

**Section Review**

**Objectives**

- Describe the type of decay a radioisotope undergoes
- Make calculations that involve half-life
- Explain the two ways transmutations can occur

**Vocabulary**

- band of stability
- positron
- half-life
- transmutation
- transuranium elements

**Part A Completion**

Use this completion exercise to check your understanding of the concepts and terms that are introduced in this section. Each blank can be completed with a term, short phrase, or number.

- Nuclei that lie outside the 1 undergo spontaneous radioactive decay. Nuclei with too many neutrons undergo 2 emission as neutrons are converted to protons. A 3 is a particle with a positive charge and the mass of an electron. Every radioisotope decays at a characteristic 4. A 5 is the time required for one half of the nuclei in a radioisotope to decay. The product nuclei may or may not be 6. Half-lives vary from fractions of a second to 7 of years. The conversion of atoms of one element to atoms of another is called 8. This process can occur by 9 or when particles bombard the nucleus of an atom. All of the elements with 10 above 92 have been 11 in nuclear reactors or accelerators.

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1. band of stability
2. beta
3. positron
4. rate
5. half-life
6. radioactive
7. billions
8. transmutation
9. radioactive
10. atomic decay
11. synthetic (created, etc)

**Part B True-False**

Classify each of these statements as always true, AT; sometimes true, ST; or never true, NT.

12. If you start with one mole of a radioisotope, after 10 half-lives, there will be none of the isotope left. NT
13. A radioisotope has a half-life of 12 minutes. After 36 minutes only one third of the radioactive atoms initially present will remain. NT
14. Transuranium elements have atomic numbers greater than 92. AT
15. Transmutation reactions occur spontaneously. ST
16. Positively charged particles have the mass of an electron. ST

**Part C Matching**

Match each description in Column B to the correct term in Column A.

- |                                    |  |
|------------------------------------|--|
| <b>Column A</b>                    | <b>Column B</b>  |
| <u>C</u> 17. band of stability     | a. conversion of an atom of one element to another element                         |
| <u>E</u> 18. positron              | b. time required for one half of the nuclei of a radioisotope to decay to products |
| <u>B</u> 19. half-life             | c. region containing stable nuclei in a neutron vs. proton plot                    |
| <u>A</u> 20. transmutation         | d. elements with atomic numbers higher than 92                                     |
| <u>D</u> 21. transuranium elements | e. particle with the same mass as an electron but with a positive charge           |

**Part D Questions**

Answer the following in the space provided.

22. Sodium-24 has a half-life of 15 hours. How much sodium-24 will remain in an 18.0-g sample after 60 hours?  
 $18.0 \rightarrow 9.0 \xrightarrow{2} 4.5 \xrightarrow{3} 2.25 \xrightarrow{4} 1.125 \text{ g or } 1.13 \text{ g}$
23. After 42 days, a 2.0-g sample of phosphorus-32 contains only 0.25 g of isotope. What is the half-life of phosphorus-32?  
 $2.0 \rightarrow 1.0 \rightarrow .5 \rightarrow .25$   
14 days