Recitation #11
Quantum 522

Consider elastic scattering by a spherical delta-function potential,

$$v(r) = \frac{\hbar^2 \gamma}{2\mu} \delta(r - a)$$

In the Born approximation, the scattering amplitude is

$$f^{(1)} = \frac{-2\mu}{\hbar^2 q} \int_0^\infty r dr \sin(qr) V(r)$$

1. What is q?

2. Find the differential cross section in the Born approximation.

3. Show that in the low energy limit the differential cross section is isotropic and independent of k.

4. Use criteria for the validity of the Born approximation,

$$\frac{2\mu}{\hbar^2 k} \left| \int_0^\infty dr e^{ikr} \sin(qr) V(r) \right| << 1$$

to show that the Born approximation is valid for $k \gg \gamma$.