46. The energy released by the formation of a nucleus of $^{56}_{26}Fe$ is 7.89×10^{-11} J. Use Einstein's equation, $E = mc^2$, to determine how much mass is lost (in kilograms) in this process.

47. Calculate the binding energy for one mole of deuterium atoms. The measured mass of deuterium is 2.0140 amu.

CRITICAL THINKING

48. Why do we compare binding energy per nuclear particle of different nuclides instead of the total binding energy per nucleus of different nuclides?

49. Why is the constant rate of decay of radioactive nuclei so important in radioactive dating?

50. Which of the following nuclides of carbon is more likely to be stable? State reasons for your answer.

a. $^{11}_{6}C$ b. $^{12}_{6}C$

51. Which of the following nuclides of iron is more likely to be stable? State reasons for your answer.

a. $^{56}_{26}Fe$ b. $^{59}_{26}Fe$

52. Use the data in the table shown to determine the following:

a. the isotopes that would be best for dating ancient rocks

b. the isotopes that could be used as tracers

State reasons for your answers.

Element	Half-Life
potassium-40	1.28×10^9 y
potassium-42	12.36 h
uranium-238	4.468×10^9 y
uranium-239	23.47 min

RESEARCH & WRITING

53. Investigate the history of the Manhattan Project.

54. Research the 1986 nuclear reactor accident at Chernobyl, Ukraine. What factors combined to cause the accident?

55. Find out about the various fusion-energy research projects that are being conducted in the United States and other parts of the world. What obstacles in finding an economical method of producing energy must still be overcome?

ALTERNATIVE ASSESSMENT

56. Using the library, research the medical uses of radioactive isotopes such as cobalt-60 and technetium-99. Evaluate the benefits and risks of using radioisotopes in the diagnosis and treatment of medical conditions. Report your findings to the class.

extension

Graphing Calculator

Half-Lives

Go to **go.hrw.com** for a graphing calculator exercise that asks you to determine the amount of a radioactive isotope based on its half-life.

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