

Chemistry I (Honors)
Nuclear Chemistry Practice

Write reactions for the following nuclear decay processes:

1. Iridium-174 emits an alpha particle
2. Platinum-199 emits a beta particle
3. Sulfur-31 emits a positron
4. Krypton-76 undergoes electron capture
5. Radium-228 undergoes the following decay series: β , β , α , α , α , α , β , β , α , β
Give the nine intermediates and the final product's isotope formulae.
6. Iodine-131 has a half-life of 8.02 days and is used as an indicator of how well the thyroid gland is functioning as well as a treatment for thyroid cancer. Patients can set off radiation detectors in airports up to 12 weeks after dosing. What percentage of an original 100% sample remains at the end of those 12 weeks?
7. With a half-life of 5730 years, Carbon-14 is found to exhibit 13.6 counts per minute per gram (cpm/g) atmospherically. If a mandible (jaw bone) found in Persia exhibits a C-14 count of 3.60 cpm/g, what is the age (in years) of the mandible?

Answers

1. ${}^{174}_{77}\text{Ir} \rightarrow {}^4_2\text{He} + {}^{170}_{75}\text{Re}$
2. ${}^{199}_{78}\text{Pt} \rightarrow {}^0_{-1}\text{e} + {}^{199}_{79}\text{Au}$
3. ${}^{31}_{16}\text{S} \rightarrow {}^0_1\text{e} + {}^{31}_{15}\text{P}$
4. ${}^{76}_{36}\text{Kr} + {}^0_{-1}\text{e} \rightarrow {}^{76}_{35}\text{Br}$
5. ${}^{228}_{89}\text{Ac}$, ${}^{228}_{90}\text{Th}$, ${}^{224}_{88}\text{Ra}$, ${}^{220}_{86}\text{Rn}$, ${}^{216}_{84}\text{Po}$, ${}^{212}_{82}\text{Pb}$, ${}^{212}_{83}\text{Bi}$, ${}^{212}_{84}\text{Po}$, ${}^{208}_{82}\text{Pb}$, ${}^{208}_{83}\text{Bi}$
6. 0.0703% of the ${}^{131}_{53}\text{I}$ remains
7. 10992 years