The energy released when sodium and chlorine combine to form NaCl is 4.2 eV. With what fractional accuracy must the masses of $^{23}\text{Na}^+$, $^{35}\text{Cl}^-$, and NaCl be measured in order to "weigh" this chemical bond to an accuracy of 30%?

Nuclei: It is often convenient to think of the interaction between a proton and a neutron as arising from the exchange of pion, with mass 138 MeV/c^2.

(a) Give the pion exchange reactions appropriate to the p-p interaction, the p-n interaction, and the n-n interaction.

(b) Estimate the range of the nucleon-nucleon force.

Nuclei: The three lowest states in the shell model are $1s_{1/2}$, $1p_{3/2}$, and $1p_{1/2}$. Use the shell model to explain which of these three nuclei are stable and which are not: $^6\text{C}$, $^{8}\text{Be}$, and $^4\text{He}$. 