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QUANTUM PERIODIC TABLE

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ABSTRACT

The order in which the energy levels of atoms is filled is well known: 1s,2s,2p,3s,3p,4s,3d,4p,5s,4d,5p,6s,4f,5d,6p,7s, 5f,6d,7p,… .... In quantum periodic table, The elements are arranged according to the order of electron– shell filling, by classifying the energy levels of the atoms in the order they are filled, to create a layout based on electronic configuration. The classification of the elements is done purely on the basis clarified above, without giving any weight age to the atomic numbers. With the advent of electronic configurations and quantum mechanics, many attempts have been tried in this periodic table to unlock all the problems related with the placement of elements, which have been remained as the topic of debate by generations of chemists.

KEYWORDS: Labellings • Vacant spaces • Dramatic changes • Quantum Periodic Table • Summary.

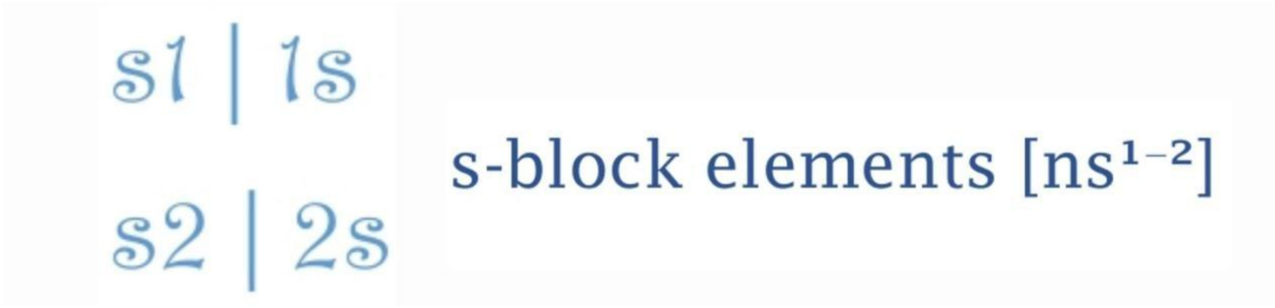
INTRODUCTION

Quantum Periodic Table consists of the total 22 vertical groups and 9 (well – defined 7), horizontal periods. Above group 1 'Hydrogen' is placed and above group 2 'Helium' is placed, which are one of the major changes of this periodic table. Period 6, 7 and 8 have been subdivided as:

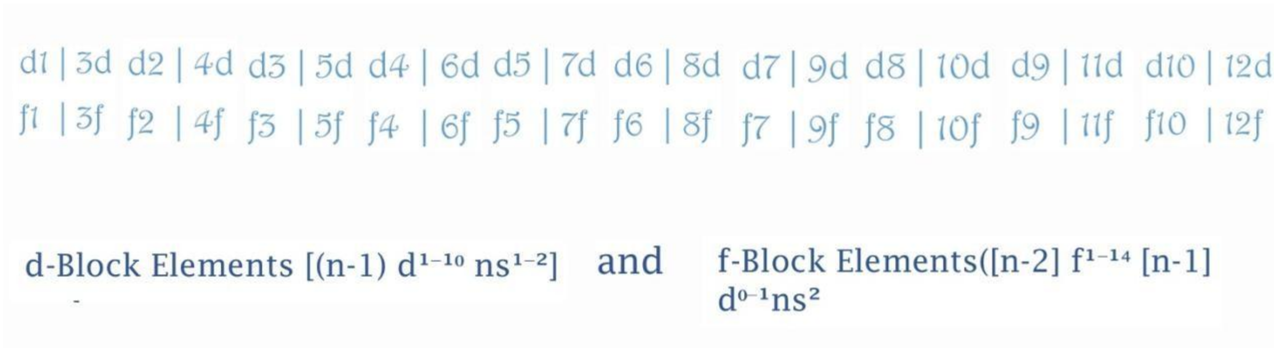
period 6(6a,6b,6c),period 7(7a,7b,7c) and period 8(8a,8b,8c). With this, the rows of lanthanides and actinides are placed in the main body of the periodic table ,by placing all the elements belonging to these rows according to the base explained above.

