

M05Q.2 - Delta Function Potential

Problem

A particle of mass m and kinetic energy E scatters from a thin spherical shell of radius R . The scattering potential can be approximated by

$$V = vR\delta(r - R),$$

where r is the distance of the particle from the scattering center, v is a characteristic energy, and δ denotes a Dirac delta function.

- a) Derive the S-wave scattering cross-section σ_0 in terms of E, m, v, R and \hbar .
- b) For what energies E does σ_0 vanish? Explain.
- c) Derive a formula for σ_0 when $E = 0$.
- d) For what values of v does $\sigma_0 \rightarrow \infty$ as $E \rightarrow 0$ in c)? Explain.