *III* *increase*, *decrease*, or *stay the same* as a result? Explain how you know.

ii. Does the energy of electrons in region *III* *increase*, *decrease*, or *stay the same* as a result? Explain how you know.