On the top of the first row of every block, a leading row is running for detailing about the particular column, for example, number of maximum electrons a leading column accommodated, in which subshell, the last electron(valence electron) entered. In Figure 1 a,'s1 and s2' symbolizing that 'group 1 and group 2' have there valence electrons in the s-subshell respective whereas '1s and 2s' is symbolizing the 'total' number of electrons, accommodated by the outermost shell, (group 1 has maximum one while group2 has maximum two electrons respectively), in a particular group of the s-block . Similarly, from group 3 to group 12, the row of labelling is subdivided into 2 rows, as seen in Figure 1 b. The reason behind subdividing the row, is that, in this periodic table, the d and f - blocks merged together.

[(d1, f1)], [(d2, f2)], [(d3f3)],…, [(d10, f10)] in Figure 1b,similarly f11, f11, f 13, f14 in Figure 1c, specifying that whether the element is belonging to the d-block or the f-block, it consists of one, two, three,……, till ten electrons in the d or the f-subshell, from group 3 to group 12 respectively and all the elements which are there from group 13 to group 16, have there valence electrons only in the f- subshell. Now taking the emphasis on the labels of both the d and the f-block, to determine there significance, by explaining what they actually mean. So, let's take a glance on them; [(3d,3f)],[(4d,4f)],[(5d,5f)],…,[(12d,12f)] in Figure 1b, similarly 13f,14f,15f,16f in Figure 1c, describing, the 'total' number of electrons accommodated by the outermost shell , by the elements belonging to the particular column of either the d- block or the f-block. In the same way, all the elements which are belonging to the p-block, are get labelled by the row as shown in Figure 1 d, running on the top of the first row of the elements of p-block. So, p1, p2, p3,…, p6, symbolizing that the elements are belonging to the p-block and it consists of one, two, three,…, six electrons in there p-subshell, from group 17 to group 22 respectively, whereas, 3p, 4p, 5p,…, 8p, symbolizing, the 'total' number of electrons accommodated by the outermost shell of the elements, belonging to the particular column of the p-block.

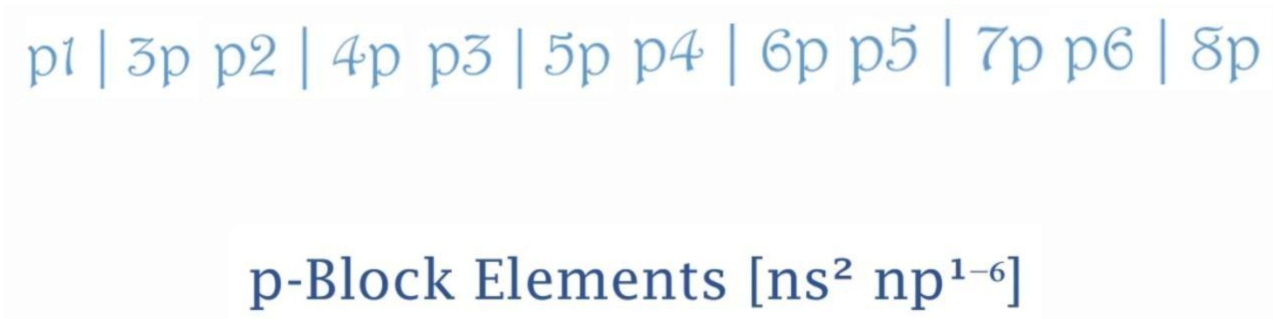


(a)



(b)

