

Marks
6

- The electron affinity is negative if energy is released upon addition of an electron. If it is positive, the resultant anion is unstable. Explain why beryllium has a positive electron affinity, while that of fluorine is highly negative.

An additional electron in Be will have to go into a $2p$ orbital, which has a planar node through the nucleus and thus does not feel nuclear charge. Consequently this leads to a higher energy system.

In F, the high nuclear charge and small atom offset the above effect and the extra electron is tightly bound.

Why is the ionisation potential of oxygen slightly smaller than nitrogen, despite being further across the period?

The electron removed from O ($1s^2 2s^2 2p^4$) is the one in the $2p$ orbital with 2 electrons in it. This electronic repulsion offsets the greater nuclear charge of O compared to N.

How is this related to the slightly positive electron affinity of nitrogen?

The electron affinity of N is ΔH for the process $2p^3 \rightarrow 2p^4$.

The ionisation potential for O is ΔH for the process $2p^4 \rightarrow 2p^3$.

The only difference (apart from the direction of the reaction) is the nuclear charge on the atom.