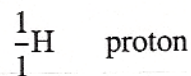
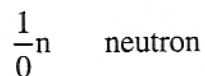
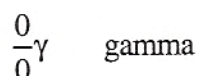
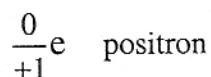
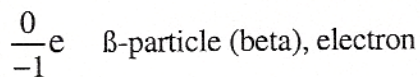
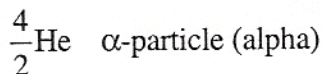


Chapter 20 Nuclear Chemistry Math Summary

Particles Involved in Nuclear Reactions, either as Nucleons, Emitted particles or Particles that React with a Nucleus and Induce a Decay

(Memorize these for Test)

-the first three, alpha, beta, and positrons are the crucial ones for balancing radioactive nuclear decay reactions



Radioactive Decay Math

$$t = (t_{1/2}/0.693) \ln (m_0/m_t) \quad \text{When solving for time, given half life and quantities of material}$$

$$\ln (m_0/m_t) = (0.693/t_{1/2}) \cdot t \quad \text{When solving for the amount of material left after a given time, given the half life}$$

Handling "ln y = x" on calculator, when you know "x" but want to solve for "y": enter "x", then hit your "e^x" button.

Mass Defect/Binding Energy Math

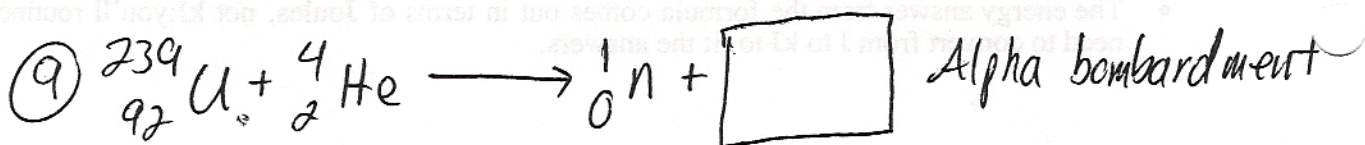
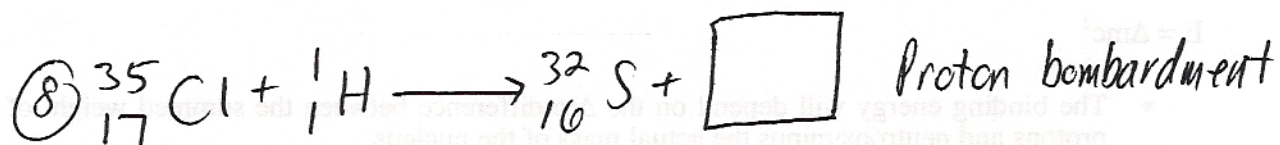
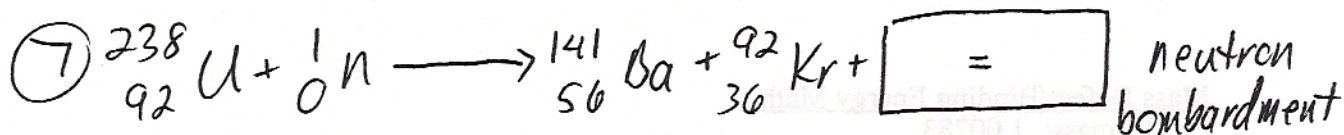
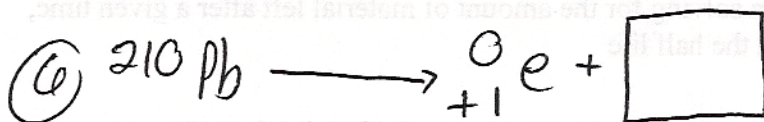
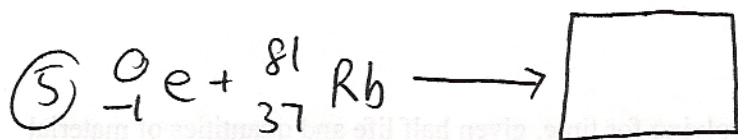
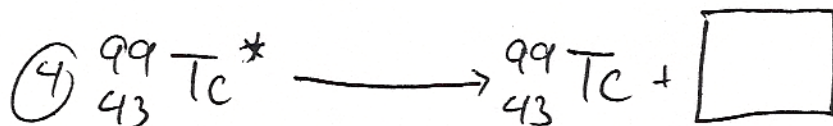
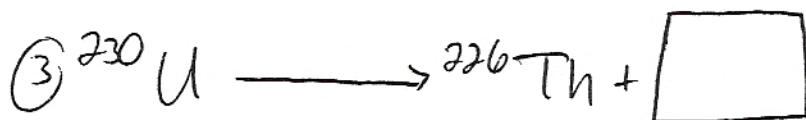
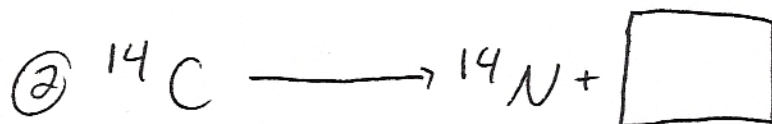
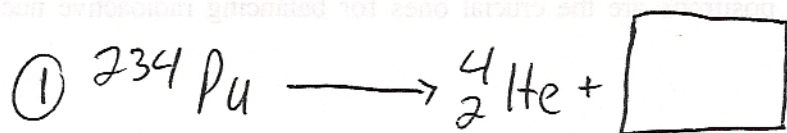
Proton mass: 1.00783

Neutron mass: 1.00867

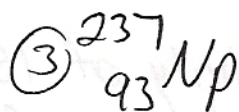
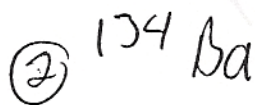
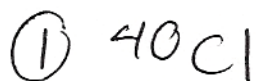
$$E = \Delta mc^2$$

- The binding energy will depend on the Δm difference between the summed weight of the protons and neutrons minus the actual mass of the nucleus.
- Δm in terms of kilograms (you'll normally need to convert from grams to kg)
- The energy answer from the formula comes out in terms of Joules, not kJ; you'll routinely need to convert from J to kJ to fit the answers.

Fill in the Holes, Name the Processes



Predict how the following would decay, by α , β , or positron emission, or by electron capture. Then draw the nuclide produced.



④ What is the binding energy in kJ/mol for $^{16}_8\text{O}$?

Given $^{16}_8\text{O}$	15.978
^1_1p	1.00783
^1_0n	1.00867

⑤ For the above, what is the binding energy in kJ/mol nucleons?

① ^{99}Tc $t_{1/2} = 6.0$ hours. What percentage of a dose of ^{99}Tc (used for a brain imaging scan) is left after 74 h? 70-12

② ^{131}I $t_{1/2} = 8.0$ days. How long to decay to 10% of original?

③ ^{14}C $t_{1/2} = 5730$ years. "Live" carbon has activity of 15.3. A shirt is claimed to be Jesus's, but is found to have carbon activity of 14.0. How old is the shirt, and can the claim be true?

④ ^{90}Sr $t_{1/2} = 28.8$ y. If 42 g of ^{90}Sr is buried, how much is left after 120 years?