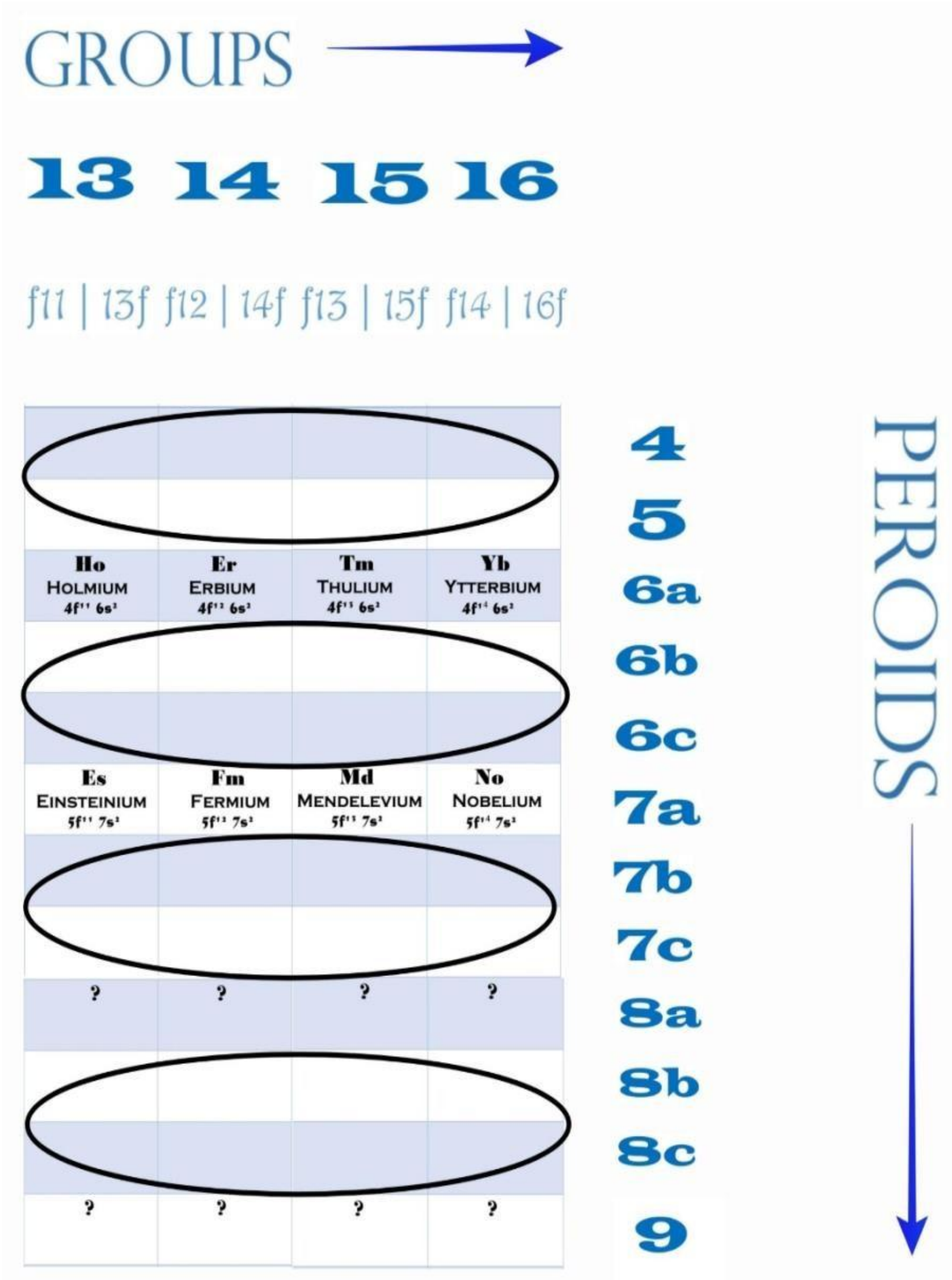
(c)



(d)

