CHAPTER REVIEW

The Nucleus

SECTION 1 REVIEW

1. a. How does mass defect relate to nuclear binding energy?
   b. How does binding energy per nucleon vary with mass number?
   c. How does binding energy per nucleon affect the stability of a nucleus?
2. Describe three ways in which the number of protons and the number of neutrons in a nucleus affect the stability of the nucleus.

PRACTICE PROBLEMS

3. The mass of a $^{20}_{10}$Ne atom is 19.992 44 amu. Calculate the atom's mass defect.
4. The mass of a $^{7}_{3}$Li atom is 7.016 00 amu. Calculate the atom's mass defect.
5. Calculate the nuclear binding energy of one lithium-6 atom. The measured atomic mass of lithium-6 is 6.015 amu.
6. Calculate the binding energies of the following two nuclei, and indicate which nucleus releases more energy when formed. You will need information from the periodic table and the text.
   a. atomic mass 34.988011 amu, $^{35}_{19}$K
   b. atomic mass 22.989767 amu, $^{23}_{11}$Na
7. a. What is the binding energy per nucleon for each nucleus in the previous problem?
   b. Which nucleus is more stable?
8. The mass of $^{7}_{3}$Li is 7.016 00 amu. Calculate the binding energy per nucleon for $^{7}_{3}$Li.
9. Calculate the neutron-proton ratios for the following nuclides:
   a. $^{12}_{6}$C
   b. $^{3}_{1}$H
   c. $^{206}_{82}$Pb
   d. $^{134}_{50}$Sn
10. a. Locate the nuclides in problem 9 on the graph in **Figure 2.** Which ones lie within the band of stability?
    b. For the stable nuclides, determine whether their neutron-proton ratio tends toward 1:1 or 1.5:1.
11. Balance the following nuclear equations. (Hint: See Sample Problem A.)
    a. $^{43}_{19}\text{K} \longrightarrow {}^{43}_{20}\text{Ca} + \underline{\ ?\ }$
    b. $^{233}_{92}\text{U} \longrightarrow {}^{229}_{90}\text{Th} + \underline{\ ?\ }$
    c. $^{11}_{6}\text{C} + \underline{\ ?\ } \longrightarrow {}^{11}_{5}\text{B}$
    d. $^{13}_{7}\text{N} \longrightarrow {}^{0}_{+1}\beta + \underline{\ ?\ }$
12. Write the nuclear equation for the release of an alpha particle by $^{210}_{84}$Po.
13. Write the nuclear equation for the release of a beta particle by $^{210}_{82}$Pb.

Radioactive Decay

SECTION 2 REVIEW

14. Where on the periodic table are most of the natural radioactive nuclides located?
15. What changes in atomic number and mass number occur in each of the following types of radioactive decay?
    a. alpha emission
    b. beta emission
    c. positron emission
    d. electron capture
16. Which types of radioactive decay cause the transmutation of a nuclide? (Hint: Review the definition of *transmutation.*)
17. Explain how beta emission, positron emission, and electron capture affect the neutron-proton ratio.
18. Write the nuclear reactions that show particle conversion for the following types of radioactive decay:
    a. beta emission
    b. positron emission
    c. electron capture
19. Compare electrons, beta particles, and positrons.
20. a. What are gamma rays?
    b. How do scientists think gamma rays are produced?
21. How does the half-life of a nuclide relate to the stability of the nuclide?
22. List the three parent nuclides of the natural decay series.