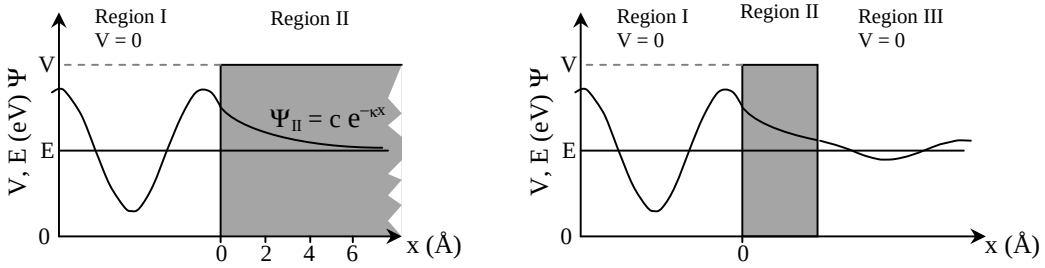
Tunneling – Particles Can Penetrate Into Barriers



$k = \dfrac{\sqrt{2mE}}{\hbar}$ $\quad \Psi_{incident} = a\, e^{ikx}$ $\quad \Psi_{reflected} = b\, e^{-ikx}$ (Region I)

$\Psi_I = \Psi_{incident} + \Psi_{reflected} = a\, e^{ikx} + b\, e^{-ikx}$ (Region I)

Region II : **classically forbidden** region:

$k' = \dfrac{\sqrt{2m(E - V)}}{\hbar}$ (Region II)

$k' = i\dfrac{\sqrt{2m(V - E)}}{\hbar} = i\kappa$ $\quad \kappa = \dfrac{\sqrt{2m(V - E)}}{\hbar}$ (Region II)

$\Psi_{transmitted} = c\, e^{ik'x} = c\, e^{-\kappa x}$ (Region II)

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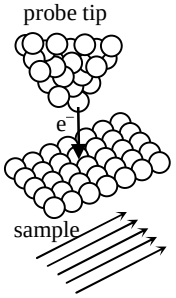
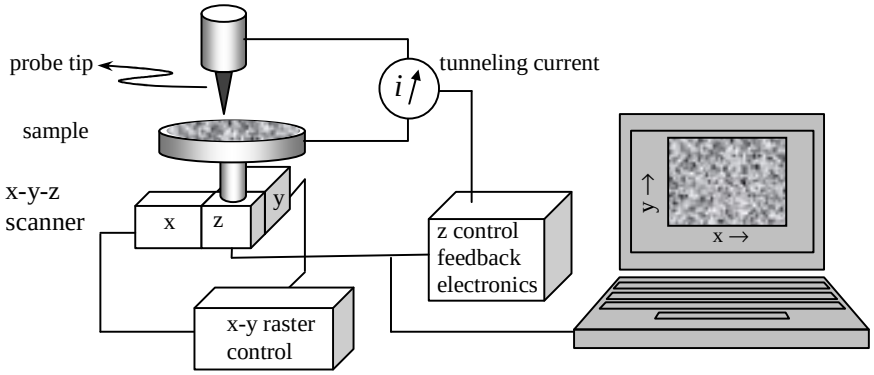
at x = 0: $\quad a\, e^{ikx} + b\, e^{-ikx} = c\, e^{-\kappa x}$ $\quad$ or $\quad a + b = c$ (continuous)

$\dfrac{d}{dx}(a\, e^{ikx} + b\, e^{-ikx}) = \dfrac{d}{dx}(c\, e^{-\kappa x})$ $\quad$ or $\quad iak - ibk = -c\kappa$ (smooth)

$c = \left(\dfrac{2ik}{ik - \kappa}\right) a$

$T = \left[\dfrac{(e^{\kappa L} - e^{-\kappa L})^2}{16\varepsilon(1 - \varepsilon)} + 1\right]^{-1}$ $\qquad \varepsilon = E/V$





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