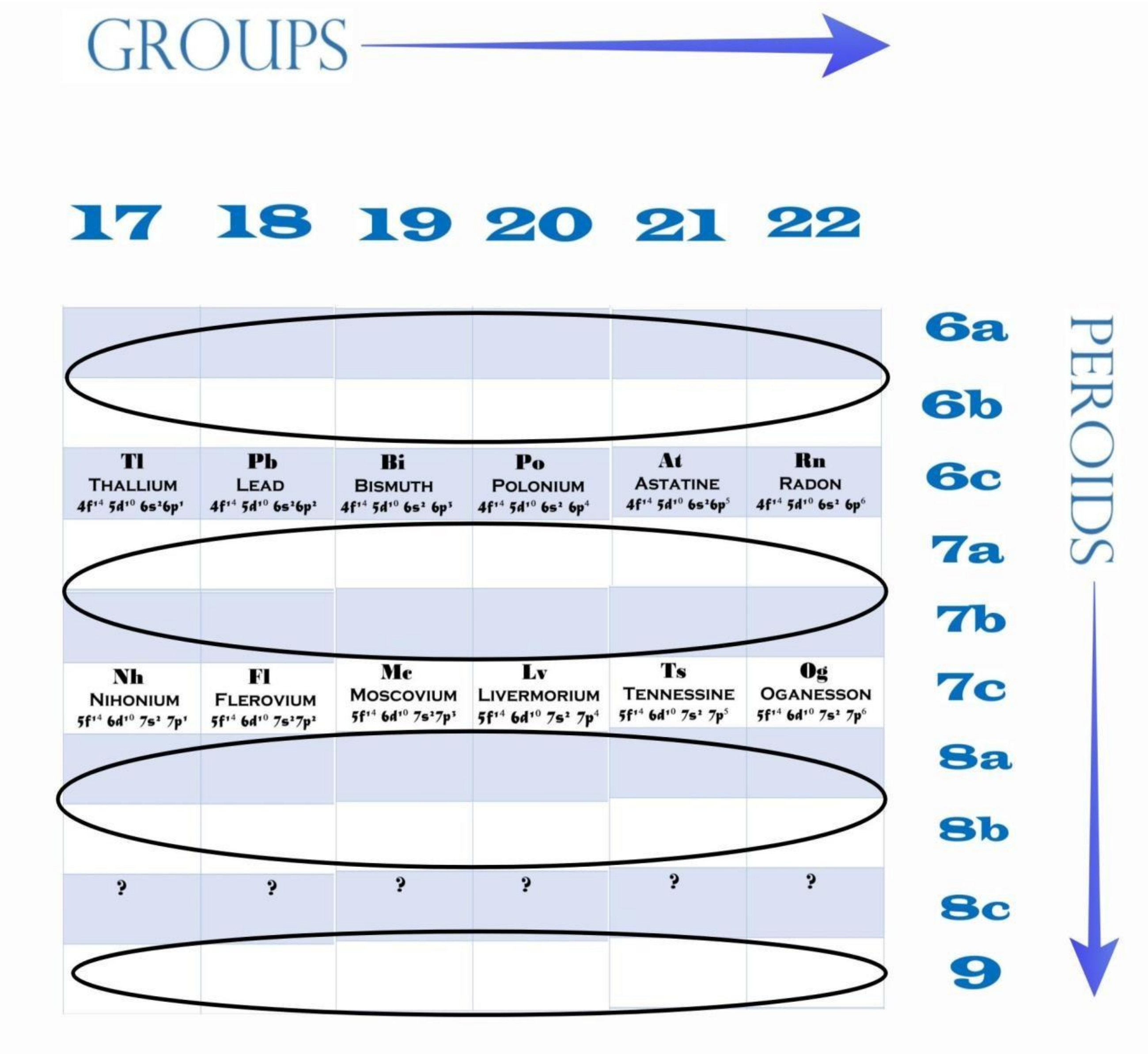
Fig 1 The leading row, running before the start of the element's first row, above all s, p, d and f – blocks, showing the labellings, prescribed for the specific column, to maintain a layout to understand about the elements which are belonging to the particular group.

From period 1 to period 7 (7c), total '20 vacant spaces' are left for the undiscovered elements. From period 8a to period 9, total '56 vacant spaces' are left there. The quantum periodic table is extended after period 7c till period 9, for a glimpse to show that this table can get extended as much as the requirements will come in the future. Figure 2 (a), is showing that, from group 13 to group 16, from period 4 to period 5, the space which is there is just a 'gap'.



