De eerste ionisatie-energie (IE1) van een element wordt gedefinieerd als de minimum hoeveelheid energie die nodig is om aan een atoom in de grondtoestand en in gasfase een buitenste valentie-elektron te onttrekken. Welke van volgende elementen heeft de grootste IE1? De elektronenconfiguratie in grondtoestand van elk element staat tussen haakjes.

A. B ( 1s22s22p1 )

B. C ( 1s22s22p2 )

C. N ( 1s22s22p3 )

D. O ( 1s22s22p4 )

**Answer: C**

By definition, the first ionization energy of an element is the energy needed to remove the outermost, or highest energy, electron from a neutral atom in the gas phase. The process by which the first ionization energy of hydrogen is measured would be represented by the following equation:

H(g) ‡ H+(g) + e- IE = 1312 .0 kJ/mol

The first ionization energy for helium is slightly less than twice the ionization energy for hydrogen because each electron in helium feels the attractive force of two protons, instead of one. It takes far less energy, however, to remove an electron from a lithium atom:

Li(g) ‡ Li+(g) + e- IE = 572.3 kJ/mol

This can be explained by noting that the outermost, or highest energy, electron on a lithium atom is in the 2s orbital. Because the electron in a 2s orbital is already at a higher energy than the electrons in a 1s orbital, it takes less energy to remove this electron from the atom.

Although there is a general trend toward an increase in the first ionization energy as we go from left to right across this row, there are two minor inversions in this pattern.

The first ionization energy of boron is smaller than beryllium, and the first ionization energy of oxygen is smaller than nitrogen. Hund's rules predict that the three electrons in the 2p orbitals of a nitrogen atom all have the same spin, but electrons are paired in one of the 2p orbitals on an oxygen atom. Hund's rules can be understood by assuming that electrons try to stay as far apart as possible to minimize the force of repulsion between these particles.

The three electrons in the 2p orbitals on nitrogen therefore enter different orbitals with their spins aligned in the same direction. In oxygen, two electrons must occupy one of the 2p orbitals. The force of repulsion between these electrons is minimized to some extent by pairing the electrons. There is still some residual repulsion between these electrons, however, which makes it slightly easier to remove an electron from a neutral oxygen atom than we would expect from the number of protons in the nucleus of the atom.