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Advanced spiral periodic classification of the elements

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ABSTRACT

An advanced spiral periodic classification of the elements is presented. It has 32 groups and 8 periods. The proposed new periodic classification is a spiral arrangement of the elements, arranged by their increasing atomic number, electronic configuration and recurring chemical properties. The debatable positions of hydrogen and helium have been rectified in the spiral periodic classification. Two equations are also given for the diagonal relationship among the elements of 2nd and 3rd periods. This classification may be acceptable in the scientific community to work properly and easily. Moreover, this classification is also capable to predict the places of undiscovered elements.

Capsule Summary: The advanced spiral periodic classification of the elements with 32 groups and 8 periods rectified the drawbacks of the position of hydrogen and helium. Two equations have also been given to find out diagonal relationship in elements of 2nd and 3rd period.

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INTRODUCTION

For a long time, scientists have been curious about the classification of the elements. Several workers attempted to arrange the elements in the different fashions. In 1789, Antoine-Laurent de arranged 33 elements in a particular sequence (Antoine-Laurent de, 1789). In 1829, Johann Wolfgang Döbereiner gave the Law of Triads (Döbereiner, 1829). Later on, British chemist, John Newlands classified sixty two known elements (at that time) in eight groups. He proposed the Law of Octaves; based on the physical and chemical properties of the elements (Newlands, 1865). Some other scientists improved and expended the periodic table. The significant improvements were carried out by Lothar Meyer who arranged 56 elements in horizontal as well as vertical forms. He published articles on the classification of the elements. The periods were ended by the elements of the earth metals (Meyer, 1870). But the breakthrough in the history of the classification of the elements was the discovery of Dmitri Mendeleev in 1869 (Mendeleev, 1869). He made the periodic table with 7 rows and 8 columns. This table was well accepted and used by the researchers at that time. But the periodic table proposed by Dmitri Mendeleev had several drawbacks such as position of hydrogen, anomalous pair, grouping of elements, position of lanthanides and actinides.

After this, in 1914 Henry Moseley arranged the elements according to the atomic numbers rather than atomic weights (Moseley, 1913; 1914). He removed only drawbacks of anomalous pairs. Still Moseley's modern periodic table has also some ambiguities such as position of hydrogen, grouping of elements, position of lanthanides and actinides. Furthermore, the groups of periodic table were assigned different numbers i.e. CAS (USA pattern A-B-A) and European pattern (A-B) (https://en.wikipedia.org/wiki/Group). Presently, the most common classification of the elements is the long form of periodic table. It consists of 7 periods and 18 groups.

Besides, the elements have been arranged in different forms (Bayley, 1882; Bohr, 1922; Benfey, 1964; Clark, 1933 & 1950; Dragoset, 2015; Emerson, 1944; Hinrichs, 1867; Hackh, 1914; Irwin, 1935; Janet, 1928 & 1929; Jensen, 1989; Laing, 2005; Quam and Quam, 1934; Scerri, 2007; Stedman, 1947; Stewart, 2004 & 2007; Thomsen, 1895) including pyramidal (Bayley, 1882), a helix on nested cylinders (Janet, 1929), spiral (Janet, 1928). The first tentative attempt of spiral version was given by Hinrichs (1867). Other notable spirals were proposed by Quam and Quam (1934), Hackh (1914), Janet (1928 & 1929), Irwin (1939), Clark (1933 & 1950) and Benfey (1964). We observed common drawbacks in every spiral arrangements of the elements. In every spiral arrangement, the beginning and ending of the periods are not clear, creating confusion in the study of the periodic trends. Furthermore, the diagonal relationship between 2nd and 3rd period cannot be studied properly. Hence, the demarcation of the periods is of great importance in the study of periodic classification. Another drawback of the spiral representations was the position of hydrogen and helium. Moreover, some spiral forms showed neither groups nor periods (Benfey, 2009; Hackh, 1914; Irwin, 1939). The most interesting and important point is that IUPAC has not approved any specific form of the periodic table. However, IUPAC has published diagrams titled "IUPAC Periodic Table of the Elements" (Leigh, 2009).

