J00Q.1—Scattering From a Central Potential

Problem

A particle of mass m and energy $\hbar^2 k^2/2m$ scatters in a central potential $V(r)$ which is everywhere positive and vanishes rapidly as $r \to \infty$. Let $d\sigma/d\Omega$ be the differential cross section as computed in the Born approximation. For precisely backwards scattering you are given

$$\left.\frac{d\sigma}{d\Omega}\right|_{\text{back}} = A\,\frac{\exp(-4\lambda k)}{k^2}$$

where A, λ are given parameters.

a) Calculate $d\sigma/d\Omega$ in the same approximation for arbitrary scattering angle.

b) Calculate $V(r)$.