

Lesson 8: Nuclear Chemistry I

text: 613-630

what to know:

- mass-energy relationships in nuclei, §15-1
- concept of nuclear stability (belt of stability), §15-1
- binding energies (mass changes during nuclear reactions), §15-1
- nature of nuclear reactions and related terms, §15-2
- how to write balanced equations for nuclear reactions, §15-2
- nature of the naturally radioactive series, §15-2
- kinetics of radioactive decay and dating procedures, §15-3

questions:

1. What are the differences between nuclides, nucleons and isotopes?
2. Describe the nature of the emissions from natural radioactive sources.
3. Consider H, Fe and U nuclei.
 - a. Which has the greatest mass defect per nucleon?
 - b. Which has the greatest nuclear binding energy per nucleon?
 - c. Which one loses mass when it undergoes fission?
4. Which has the least binding energy per nucleon, a He or Cu nucleus?
5. What does the symbol, a) ${}_{-1}^0\text{e}$, b) ${}_{-1}^0\hat{\text{a}}$ c) ${}_{1}^0\text{e}$ represent?
6. How do nuclear reactions differ from ordinary chemical reactions?
7. Identify X in the following nuclear equations.
 - a. ${}_{53}^{135}\text{I} \implies {}_{54}^{135}\text{Xe} + \text{X}$
 - b. ${}_{24}^{53}\text{Cr} + {}_{2}^4\text{He} \implies {}_{1}^1\text{n} + \text{X}$
8. Given the nuclear reaction, ${}_{11}^{20}\text{Na} \implies {}_{10}^{20}\text{Ne} + \text{X}$.
 - a. What is the mass number of X?
 - b. What is the atomic number of X?
 - c. What is the name of X?
- d. How does X originate in a nucleus?
9. If a nucleus is unstable because its neutron to proton ratio is too high, what type of particle emission
10. What nuclide is formed when ${}_{94}^{242}\text{Pu}$ undergoes alpha particle emission?
11. What is meant by "induced radioactivity"? K-electron capture?
12. Why are neutrons never used in nuclear bombardment reactions in particle accelerators?
13. Strontium-90 has a half-life of 28.8 years. How many grams of strontium-90 was present initially, if after 144 years 10.0 g remain?
14. The radioactive decay of Tl-206 to Pb-206 has a half-life of 4.40 minutes. Starting with 5.00×10^{22}
15. Why is C-14 dating not applicable to objects over 50,000 years old?
16. Estimates show that the total energy output of the sun is 5×10^{26} J/s. What is the corresponding