(a)

Since d-subshell can accommodate at the maximum ten electrons, hence the elements which are belonging to the d-block can't get extended beyond 12^{th} group. Similarly, from group 13 to the group 16, [from (period 6b to 6c), (period 7b to 7c) and (period 8b to 8c)], the gap which is there is not showing any vacant spaces, but left because of the arrangement of the elements. Same case is seeing in p-block, showing in Figure 2 (b), the space from (period 6a to 6b),(period 7a to 7b) and (period 8a to 8b) is just a 'gap' which is left in arranging the elements accordingly, but not signifying any vacant spaces for undiscovered elements.



(b)

Fig. 2 Showing the 'gaps' which are not the 'vacant spaces' for the undiscovered elements.

Highlights

- Law of the quantum periodic table is, "the elements are arranged according to the order of electron-shell filling , by classifying the energy levels of the atoms in the order they are filled, to create a layout based on the electronic configuration".
- Quantum periodic table consists of the total 22 vertical groups and 9 (well-defined 7) horizontal periods.
- Rows of the lanthanides and the actinides are placed in the main body of the periodic table.
- Above group 1'Hydrogen' is placed and above group 2 'Helium' is placed.
- Period 6, 7 and 8 have been subdivided as: period 6 (6a, 6b, 6c), period 7 (7a, 7b, 7c) and period 8 (8a, 8b, 8c).
- From period 1 to period 7 (7c), total '20 vacant spaces ' are left and from period 8a to period 9, total 56 vacant spaces are there. In total, there are '76 vacant spaces', in the quantum periodic table.

