

Chapter 4.4 Worksheet- Unstable Nuclei and Radioactive Decay

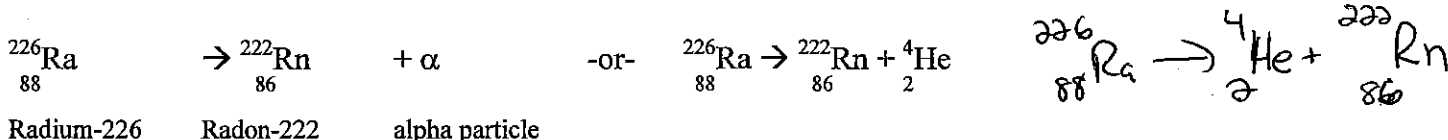
In this section, we will go over why some unstable isotopes undergo **radiation**. These particles emit, or release, energy from the nucleus in order for the nucleus of the atom to become stable. Unstable nuclei lose energy by emitting radiation in a spontaneous process called **radioactive decay**. Unstable atoms undergo radioactive decay until they form stable atoms, often of a different element.

Three types of Radiation

Alpha Radiation- Alpha particles contain 2 protons, 2 neutrons and 0 electrons. It's mass is 4 amu but it's charge is +2 because there are no negative electrons.

Symbol for alpha radiation: α -or- ${}^4_2\text{He}$

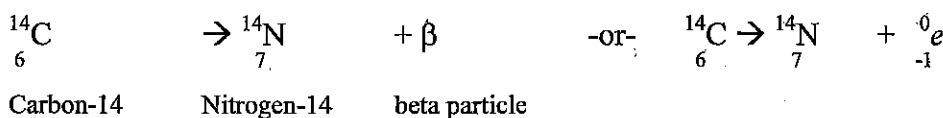
The alpha decay of radioactive radium-226 into radon-222 is shown below:



Beta Radiation- Beta particles are simply electrons. They contain 0 protons, 0 neutrons and 1 electrons. It's mass is 0 amu, but it's charge is -1 because there are no positive protons.

Symbol for beta radiation: β -or- ${}^0_{-1}e$

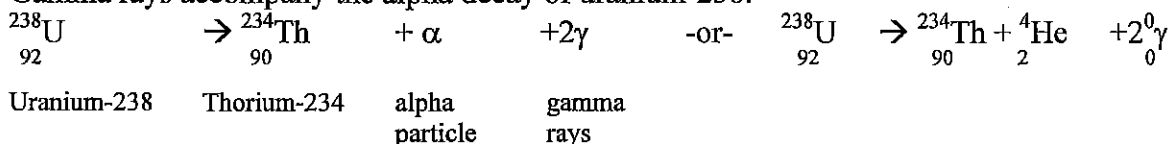
The beta decay of unstable carbon-14 results in the creation of the new atom, nitrogen (N).



Gamma Radiation- Gamma radiation, or gamma ray, is a high-energy radiation that possesses no mass. They contain 0 protons, 0 neutrons and 0 electrons. Since they are massless, they usually accompany alpha and beta radiation, and they account for most of the energy lost during radioactive decays.

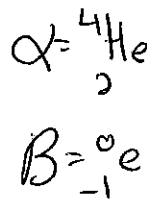
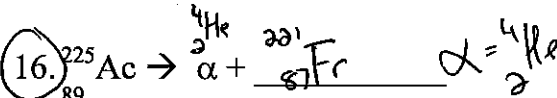
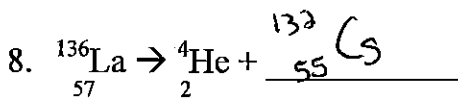
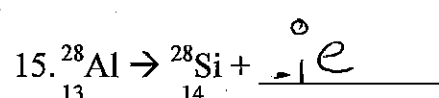
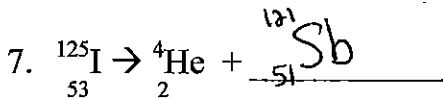
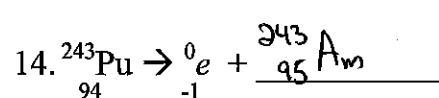
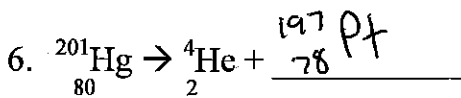
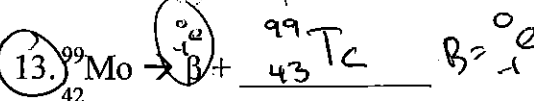
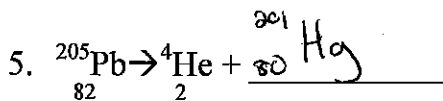
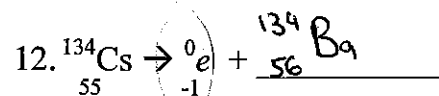
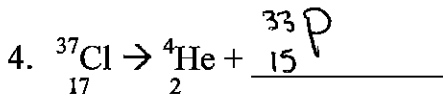
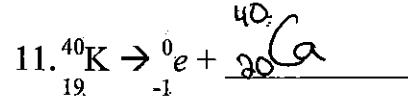
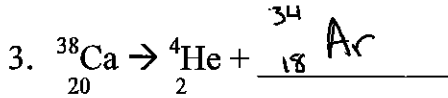
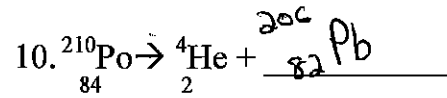
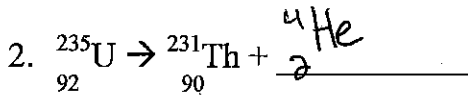
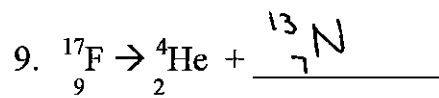
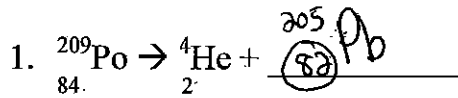
Symbol for gamma radiation: γ -or- γ

Gamma rays accompany the alpha decay of uranium-238.



*****To balance any nuclear reaction, the sum of the atomic numbers on both sides of the arrow must be equal. Also, the sum of the atomic masses on both sides of the arrow must be equal.*****

Radioactive Decay Problems



The radioactive isotope curium-242 (atomic # 96) undergoes decay to lead-206 (atomic # 82) in the following order: $\alpha, \alpha, \alpha, \alpha, \alpha, \alpha, \alpha, \alpha, \beta, \beta, \alpha, \beta, \beta, \alpha$.

Write the 13 decay steps from curium-242 to lead-206, using the product from the previous step as the reactant in the next step.

