

Nuclear Physics Practice Problems

- In each of the following cases, what element does the symbol X represent and how many neutrons are in the nucleus? Use the periodic table as needed.
 - ${}^{195}_{75}\text{X}$
 - ${}^{32}_{16}\text{X}$
 - ${}^{63}_{29}\text{X}$
 - ${}^{11}_{5}\text{X}$
 - ${}^{239}_{94}\text{X}$
- In electrically neutral atoms, how many
 - protons are in the uranium ${}^{238}_{92}\text{U}$ nucleus?
 - neutrons are in the mercury ${}^{202}_{80}\text{Hg}$ nucleus?
 - electrons are in orbit about the niobium ${}^{93}_{41}\text{Nb}$ nucleus?
- Write the β^+ decay process for each of the following nuclides.
 - ${}^{18}_{9}\text{F}$
 - ${}^{15}_{8}\text{O}$
- Lead ${}^{207}_{82}\text{Pb}$ is a stable daughter nucleus that can result from either an α decay or a β^- decay. Write the decay processes, including the chemical symbols and values for Z and A of the parent nuclei, for the α decay and the β^- decay.
- Most of the time radon ${}^{220}_{86}\text{Rn}$ decays to lead ${}^{208}_{82}\text{Pb}$ by the following decay chain:
 ${}^{220}_{86}\text{Rn} \rightarrow {}^{216}_{84}\text{Po} \rightarrow {}^{212}_{82}\text{Pb} \rightarrow {}^{212}_{83}\text{Bi} \rightarrow {}^{208}_{82}\text{Pb}$. What are the total number of α particles and the total number of β^- particles that are generated in this series of radioactive decays?
- In 9.0 days the number of radioactive nuclei decreases to one-eighth the number present initially. What is the half-life (in days) of the material?
- Iodine ${}^{131}_{53}\text{I}$ is used in diagnostic and therapeutic techniques in the treatment of thyroid disorders. This isotope has a half-life of 8.04 days. What percentage of an initial sample of ${}^{131}_{53}\text{I}$ remains after 30.0 days?

Questions adapted from Young, David and Shane Stadler. Cutnell & Johnson Physics. 11th edition. John Wiley & Sons Inc, 2018.