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Orbital Version of Periodic Table of Elements

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Abstract
Teaching atomic properties is obviously based on their electronic structure. The present communication provides a simple suggestion how reconfiguring the Periodic Table may help teaching by a simple and explicit demonstration of electronic structure of atoms.
Keywords: Periodic Table, properties, electronic structure, teaching.

1. INTRODUCTION

Periodic Table of Elements has a long fascinating history and exists in almost infinite number of forms [1]. Its recent version officially accepted by IUPAC is available [2]. Although there have been interesting attempts to modify it, the Table has not been presented, to our knowledge, in a form based upon orbital structure of atoms [3].

2. IDEA

It is to represent the atomic orbital structure and the occupancy of the orbitals. The atoms are arranged in accordance with their electronic structure presented in the form of orbitals (Fig.1).
The picture below (Fig.1) the proposed version and, to the authors belief, is self-explaining for chemists involved in teaching. V33ertical black line divides the field into two parts: on the left side atoms have external orbitals filled up to 50% while at the right part filling grows up to full occupancy. As commonly known such a division is clearly associated with differences in physicochemical properties.

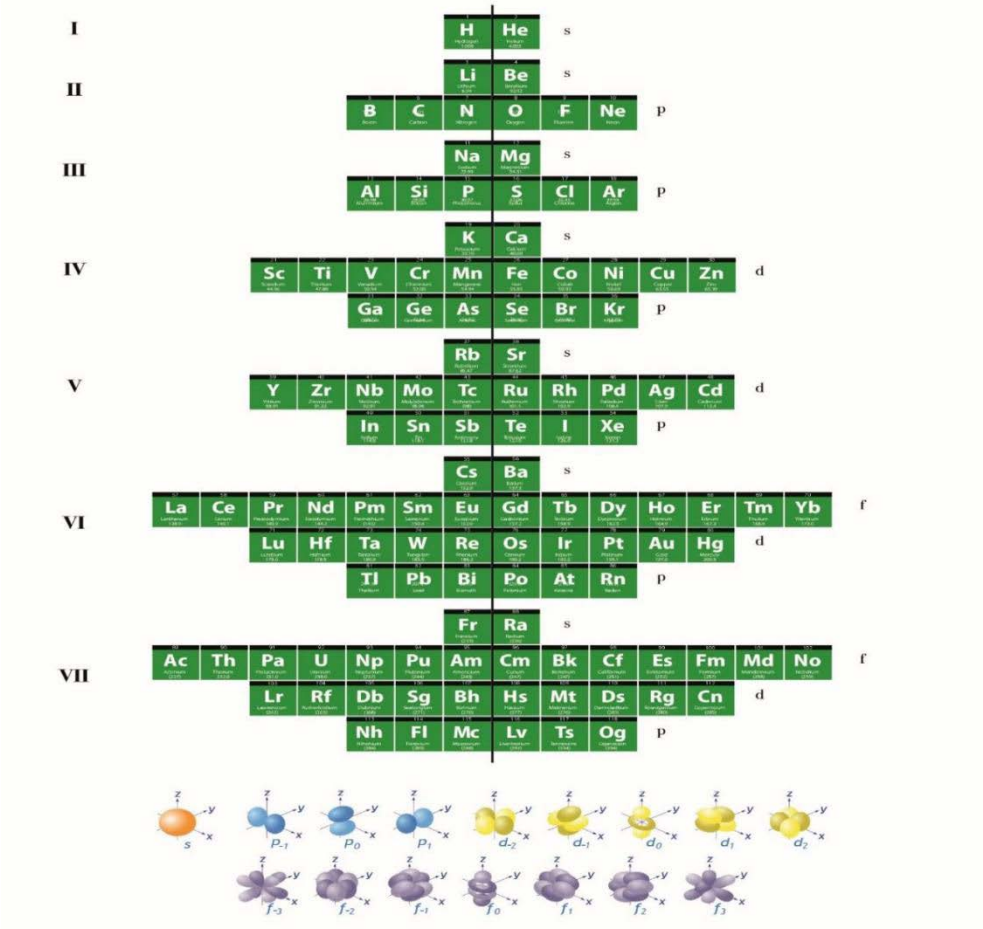

Figure 1. Orbital version of the periodic table of elements Geometry of orbitals shown at the bottom line.

Why orbital version ?

Since physical and chemical properties of the elements depend mainly upon electronic configuration and it is organized in orbitals, then the simplest explanations of properties are, obviously, based upon electronic structure of atoms. Put in terms of orbital structure and occupancy, teaching properties of chemical elements becomes straightforward and easy, as compared to the implicit form of classic periodic table. It particularly refers to valencies depending on the number of available orbitals and, in particular, to supervalencies determined by the number of available orbitals and their occupancies.

Convenient illustration of utility of the orbital version proposed herein is provided below in a form following classic chemistry teaching from its history (Linus Pauling).

Example of correlation of electronic structure with selected elementary properties of the elements from the period IV given below may serve as a convenient illustration of suitability of the proposed graphical version of the Periodic Table, when simply compared the curves in Figure (2) to the electronic structure of elements from the IV period.

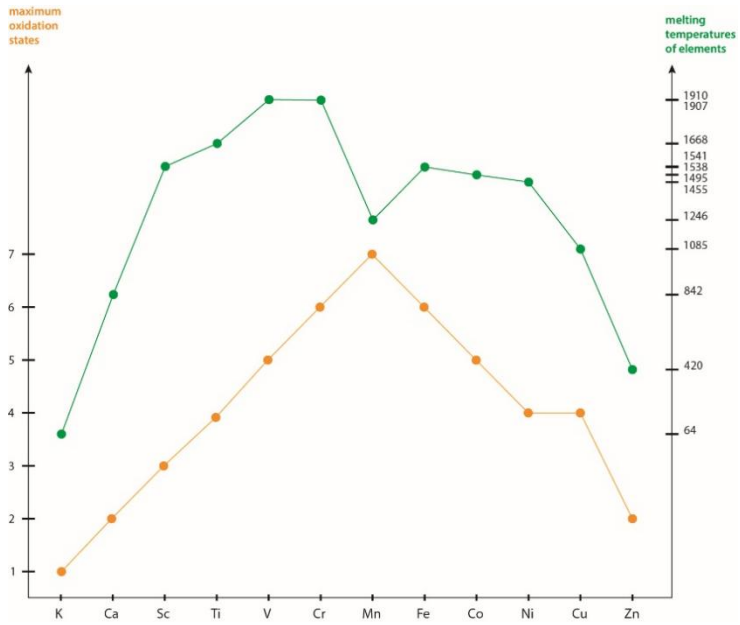

Figure 2. Example of correlations of physical properties of the elements (upper curve) and the maximum oxidation states (lower curve) of the period IV.

3. CONCLUSION:

The above illustration demonstrate the utility of the concept in interpreting atomic properties as based on their electronic structure – in authors feeling very useful in chemistry teaching. And, basic atomic properties like their valencies, covalent or ionic, can directly be derived from this graphic representation of the Table. Put in other words, the proposed orbital version seems very convenient form of the Periodic Table in teaching fundamentals of chemistry.

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