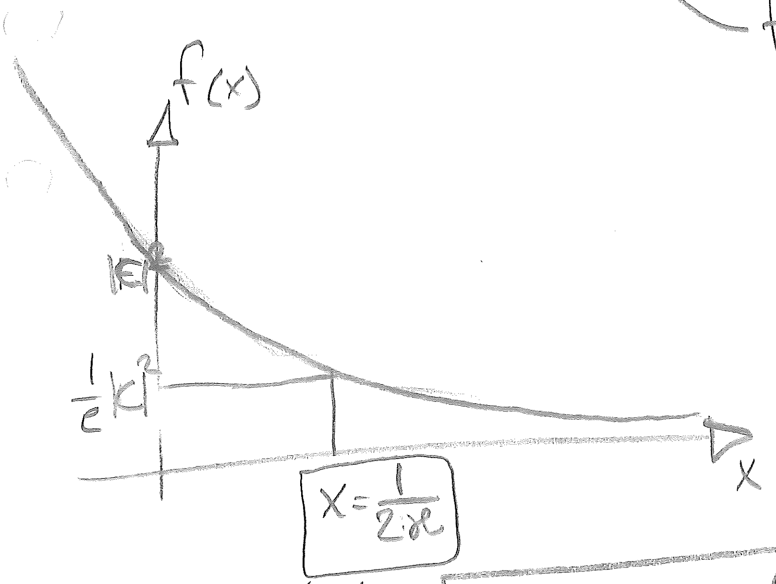
Föreläsning 8

Tunneleffekt, fortsättning

Sannolikhetståthet i väggen

$$\phi_{II}(x) = |\varphi_{II}(x)|^2 = |C|^2 \cdot e^{-2\varkappa x}$$

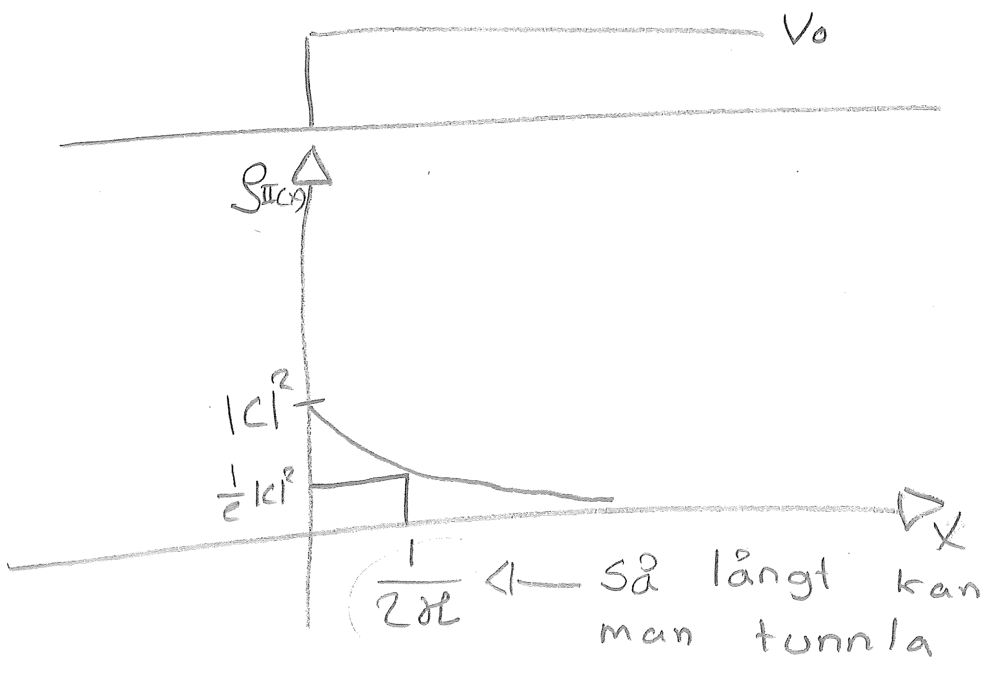
fås från passningsvillkor



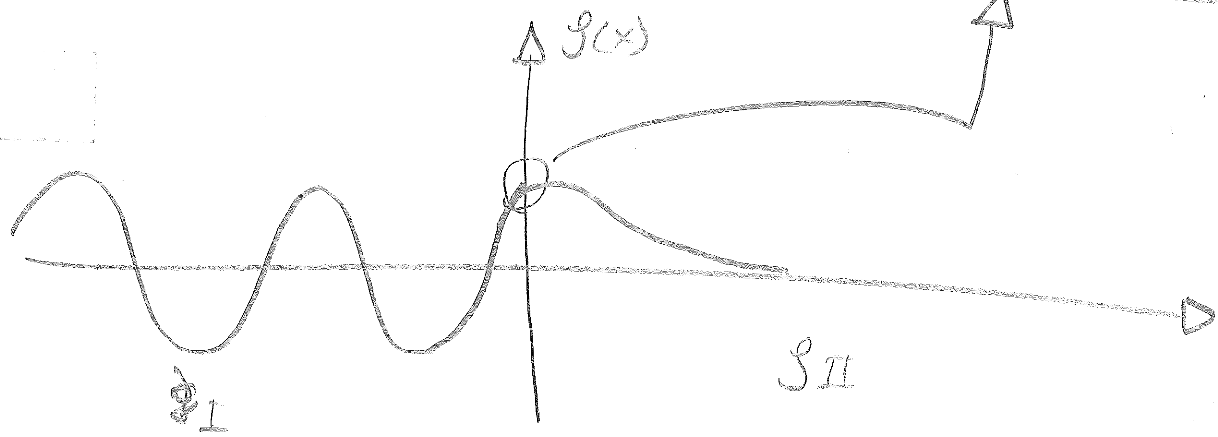
Används för att avgöra hur fort f(x) "inte blir noll"...

Karakteristiska längden

$([a] = m^{-1})$



AVSLUTA MATTEBITEN: PASSNINGSVILLKOR



① $\phi_I(x=0) = \phi_{II}(x=0)$

$A e^{ik0} + B e^{-ik0} = C \cdot e^{ik0}$

$\Leftrightarrow A + B = C$

② $\phi_I'(x=0) = \phi_{II}'(x=0)$

$ikA \cdot e^{ik0} - ikB e^{ik0} = C(-\varkappa)e^{0}$

$ikA - ikB = -C\varkappa$

① $B = C - A$

② $ikA - ik(C-A) = -C\varkappa$

$\Leftrightarrow A = C\,\frac{-\varkappa + ik}{2ik} = \boxed{\frac{1}{2} C \left(1 - \frac{\varkappa}{ik}\right)}$

$\boxed{B = \frac{1}{2} C \left(1 - \frac{i\varkappa}{k}\right)}$

