ionization energies of boron, B, and between the fourth and fifth ionization energies of carbon, C. In each case, the jump in ionization energy occurs when an ion assumes a noble-gas configuration. For example, the removal of one electron from a lithium atom ([He]$2s^1$) leaves the helium noble-gas configuration. The removal of four electrons from a carbon atom ([He]$2s^2 2p^2$) also leaves the helium configuration. A bigger table would show that this trend continues across the entire periodic system.

SAMPLE PROBLEM F

Consider two main-group elements, A and B. Element A has a first ionization energy of 419 kJ/mol. Element B has a first ionization energy of 1000 kJ/mol. Decide if each element is more likely to be in the *s* block or *p* block. Which element is more likely to form a positive ion?

SOLUTION

Element A has a very low ionization energy, which means that atoms of A lose electrons easily. Therefore, element A is most likely to be an *s*-block metal because ionization energies increase across the periods.

Element B has a very high ionization energy which means that atoms of B have difficulty losing electrons. Element B would most likely lie at the end of a period in the *p* block.

Element A is more likely to form a positive ion because it has a much lower ionization energy than element B does.

PRACTICE

Answers in Appendix E

1. Consider four hypothetical main-group elements, Q, R, T, and X, that have the outer electron configurations indicated below. Then, answer the questions that follow.

Q: $3s^2 3p^5$ R: $3s^1$ T: $4d^{10} 5s^2 5p^5$ X: $4d^{10} 5s^2 5p^1$

   a. Identify the block location of each hypothetical main-group element.

   b. Which of these elements are in the same period? Which are in the same group?

   c. Which element would you expect to have the highest first ionization energy? Which would have the lowest first ionization energy?

   d. Which element would you expect to have the highest second ionization energy?

   e. Which of the elements is most likely to form a 1+ ion?

extension

Go to **go.hrw.com** for more practice problems that ask you to use periodic trends in ionization energy.

Keyword: HC6PERX