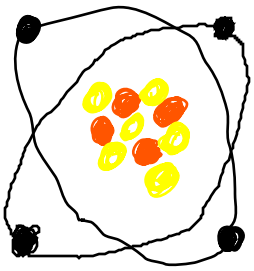
PHYS 102 – Good Nukes, Bad Nukes, Fall, '06 – Quiz #1

This quiz is open book, open notes, but you must work without assistance from others. It is not enough to just give the answers, but you must explain your reasoning in words about how you got your answers. All questions are equally weighted.

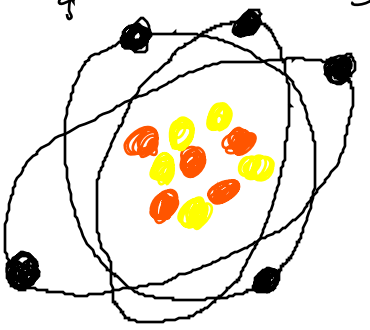
1. Draw a cartoon picture of $^{10}_{4}$Be. It turns out that $^{9}_{4}$Be is the single stable isotope of Be. Give your best guess as to what type of decay $^{10}_{4}$Be undergoes (explain your reasoning), state the nucleus that remains after the decay, and draw a cartoon picture of the nucleus that remains after the decay.

If $^{10}_{4}Be$ is unstable but $^{9}_{4}Be$ is stable then "problem" is too many neutrons. "Answer" is beta decay: $n^0 \rightarrow p^+ + e^- + \bar{\nu}_e$

So, $^{10}_{4}Be \rightarrow {}^{10}_{5}B + e^- + \bar{\nu}_e$



$^{10}_{4}Be$



$^{10}_{5}B$

● = e^-

● = p^+

● = n^0

2. $^{10}_{4}$Be has a half-life of 1.52 million years. If the activity of a sample of $^{10}_{4}$Be was 80 mCi today, how long would it be before the sample activity dropped to 10 mCi?

For the activity to drop from 80 mCi to 10 mCi

(over)

3. On the first worksheet, you were asked to calculate the relative electrical potential energy of the outermost electron in $^{238}_{92}U$ to the electric potential energy of two equal chunks of the nucleus. Without going through the calculation in gory detail, explain what considerations made the potential energies come out so different.