Reflektionssannolikhet

$$R = \frac{|B|^2}{|A|^2} = \frac{\left|\frac{1}{2}C\right|^2 \left|\left(1 - i\frac{\varkappa}{k}\right)\right|^2}{\left|\frac{1}{2}C\right|^2 \left|\left(1 + i\frac{\varkappa}{k}\right)\right|^2} = \frac{\left(1 - i\frac{\varkappa}{k}\right)\left(1 + i\frac{\varkappa}{k}\right)}{\left(1 - i\frac{\varkappa}{k}\right)\left(1 + i\frac{\varkappa}{k}\right)} = \boxed{1}$$

Transmission

$$\phi_{II}(x=a) \propto e^{-2\varkappa a}$$

proportionellt

$$\boxed{T \approx e^{-2\varkappa a}}$$

Transmissionssannolikhet.

$$\left(= \underbrace{16 \cdot \frac{E}{V_0}\left(1 - \frac{E}{V_0}\right)}_{\approx 1} \cdot e^{-2\varkappa a} \right)$$

$T \to 0$ när $2\varkappa a \gg 1$ (obv.)

$a > \frac{1}{2\varkappa}$ } kar. längd } tunnlingslängd

Saker man kan rita

(1) Vågfunktion $(\mathrm{Re}(\psi(x)))$

(2) Sannolikhetstäthet $\phi(x) = |\psi(x)|^2$

(3) Transmissionssannolikhet $T(E)$