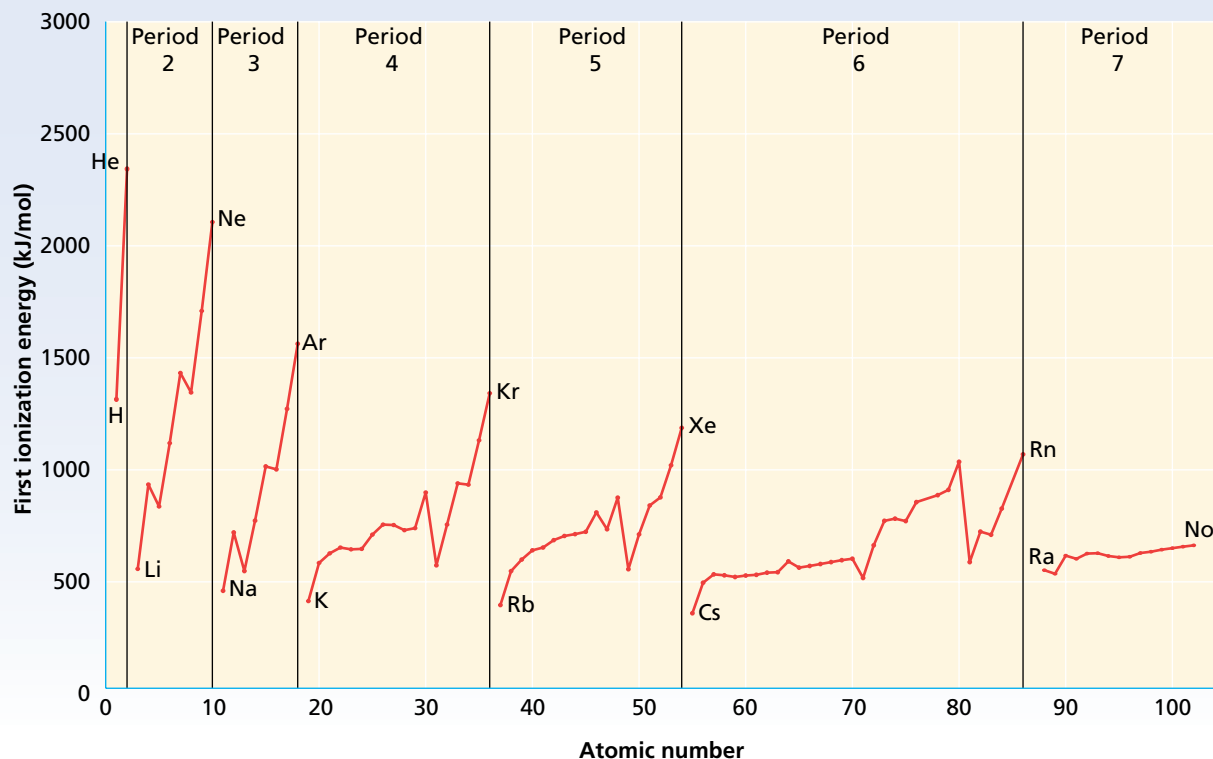


## First Ionization Energy vs. Atomic Number



**FIGURE 16** Plot of first ionization energy,  $IE_1$ , versus atomic number. As atomic number increases, both the period and the group trends become less pronounced.

### Period Trends

In **Figures 15 and 16**, examine the ionization energies for the first and last elements in each period. You can see that the Group 1 metals have the lowest first ionization energies in their respective periods. Therefore, they lose electrons most easily. This ease of electron loss is a major reason for the high reactivity of the Group 1 (alkali) metals. The Group 18 elements, the noble gases, have the highest ionization energies. They do not lose electrons easily. The low reactivity of the noble gases is partly based on this difficulty of electron removal.

*In general, ionization energies of the main-group elements increase across each period.* This increase is caused by increasing nuclear charge. A higher charge more strongly attracts electrons in the same energy level. Increasing nuclear charge is responsible for both increasing ionization energy and decreasing radii across the periods. Note that, in general, nonmetals have higher ionization energies than metals do. In each period, the element of Group 1 has the lowest ionization energy and the element of Group 18 has the highest ionization energy.

### Group Trends

*Among the main-group elements, ionization energies generally decrease down the groups.* Electrons removed from atoms of each succeeding element in a group are in higher energy levels, farther from the nucleus. Therefore, they are removed more easily. Also, as atomic number