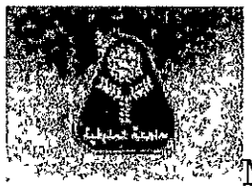

Menoufia University
Faculty of Science
Physical Department
Subject and Code Number: Theoretical Nuclear Physics Ph
Examination of the end second term 2017-2018
Allowed time of examination: Two hours Date: 12 -5-2018

Answer the following questions:

1-Calculate the scattering cross-section in the first Born approximation method for the Gaussian potential $V(r) = V_0 e^{-\frac{r^2}{a^2}}$.

2- Use the partial wave method to calculate the total scattering cross-section, in the limiting cases of very low and very high incident energy for the scattering of a particle from the hard sphere potential of radius a, $V(r) = \begin{cases} \infty, & for\ r \prec a \\ 0, & for\ r \succ a \end{cases}$.

Compare the results with the corresponding classical results.

3- The potential energy for scattering of an electron by an atom can be represented approximately by the screened Coulomb potential

$V(r) = \frac{-Ze^2}{r} e^{-\frac{r}{a}}$ where a is the scattering radius.

Show that, in the first Born- Approximation, the scattering amplitude is $f(\theta) = \frac{2mZe^2a^2}{\hbar^2\left(1+K^2a^2\right)}$; $K = 2k\sin\frac{\theta}{2}$

4-Using Green functions in the scattering theory to drive the differential scattering cross section:

$$f(\theta) = \frac{-1}{4\pi}\int e^{-ik\vec{n}.\vec{r}} U(r')\overset{+}{\Psi}(r')dr'$$

With my best wishes
Dr. Taha Abdel-Karim