

FISSION AND FUSION OF ATOMIC NUCLEI

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Section Review

Objectives

- Describe what happens in a nuclear chain reaction
- Explain the role of water in the storage of spent fuel rods
- Compare and contrast fission and fusion reactions

Vocabulary

- fission
- neutron moderation
- neutron absorption
- fusion

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.

- Nuclear 1 occurs when fissionable isotopes are bombarded with 2. The 3 breaks into two fragments of about the same size, and in the process they release more neutrons and 4.
U²³⁵ Po²³⁹
- Nuclear 5 is the process that reduces the speed of neutrons. Neutron 6 is the process that decreases the number of slow-moving neutrons. In nuclear 7, nuclei combine to make nuclei of greater 8. The sun's 9 is produced when 10 nuclei fuse to make 11 nuclei. Fusion releases even more energy than fission.

Part B True-False

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

- ST 12. Water is used as a moderator in nuclear reactors.
- NT 13. In nuclear fusion, the nuclei of two large atoms fuse together.

- NT 14. Moderation of neutrons is used to slow nuclear fission.
- NT 15. Nuclear fusion can be easily produced under laboratory conditions.

Part C Matching

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

- | | |
|---------------------------------|---|
| Column A | Column B |
| <u>A</u> 16. fission | a. the splitting of an atomic nucleus into smaller fragments |
| <u>C</u> 17. neutron moderation | b. combination of two nuclei to produce a nucleus of greater mass |
| <u>E</u> 18. neutron absorption | c. process used to reduce the speed of neutrons |
| <u>B</u> 19. fusion | d. isotope capable of fission |
| <u>D</u> 20. uranium-235 | e. process used to decrease the number of slow-moving neutrons |

Part D Questions and Problems

Answer the following in the space provided.

21. How many neutrons are produced in each of the following fission reactions?
- a. ${}_{92}^{235}\text{Pu} + {}_0^1n \rightarrow {}_{38}^{90}\text{Sr} + {}_{54}^{141}\text{Ba} + 3{}_0^1n$
 $239 + 1 \rightarrow 90 + 147 + 3$
- b. ${}_{92}^{235}\text{U} + {}_0^1n \rightarrow {}_{38}^{90}\text{Sr} + {}_{54}^{141}\text{Ba} + ?{}_0^1n$
 $239 + 1 \rightarrow 90 + 147 + ?$
 $60 + 91 + 1 = 152$
 $152 - 151 = 1$

22. What is the role in a nuclear reactor of a neutron moderator?

- a. neutron moderator? *it slows down fast moving neutrons so they can be absorbed by the fuel atoms.*
- b. neutron absorption?
↓ # of slow moving neutrons + slows the chain reaction.

