1. Fill in the missing products or reactants for the following nuclear reactions.
   
   a. \( ^{235}_{92}U \rightarrow ^{233}_{90}Th + ? \)
   
   b. \( ^{235}_{92}U \rightarrow ^{235}_{93}NP + ? + ^{0}_{0}\bar{\nu} \)
   
   c. \( ^{235}_{92}U \rightarrow ^{235}_{93}NP + ? \)
   
   d. \( ^{238}_{89}Ra + ? \rightarrow ^{236}_{86}Ac + ^{0}_{0}\beta + ^{0}_{0}\bar{\nu} \)

2. Americium-242 \( (^{242}_{95}Am) \) undergoes alpha decay, emitting alpha radiation to become neptunium. Write the equation for this decay.

3. Tritium (hydrogen-3) undergoes beta decay to become helium-3. Write the equation for this decay.

4. Uranium-238 emits radiation that is stopped by a sheet of paper.
   
   a. Which type of radiation is emitted? Justify your answer.
   
   b. Write an equation to show the decay process.
c. What is the daughter nuclide formed from this decay?

5. Carbon-14 is used in carbon dating. It is unstable and will decay. The radioactive particle emitted passes through paper but does not pass through a sheet of aluminium.
   a. Which type of radiation is emitted? Justify your answer.

   b. Write an equation to show the decay process.

   c. What is the daughter nuclide formed from this decay?

6. Iodine-123 is a useful metastable radioisotope used for nuclear imaging to help with diagnosis in a hospital. The radioactive particle emitted can pass through even thick pieces of lead. The notation for metastable iodine-123 is $^{123m}_{53}$I.
   a. Which type of radiation is emitted? Justify your answer.

   b. Write an equation to show the decay process.
c. What is the daughter nuclide formed from this decay?

d. Where does the energy for the emission of this radioactive particle come from?

7. One of the earliest records of artificial transmutation was by Cockcroft and Walton in 1932. An accelerated proton was bombarded into lithium-7 which produced two alpha particles. Write a decay equations for this process.

8. Uranium -238 decays in two stages to become protactinium-234. Write a possible pair of decay equations which shows this.
9. Explain if it is possible for lead-214 to decay into thallium-210 in a single decay event. Decay equations may help with your explanation.

10. Write out the decay equations showing how polonium-218 can convert into radon-218.

11. Boron-8 is unstable. When it decays, it forms beryllium-8 and emits a radioactive particle and neutrino.
   a. What is the atomic number and mass number of the radioactive particle that is emitted during this decay?
   b. What is the name of this radioactive particle? You may need to research the answer.
   c. Compare this type of decay to beta decay. Consider changes to the nucleus and properties of the particles emitted.