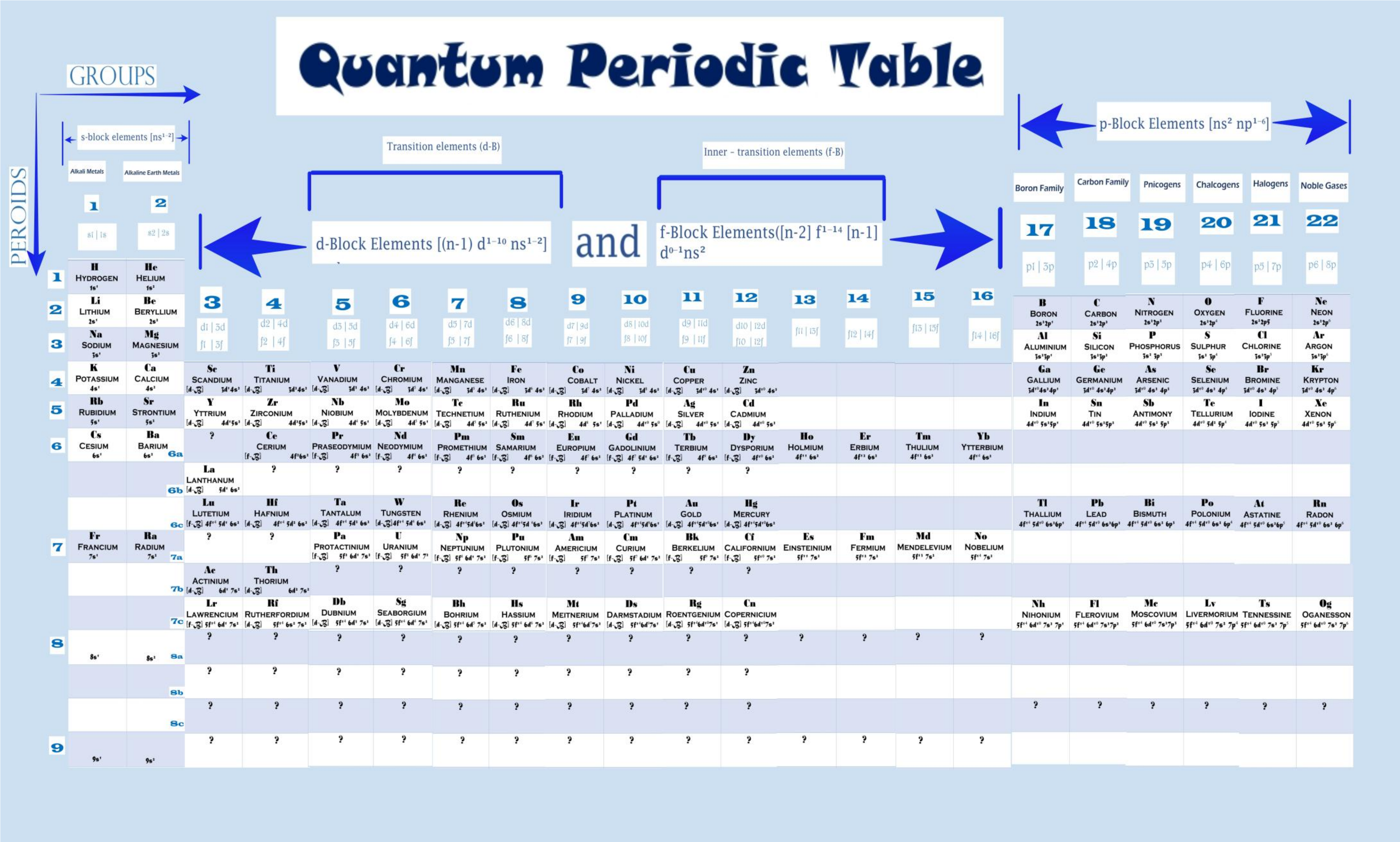
DRAMATIC CHANGES

In quantum periodic table, so many dramatic changes have been done, which somewhere can be helpful to unlock the problems related with the placement of elements, running from many years. Element [Cerium(Ce), Praseodymium(Pr), Neodymium(Nd), Promethium (Pm), Samarium(Sm), Europium(Eu), Gadolinium(Gd), Terbium(Tb), Dysprosium(Dy), Holmium(Ho), Erbium(Er), Thulium(Tm) and Ytterbium(Yb)] of period 6 of the modern periodic table except elements [Lanthanum(La) and Lutetium(Lu)], have been placed after elements [Yttrium(Y), Zirconium(Zr), Niobium(Nb), Molybdenum(Mo), Technetium(Tc), Ruthenium(Ru), Rhodium(Rh), Palladium(Pd), Silver(Ag) and Cadmium(Cd)] in the quantum periodic table, in period 6a. Element Lanthanum (La), has been placed separately in period 6b. Element Lutetium (Lu), which is placed in the period 6 at the end of the Lanthanide series, in the modern periodic table, is placed in period 6c, at the first position in the quantum periodic table. [Lutetium(Lu), Hafnium(Hf), Tantalum(Ta), Tungsten(W), Rhenium(Re), Osmium(Os), Iridium(Ir), Platinum(Pt), Gold(Au) and Mercury(Hg)], all these ten elements have been placed in period 6c. [Protactinium(Pa), Uranium(U), Neptunium(Np), Plutonium(Pu), Americium(Am), Curium(Cm), Berkelium(Bk), Californium(Cf), Einsteinium(Es), Fermium(Fm), Mendelevium(Md) and Nobelium(No)], all these twelve elements, have been placed in the period 7,in the modern periodic table, but are placed in the period 7a, in the quantum periodic table. Elements [Actinium(Ac) and Thorium(Th)], which have been placed in the period 7, in the modern periodic table, are placed in the period 7b,in the quantum periodic table. Element Lawrencium (Lr), which is placed in the period 7, at the end of the actinides series, is placed in the period 7c,at the first position, in the quantum periodic table. [Lawrencium(Lr), Rutherfordium(Rf), Dubnium(Db), Seaborgium(Sg), Bohrium(Bh), Hassium(Hs), Meitnerium(Mt), Darmstadium(Ds), Roentgenium(Rg) and Copernicium(Cn)], all these nine elements have been placed in the period 7c.

Quantum Periodic Table

The very idea of electrons in shells is a quantum mechanical concept. The energy of electrons is said to be quantized in the sense that electrons occupy a set of energy levels or orbitals, each level having a specific and discrete energy values.[1] The name, quantum periodic table itself is justifying the outlook, which somewhere is giving the glimpse that the base of this periodic table is revolving strongly around quantum mechanics. Quantum periodic table is entirely different from the concept of the left – step table, which was proposed by the frenchman, Charles Janet. Janet's periodic table displays the order of orbital filling more clearly than the conventional form.[2]

Janet's form of the periodic table is obtained when, "classifying the energy levels of the atoms in the order they are filled when passing from one element of atomic number Z to the next, with atomic number Z+1 and so on,[3] whereas the quantum periodic table is obtained when, "the elements are arranged according to the order of electron – shell filling, by classifying the energy levels of the atoms in the order they are filled to create a layout based on electronic configuration".


