Beispiel 1

a

$$\Psi_E(x) = \theta(-x) \left[e^{ikx} + \frac{iD}{k-iD} e^{-ikx} \right] + \theta(x) \left[\frac{k}{k-iD} e^{ikx} \right], \ k = \sqrt{\frac{2mE}{\hbar^2}}$$

b

$$j_I(0) = j_{II}(0), \mathrm{da} : j(x) = j = \frac{\hbar k}{m} \frac{k^2}{k^2 + D^2}$$

c

$$j_{\mathrm{ein}} = \frac{\hbar k}{m}, \ j_{\mathrm{ref}} = \frac{D^2}{k^2 + D^2} \frac{\hbar k}{m}, \ j_{\mathrm{trans}} = j_I = j_{II} = \frac{k^2}{k^2 + D^2} \frac{\hbar k}{m}$$

$$\Rightarrow j_{\mathrm{ref}} + j_{\mathrm{trans}} = j_{\mathrm{ein}}$$

d

$$T = \frac{k^2}{k^2 + D^2}$$

$$|D| \ll k \Rightarrow T \to 1 - \frac{D^2}{k^2} \approx 1$$

$$|D| \gg k \Rightarrow T \to \frac{k^2}{D^2} \ll 1$$

$$\lim_{D \to \infty} T(D; k) = 0$$

e

$$\Psi_E(x) = \theta(-x) \left[e^{ikx} + \frac{iD}{k-iD} e^{-ikx} \right] + \theta(x) \left[\frac{k}{k-iD} e^{ikx} \right] = e^{ikx} + \frac{iD}{k-iD} e^{ik|x|}$$

$$k_{\mathrm{Pol}} = iD \Rightarrow E_{\mathrm{geb}} = -\frac{\hbar^2 D^2}{2m} = \frac{\hbar^2 k_{\mathrm{Pol}}^2}{2m}$$

Beispiel 2

b

$$T = \frac{1}{5 - 4\sin 4Da}$$

c

$$R = 1 - T$$

d

$$T_{\max} = 1 \quad \text{wenn} \quad 4Da = \frac{\pi}{2} + 2n\pi,\ n \in \mathbb{N}$$

$$T_{\min} = \frac{1}{9} \quad \text{wenn} \quad 4Da = \frac{3\pi}{2} + 2n\pi,\ n \in \mathbb{N}$$