- **53. Applying Models** In discussions of the photoelectric effect, the minimum energy needed to remove an electron from the metal is called the *threshold energy* and is a characteristic of the metal. For example, chromium, Cr, will emit electrons when the wavelength of the radiation is 284 nm or less. Calculate the threshold energy for chromium. (Hint: You will need to use the two equations that describe the relationships between wavelength, frequency, speed of light, and Planck's constant.)
- **54. Analyzing Information** Four electrons in an atom have the four sets of quantum numbers given below. Which electrons are in the same orbital? Explain your answer.
 - a. 1, 0, 0, -___
 - b. 1, 0, 0, +___
 - c. 2, 1, 1, +___
 - d. 2, 1, 0, +
- **55. Relating Ideas** Which of the sets of quantum numbers below are possible? Which are impossible? Explain your choices.
 - a. 2, 2, 1, +___
 - b. 2, 0, 0, -__
 - c. 2, 0, 1, -__



USING THE HANDBOOK

- **56.** Sections 1 and 2 of the *Elements Handbook* contain information on an analytical test and a technological application for Group 1 and 2 elements. The test and application are based on the emission of light from atoms. Review these sections to answer the following:
 - a. What analytical technique utilizes the emission of light from excited atoms?
 - b. What elements in Groups 1 and 2 can be identified by this technique?
 - c. What types of compounds are used to provide color in fireworks?
 - d. What wavelengths within the visible spectrum would most likely contain emission lines for barium?

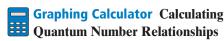
RESEARCH & WRITING

- **57.** Neon signs do not always contain neon gas. The various colored lights produced by the signs are due to the emission of a variety of low-pressure gases in different tubes. Research other kinds of gases used in neon signs, and list the colors that they emit.
- **58.** Prepare a report about the photoelectric effect, and cite some of its practical uses. Explain the basic operation of each device or technique mentioned.

ALTERNATIVE ASSESSMENT

59. Performance A spectroscope is a device used to produce and analyze spectra. Construct a simple spectroscope, and determine the absorption spectra of several elemental gases. (Your teacher will provide you with the gas discharge tubes containing samples of different gases.)

extension



Go to **go.hrw.com** for a graphing calculator exercise that asks you to calculate quantum number relationships.