There is an urgent need to develop more advanced classification of the elements without any drawback. In the hope of conveying our own excitement to a new generation of chemists, we have also attempted to arrange the elements in spiral form to remove all the drawbacks of the periodic classification of the elements. Hence, the elements are arranged in the spiral form. This arrangement has reduced the existing cloudiness and rectified all the drawbacks of the long form of the periodic table as well as other classifications. The arrangement of the elements in spiral form is described herein.

DRAWBACKS OF LONG FORM OF THE PERIODIC TABLE AND OTHER CLASSIFICATIONS

The serious drawbacks of the long form of the periodic table as well as other classifications are summarized below. These need immediate rectification.

Place of hydrogen

Hydrogen is the first element of periodic table and its position is debatable. It is due to the fact that it can both lose as well as gain an electron. Hence, on the basis of electronic configuration it should be placed with alkali metals and on the basis of properties it should be placed with halogen because it may gain one electron as halogens do. There is no absolutely satisfactory position of hydrogen (Scerri, 2007). Therefore, the problem of hydrogen place still exists in all forms of the periodic classifications.

Place of helium

Helium is similar with alkaline earth metals in electronic configuration but also shows similarity with the noble gases. Hence, on the basis of electronic configuration, it should be placed with alkaline earth metals. But due to electronic reason, it should be placed with noble gases because helium requires zero electron like noble gases. Therefore, the problem of helium place still exists in all periodic classifications.

NOVEL SPIRAL PERIODIC CLASSIFICATION OF THE ELEMENTS

On the basis of drawbacks present in the long form of the periodic table and other classifications including spiral arrangements an approval, useful and acceptable modified form of periodic classification of the elements without any drawback is still required. Taking these facts and basic IUPAC rules into consideration, we have also classified the elements into a spiral format. This arrangement is shown in Figure 1 along with CAS (US, pattern A-B-A) and old IUPAC (Europe, pattern A-B) systems.

The salient features of this classification are as below:

1. The proposed new periodic classification is a spiral arrangement of the elements, arranged by their increasing atomic number, electronic configuration and recurring chemical properties. It has 32 groups and 8 periods.
2. For the convenience of the readers, a dark line is drawn at the starting as well as ending points of the periods to make the study of periodic trends easy.
3. The spiral periodic classification does not break up the numerical progression of the atomic number and electronic configuration of the elements.

Position of hydrogen

The questionable position of hydrogen has been solved in this classification. In the spiral periodic classification, hydrogen is placed at the centre of spiral as well as at the top

