Homeworks for the Weak of 1 - 8 - February (due on February 13)

1. The localization of the particle can be estimated as:
   \[ r = \frac{\hbar}{p} \]
   (a) Estimate the localization of 8 MeV proton
   (b) The same for 8 MeV electron.
   (c) What should be the energy for electron to have the same localization as 8 MeV proton.

2. The phenomenological expression of nuclear radius is
   \[ R = r_0 A^{\frac{1}{3}}, \quad \text{where} \quad r_0 = 1.2 \times 10^{-13} \, \text{cm} = 1.2 \, \text{fm} \]
   Using the fact that the binding energy per nucleon is \( B/A = 8 \) MeV, calculate the density of nucleus with \( A = 40 \).

3. Using Problem 2 obtain the \( A \) dependence of the nuclear density

3. Show that for even nuclei the total spin \( J \) is integer and for odd nuclei it is half integer.
   Hint (use the fact that nucleons have intrinsic spin \( \frac{1}{2} \) and orbital angular momentum which can have positive integer values only)