

Quantum Mechanics 2 – February-May 2011

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Home Assignment 4

Assigned: May 12, 2011, Due: May 23, 2011

1. Consider a particle of mass m moving in a Gaussian potential $V_0 e^{-\alpha r^2}$. Calculate the differential cross-section and the total cross-section in the Born approximation.

(35 marks)

2. Show that for slow-moving particles (i.e. in the limit of small k), the partial scattering amplitude $f_{k,l}$ defined by:

$$f_k(\theta) = \sum_{l=0}^{\infty} (2l+1) f_{k,l} P_l(\cos \theta)$$

has the k -dependence:

$$f_{k,l} \sim k^l$$

(35 marks)

3. Find the differential cross-section for Rutherford scattering of two electrons in the Born approximation, both for total spin 1 and total spin 0.

(35 marks)