Recitation #9
Quantum 522

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1. Consider scattering of a potential $V(r) = -V_0\theta(r_0 - r)$. In the born approximation, find the total cross section in the limit $kr_0 \to 0$ and show that it is isotropic. With $q = 2k\sin(\theta/2)$ the Born approximation is
$$f^{(1)}(\theta) = \frac{-2m}{q\hbar^2}\int_0^\infty r\sin{(qr)}V(r)dr$$

2. Calculate the total cross section for scattering off of a Yukawa potential. In class we found (with $m_0 = 1/r_0$)
$$\frac{d\sigma}{d\Omega} = \left(\frac{2mg}{\hbar^2}\right)^2\left(\frac{r_0^2}{q^2r_0^2+1}\right)^2$$
Hint: $q^2 = 2k^2(1-\cos\theta)$ and change variables from $\cos\theta$ to q^2.

   Take the limit $r_0 \to \infty$. What is the total Rutherford cross section?