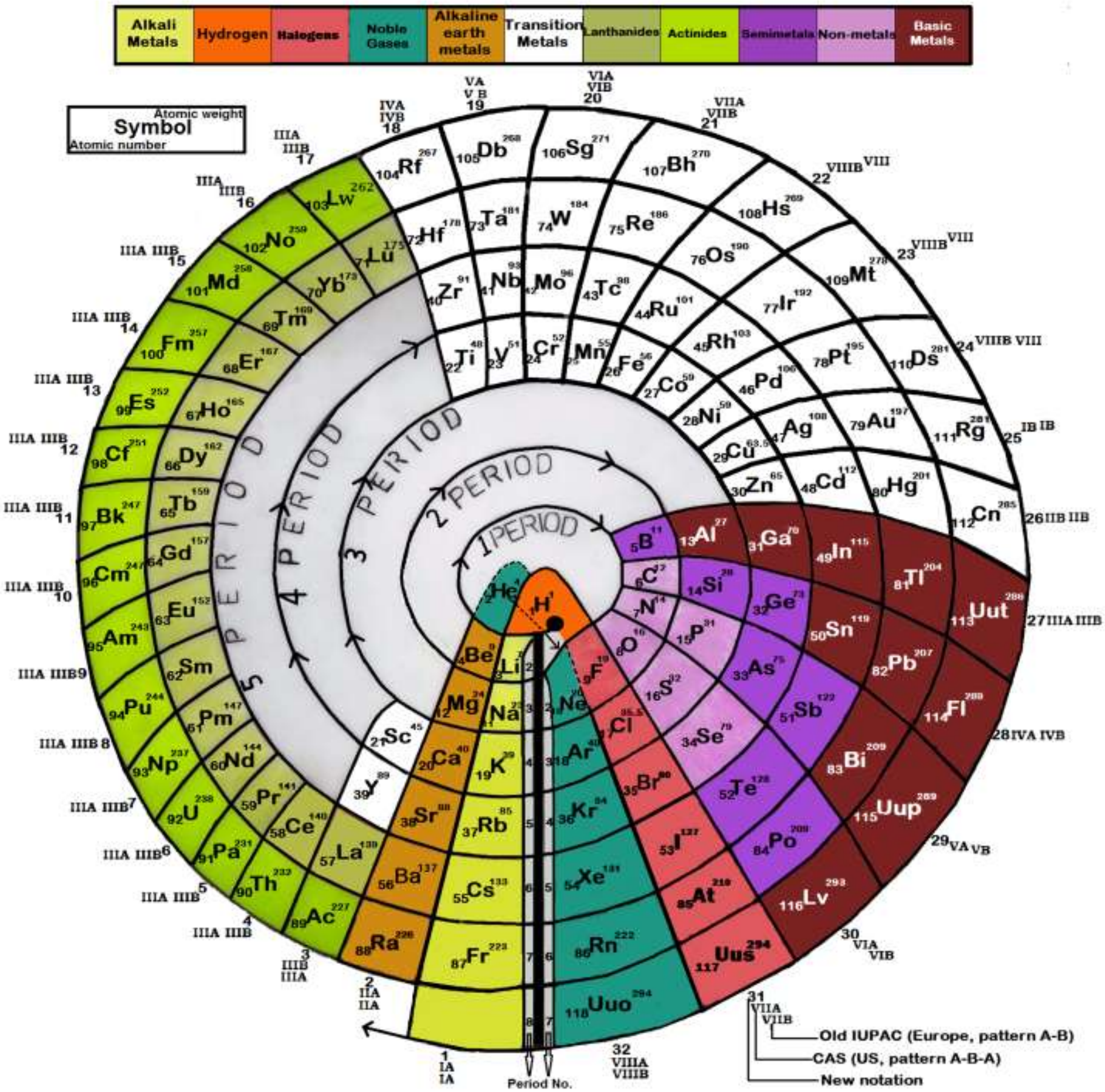

Fig. 1: Advanced spiral periodic classification of the elements

Where,

Groups 1 to 2 → s-Block elements
Groups 27 to 32 → p-Block elements
Groups 3, 18 to 26 → d-Block elements
Groups 4 to 17 → f-Block elements

of two groups (1st and 31st). It belongs to both alkali metals (group 1st) and halogens (group 31st).

Position of helium

The debatable position of helium has been solved in this classification. In the spiral periodic classification, helium is placed in group 2nd. It is because of having same electronic configuration as of other elements of the second group. Also helium is similar to noble gases because it requires zero electrons to fill its outer-shell. Hence, its place is close to the center of the spiral structure and at the back side of hydrogen from where helium belongs to group 32 too, showing closeness to inert gas properties.

Block wise classification of the elements

Of course, s-, p-, d- and f-blocks classification of long form of the periodic table is intact in this new arrangement. These are as below.

Groups 1 to 2 → s-Block elements
Groups 27 to 32 → p-Block elements
Groups 3, 18 to 26 → d-Block elements
Groups 4 to 17 → f-Block elements

Groups

The groups from 1 to 32 were also named according to CAS (US, pattern A-B-A), old IUPAC (Europe, pattern A-B).

Periods

The spiral circles are named as periods in this new classification of the elements. First period starts from hydrogen at centre and ends at helium. Second period begins with lithium and ends at neon and so on.

Periodic trends

In this new periodic classification, all the periodic trends of the elements i.e. the atomic radius, ionization energy, electron affinity and electronegativity show the same trends as in long form of the periodic table.

Diagonal relationship

The diagonal relationship is expressed by 2 equations. These are given below.
For second period
Z + 9 = atomic number of diagonal element (period 3rd) (1)
Where, Z is atomic number of period 2nd elements.
For third period
Z - 9 = atomic number of diagonal element (period 2nd) (2)
Where, Z is atomic number of period 3rd elements.

CONCLUSIONS

The spiral periodic classification of table has settled the position of hydrogen and helium according to their properties and electronic configuration. Besides, this spiral periodic classification reflects the relationships among the properties of the known elements. Additionally, it is also able to reflect the periodic trends with periodic indication in comparison to other calcifications. The present classification of the element will be useful to the scientific community. The proposed classification will be useful in the learning process because it is free of the existing drawbacks of long form of periodic table and other classifications.

