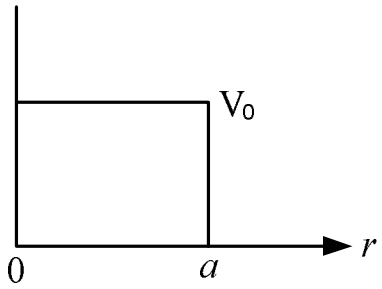
The scattering problem for quantum mechanics II

Problem:
Determine the cross-section for the scattering of slow particles (low energy) by the following repulsive potential

$V(r) = V_0 \quad (r < a)$

$V(r) = 0 \quad (r > a)$



Solution:
The cross-section for the scattering of slow particles is given as

$$\sigma = 4\pi a^2 \left(\frac{\tanh ka}{ka} - 1 \right)^2$$

where $k = \frac{\sqrt{2\mu V_0}}{\hbar}$.

If $V_0 \to \infty$, $\sigma = 4\pi a^2$; that is, it is four times as large as the elastic scattering cross-section for an impenetrable sphere in classical case.