HW 11.1. In the first Born approximation, calculate the differential cross section $\frac{d\sigma}{d\Omega}$ for the Gaussian potential

$$V(r) = V_0 \, e^{-r^2/a^2} .$$

Give your answer in terms of the momentum transfer q and the various constants.

HW 11.2. (a) Again in the first Born approximation, calculate the differential cross section $\frac{d\sigma}{d\Omega}$ for the potential

$$\begin{aligned} V(r) &= V_0 \ , \quad r \le R \\ &= 0 \ \ , \quad r > R \end{aligned} .$$

(b) Show that $d\sigma / d\Omega$ is a constant (independent of both k and θ) in the limit of low momentum transfer q.

(c) Now consider the 3-dimensional delta-function potential

$$V(r) = A \, \delta(\mathbf{r}) .$$

Using the first Born approximation once more, calculate $d\sigma / d\Omega$. Determine the constant A which gives the same result as was found in part (b).