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REFERENCES

Antoine-Laurent de, L., 1789. Traitéélémentaire de Chimie, présentédansunordre nouveau, et d'après les découvertesmodernes. Paris: Chez Cuchet, First edition.

Bayley, T., 1882. On the connection between the atomic weight and the chemical and physical properties of the elements. Philosophical Magazine 13, 26-37.

Benfey.,1964. Benfey's spiral table first appeared in an article by Glenn Seaborg, 'Plutonium: The Ornery Element'. Chemistry 37 (6), 12-17.

Bohr, N., 1922. Dreiaufsätzűberspektren und atombanu, Braunschweis: F. Viewes & Sohn.

Clark, J. D., 1933. A new periodic chart. Journal of Chemical Education 10, 675-677.

Clark, J. D., 1950. A modern periodic chart of chemical elements. Science 111, 661-663.

Dmitrii Mendeleev, D., 1869. On the relationship of the properties of the elements to their atomic weights," Zhurnal Russkoe Fiziko-Khimicheskoe Obshchestvo 1, 60-77; abstracted in Zeitschriftfür Chemie, 12, 405-406.

Döbereiner, J.W., 1829. An Attempt to Group Elementary Substances according to Their Analogies. Poggendorf's Annalen der Physik und Chemie 15, 301-307.

Dragoset, R.A., Musgrove, A., Clark, C.W., Martin, W.C., 2015. Periodic Table: Atomic Properties of the Elements (Version 8), NIST SP 966.

Emerson, E.I., 1944. A new spiral form of the periodic table. Journal of Chemical Education 22, 111–115.

https://en.wikipedia.org/wiki/Group_(periodic_table).

Hackh, I., 1914. Das Synthetisches System der Atome, Eine modern modification des periodischen system der chemischenelemente, Hephaestos-Verlage, Hamburg.

Hinrichs, G.D., 1867. Programm der Atomechanik, oder die Chemieeine Mechanik der Panatome. Iowa City, 7-8.

Irwin, K.G., 1939. Periodicity patterns of the elements.Journal of Chemical Education 16, 335.

Janet, C., 1928. La Classification Hélicoïdale des Éléments Chimiques, Beauvais: Imprimerie Départementale de l'Oise.

Janet, C., 1929. The helicoidal classification of the elements. Chemistry News 138, 372–374, 388–393.

Jensen, W.B., 1989. Classification, Symmetry, and the Periodic Table. Computer and Mathematical Applications 12B, 487 -510.

Laing, M., 2005. A revised periodic table: with the lanthanides repositioned, Foundation Chemistry 7, 203–233.

Leigh, G.J., 2009. Periodic tables and IUPAC. Chemistry International 31, 4-6.

Meyer, J. L., 1870. Table from Annalen der Chemie. Supplementband 7, 354.

Moseley, H. G. J., 1913. The high frequency spectra of the elements. Part I, Philosophical Magazine 26, 1024-1034.

Moseley, H. G. J., 1914. The high frequency spectra of the elements. Part II Philosophical Magazine 27, 703-713.

Newlands, J.A.R., 1865. On the Law of Octaves. Chemistry News 12, 83.

Quam G.N., Quam, M.B., 1934. types of graphic classifications of the elements, III, Spiral, Helical, and fliscellaneous charts.Journal of Chemical Education11, 288.

Scerri, E.R., 2007. Mendeleev's legacy: The periodic system. Chemistry Heritage 25, 22-27.

Scerri, E. R., 2007. The Periodic Table, Its Story and Its Significance. Oxford University Press, New York.

Stedman, D. F., 1947. A Periodic Arrangement of The Elements, Canadian Journal of Research 25, 199-210.

Stewart, P.J., 2004. A new image of the periodic table. Education in Chemistry 41, 156–158.

Stewart, P.J., 2007. A Century on from Dmitrii Mendeleev: Tables and Spirals, Noble Gases and Nobel Prizes. Foundation Chemistry 9, 235–245.

Thomsen, J., 1895. Systemachische gruppierung de chemischen elemente, Anorganische Chemie 9, 190-193.

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