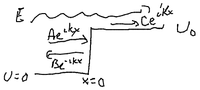


$k = \frac{\sqrt{2mE}}{\hbar}$

$k' = \frac{\sqrt{2m(E-U_0)}}{\hbar}$

$\psi_L(x) = Ae^{ikx} + Be^{-ikx}$

$\psi_R(x) = Ce^{ik'x}$

$\psi_L(0) = \psi_R(0)$ $\qquad$ $\psi_L'(0) = \psi_R'(0)$

$A + B = C$ $\qquad$ $Aik - Bik = Cik'$

$\hookrightarrow B = \frac{k-k'}{k+k'}A$ $\qquad$ $C = \frac{2k}{k+k'}A$

$|Ae^{ikx}|^2 = |A|^2$ is proportional to # of particles per unit length

$\frac{\#\text{ particles}}{\text{time}} = \frac{\#\text{ particles}}{\text{distance}} \cdot \frac{\text{distance}}{\text{time}}$ $\qquad$ $v = \frac{p}{m} = \frac{\hbar k}{m}$

$\propto |A|^2 v \propto |A|^2 k$

rate of incident particles

$R = \frac{\text{rate of reflected particles}}{\text{rate of incident particles}}$ $\qquad$ $B = \frac{k-k'}{k+k'}A$

$= \frac{|B|^2 k}{|A|^2 k} = \left(\frac{k-k'}{k+k'}\right)^2$

$T = \frac{\text{rate transmitted}}{\text{rate incident}}$

$= \frac{|C|^2 k'}{|A|^2 k} = \frac{4kk'}{(k+k')^2}$

if $E = U_0 \varepsilon$

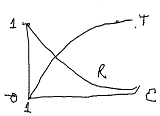
$k = \sqrt{U_0}\frac{\sqrt{2m\varepsilon}}{\hbar}$ $\qquad$ $k' = \sqrt{U_0}\frac{\sqrt{2m(\varepsilon-1)}}{\hbar}$

$R = \left(\frac{\sqrt{\varepsilon} - \sqrt{\varepsilon-1}}{\sqrt{\varepsilon} + \sqrt{\varepsilon-1}}\right)^2$ & $T = \frac{4\sqrt{\varepsilon}\sqrt{\varepsilon-1}}{(\sqrt{\varepsilon}+\sqrt{\varepsilon-1})^2}$

$R + T = 1$

if $\varepsilon \gtrsim 1$ $\qquad$ $\sqrt{\varepsilon-1} << 1$ $\qquad$ $R \simeq \left(\frac{\sqrt{\varepsilon}}{\sqrt{\varepsilon}}\right)^2 = 1$

if $\varepsilon >> 1$ $\qquad$ $R \approx 0$ $\qquad$ $T \approx 1$



Would this work for a bowling ball? No

is an approximation

Change in U occurs over a distance d

if $d << \lambda$ of particles it looks vertical

for bowling ball, $\lambda <<<<< d$

so solution doesn't hold

for a realistic shelf