

Answer on Question #37511 - Chemistry - Other

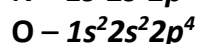
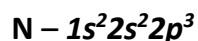
Question

Although size of oxygen is small as compared to nitrogen but the first ionization enthalpy of nitrogen is higher than oxygen why?

Answer

As you know, the ionization energy (or ionization enthalpy) is the energy to remove an electron from the atom. This electron is removed from the outer shell of atom.

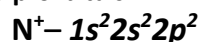
Let us consider the electronic configuration of nitrogen and oxygen:



Nitrogen has 3 electrons in **2p** sub-shell, i.e. it has three **p**-orbitals, each involving 1 electron. Such configuration, when **p** sub-shell is half-filled is very stable.

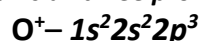
Oxygen has 4 electrons in **2p** sub-shell, i.e. two **p**-orbitals involve 1 electron each and one **p**-orbital involves a couple of electrons.

Removal of an electron from nitrogen means removal of a **p**-orbital and resulting ion has two **p**-orbitals:



Such transition requires much energy and resulting ion is much less stable compared to neutral nitrogen atom.

Removal of an electron from oxygen results in much less crucial changes: resulting ion retains all three **p**-orbitals, just now each of them involves one electron:



The 2p sub-shell of the ion is half-filled, that is a stable configuration.

Generally, any transition from more stable state to less stable requires more energy.

Therefore, removal of one electron from **2p** sub-shell of nitrogen requires more energy than to remove one electron from **2p** sub-shell of oxygen atom, and the first ionization energy of nitrogen is greater than that of oxygen.