

A Comment on “Count the Boxes—A Simple Guide to Determining Electronic Configuration”, K. Amoa, *Chem. Educator* (2006), 11(DOI. 10.1333/s00897050987a)

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The problem of determining the electronic configuration of an arbitrary atom is an important and a very relevant one. Many publications were devoted to this issue, as mentioned by Amoa himself [1]. It was one of the inevitable tasks that were worked out with many generations of my students, at the time when I conducted numerical exercises in physical chemistry (covering the topic Atomic Structure). I was therefore really curious to see new approaches that work faster & better than the well-known ones.

The paper “Count the Boxes...” offers a fast method of arriving to the electronic configuration of the atoms ‘*for the first 57 elements*’ as the author claims. Amoa mentions further that ‘... *f-block elements are purposefully neglected; however, those students who want to know how to determine the electronic configuration for the remaining elements are taught how to do so.*’, meaning that this problem can also be solved. Let us see now whether this is really so.

While the method is definitely a fast one (and I am almost certain that one needs less than 45 minutes, the recommended time by the author), it is also not a correct one – at least, it does not work for several d-block elements. Thus, the approach fails in the correct prediction of the configurations of Cr and Cu (from Period 4) and also Nb, Mo, Tc, Ru, Rh, Pd, Ag (from Period 5). Further complications will arise upon inclusion of the f-block elements. Interestingly, all worked examples by Amoa [1] refer either to p-elements (i.e. C, S, Br), or to those d-elements (the one example given referred to iron) where of course no problems exist!

One might object that I am discussing some ‘subtleties’ in the d-block, and that the approach gives the correct result for the majority of elements. I have to say that it is the sub-

tleties that make the problem to be far from a trivial one. Some of the subtleties (i.e. the electronic configuration of Pd) are the source of absolutely unique results: the palladium (an element from Period 5) has only 4 electronic shells! It is the only element in the periodic table that has one shell less, than the number of the period in which it belongs. I will mention here in passing that its spectral term of the ground electronic state is 1S_1 (equal to the terms for all noble gases, or all alkaline earths). In short, the so-called ‘subtleties’ are very important.

If the author aimed to offer a fast (but not accurate) method for those that chose chemistry as an elective course, while planning to major in some other area, then it had to be mentioned specifically. In that case, the approach might be acceptable, but it was necessary to underline its limitations for many of the d-block and f-block elements. The approach would certainly not be recommended for the science majors, and definitely not for the chemistry/physics majors, and this had to be made very clear.

References

1. K. Amoa, *Chem. Educator* (2006), 11, 1–3 (DOI. 10.1333/s00897050987a).