

Recuperatorio primer parcial

1- Consider the potential of the form:

$$V = \begin{cases} V_0 & r < a \\ 0 & r > a \end{cases}$$

- a-** Using the Born approximation, calculate the total cross section in the limit of low energies.
- b-** Repeat the calculation of by using wave expansion and compare it with the above result.

2-

- a-** Using the Born approximation, express the differential cross section for scattering of an electron from a spherical symmetric charge distribution as the product of the cross section for a point charge and the square of a form factor $F(k)$, where k is the moment transfer.
- b-** Evaluate explicitly for a Gaussian charge, $\rho(r) = \frac{q}{\pi^{\frac{3}{2}}R^3} \exp(-r^2/R^2)$

3- Explain the resonance scattering theory and the lifetime of a resonance state.

4- Particles (with mass m) are scattered from the potential $V(r) = \frac{g}{r^2}$, ($g > 0$).

- a-** Write the radial wave equations and give their regular solutions.
- b-** Prove that the phase shifts are given by

$$\delta_l = \frac{\pi}{2} \left[l + \frac{1}{2} - \sqrt{\left(l + \frac{1}{2} \right)^2 + \frac{2mg}{\hbar^2}} \right]$$