Quantum Periodic Table
GROUPS
PEROIDS
s-block elements [ns1-2]
Alkali Metals
Alkaline Earth Metals
Transition elements (d-B)
Inner - transition elements (f-B)
d-Block Elements [(n-1) d1-10 ns1-2]
and
f-Block Elements([n-2] f1-14 [n-1] d0-1ns2
p-Block Elements [ns2 np1-6]
Boron Family
Carbon Family
Pnicogens
Chalcogens
Halogens
Noble Gases
H Hydrogen
He Helium
Li Lithium
Be Beryllium
Na Sodium
Mg Magnesium
K Potassium
Ca Calcium
Sc Scandium
Ti Titanium
V Vanadium
Cr Chromium
Mn Manganese
Fe Iron
Co Cobalt
Ni Nickel
Cu Copper
Zn Zinc
Rb Rubidium
Sr Strontium
Y Yttrium
Zr Zirconium
Nb Niobium
Mo Molybdenum
Tc Technetium
Ru Ruthenium
Rh Rhodium
Pd Palladium
Ag Silver
Cd Cadmium
Cs Cesium
Ba Barium
Ce Cerium
Pr Praseodymium
Nd Neodymium
Pm Promethium
Sm Samarium
Eu Europium
Gd Gadolinium
Tb Terbium
Dy Dysprosium
Ho Holmium
Er Erbium
Tm Thulium
Yb Ytterbium
La Lanthanum
Lu Lutetium
Hf Hafnium
Ta Tantalum
W Tungsten
Re Rhenium
Os Osmium
Ir Iridium
Pt Platinum
Au Gold
Hg Mercury
Fr Francium
Ra Radium
Pa Protactinium
U Uranium
Np Neptunium
Pu Plutonium
Am Americium
Cm Curium
Bk Berkelium
Cf Californium
Es Einsteinium
Fm Fermium
Md Mendelevium
No Nobelium
Ac Actinium
Th Thorium
Lr Lawrencium
Rf Rutherfordium
Db Dubnium
Sg Seaborgium
Bh Bohrium
Hs Hassium
Mt Meitnerium
Ds Darmstadium
Rg Roentgenium
Cn Copernicium
B Boron
C Carbon
N Nitrogen
O Oxygen
F Fluorine
Ne Neon
Al Aluminium
Si Silicon
P Phosphorus
S Sulphur
Cl Chlorine
Ar Argon
Ga Gallium
Ge Germanium
As Arsenic
Se Selenium
Br Bromine
Kr Krypton
In Indium
Sn Tin
Sb Antimony
Te Tellurium
I Iodine
Xe Xenon
Tl Thallium
Pb Lead
Bi Bismuth
Po Polonium
At Astatine
Rn Radon
Nh Nihonium
Fl Flerovium
Mc Moscovium
Lv Livermorium
Ts Tennessine
Og Oganesson

SUMMARY

In the quantum periodic table, the problem of placing the lanthanides and actinides series elements tries to get solved, as all the elements, belonging to these series are placed in the main body of the periodic table. There are a number of elements whose placement in the periodic table have been debated by generations of chemists. These elements include Hydrogen, Lanthanum, actinium, Lutetium, Lawrencium.[4],[5],[6],[7],[8],[9],[10] Twenty vacant spaces [till period 7(7c)], left for the placement of the undiscovered elements, with this fifty – six additional vacant spaces are there in the periodic table from period 8a to the period 9, in total seventy – six vacant spaces are there right now left in the quantum periodic table but this is not the end. This periodic table can be further get extended as per the requirements in the future. All the major changes which are defined till now brings a totally new outlook, if compared to all the periodic tables, which published till now, with this also unlock the defects and the need for the more advancement of the periodic table version which could run for years without facing any trouble in the settlement of the upcoming undiscovered elements.

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