# The Periodic Table Series

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1 **Abstract**

There is a periodic table, at least in terms of atomic number and electronic configuration, for every positive integer, , with a capacity of elements, where c is the construction index, and c equals one plus the maximum number of electrons per orbital of an atom. The c-construction index and the c-construction-index formulae are unique to this report. The maximum number of potential orbitals per sub-shell of an atom where n is the index of the s, p, d, and f sub-shells.

2 **Introduction**

The investigation that lead to the derivation of the periodic table series was based on the following hypothesis: if electrons in the electronic structure of atoms are arranged in a configuration that involves prime numbers, the role the prime numbers play in building the electronic structure of atoms can be discerned. Which prime numbers might play a role in building the electronic structure of atoms, was based on two reasons: (a) prime numbers are combinations of 1’s, 2’s and 3’s; and (b) the electronic structure of atoms is an efficiently organized system and efficiency requires the use of small numbers to repeatedly code for larger ones. After a long phase of trial and error, some headway was made by investigating the prime number 3. The role the digit 3 plays in the electronic structure of atoms was investigated by writing natural numbers in base 3 and analyzing the base 3 numerals.

3 **C3 Periodic Pattern**

Write Natural Numbers in base 3 and analyze the base 3 numerals. Arrange the base 3 numerals in columns and place the columns in ascending order. Column 1 begins at 1 and terminates at 2 (largest 1- digit base 3 numeral), Column 2 begins at 1 and terminates at 22 (largest 2-digit base 3 numeral), column 3 begins at 1 and terminates at 222 (largest 3-digit base 3 numeral), and so on and so forth. All the columns begin from 1 in order for the pattern formed by the base 3 numerals, to be periodic. Whenever possible, every column is subdivided into segments of 1-digit numerals, 2-digit numerals, 3-digit numerals, and so on and so forth.

|  |  |  |  |
| --- | --- | --- | --- |
|  |  | 222 |  |
|  |  | 221 |  |
|  |  | 220 |  |
|  |  | 212 |  |
|  |  | 211 |  |
|  |  | 210 |  |
|  |  | 202 |  |
|  |  | 201 |  |
|  |  | 200 |  |
|  |  | 122 |  |
|  |  | 121 |  |
|  |  | 120 |  |
|  |  | 112 | : |
|  |  | 111 |  |
|  |  | 110 |  |
|  |  | 102 |  |
|  |  | 101 |  |
|  |  | 100 |  |
|  |  |  |  |
|  | 22 | 22 |  |
|  | 21 | 21 |  |
|  | 20 | 20 |  |
|  | 12 | 12 |  |
|  | 11 | 11 |  |
|  | 10 | 10 |  |
|  |  |  |  |
| 2 | 2 | 2 |  |
| 1 | 1 | 1 |  |
|  |  |  |  |
| Column 1 | Column 2 | Column 3 |  |
| Analysis of base 3 numerals | | | |

Finally, reorganize the base 3 numerals in pairs and replace every pair of base 3 numerals by a pair of bubbles; the result is a periodic pattern that conforms to the general formula where c is the construction index of the base 3 patterns and n is the index of the columns.



For base 3 patterns, c = 3 and all patterns that are derived by analysis of base 3 numerals, as described above, are labeled C3.

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The C3 periodic pattern is compatible with the electronic configuration of atoms, and it corresponds to Mendeleev’s periodic table. For this reason, Mendeleev’s periodic table can be referred to as a C3 periodic table.

C = 3

Electron max per orbital = c – 1 = 2 e-/orbital

The general formula can be investigated further by analyzing base 2 numerals.

4 **The C2 Periodic Pattern**

Write natural numbers in base 2 and analyze the base 2 numerals in the same way as base 3 numerals were analyzed in section 3 above. Column 1 consists of only 1 because 1 is the largest 1-digit base 2 numeral. The base 2 numerals cannot be organized in pairs; the C2 periodic pattern consists of individual units, but the pattern also conforms to the general formula where c is the construction index and n is the index of the columns. The construction index of the patterns derived from base 2 numerals equals two: c=2.

Analysis of base 2 numerals



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It is imperative to determine the number of orbitals in the sub-shells of the C2 periodic pattern atoms in order to write electronic configurations for the C2 atoms and keep the investigation running. In general, the number of orbitals in the s p d f sub-shells form an arithmetic sequence defined by the general formula where is the number of orbitals per sub-shell and is the number of orbitals in the s sub-shell (first term of the sequence), and d is the common difference. The common difference can be expressed in terms of the construction index, c. The number of orbitals in the p sub-shell always equals c. The s sub-shell contains one orbital, and so the common difference d = c – 1.

S sub-shell: , p subshell: , d subshell: , and f subshell: .

The maximum number of electrons per orbital of a C2 atom = c – 1 = 1e-/orbital.



Use the C2 periodic pattern above to write electronic configurations for the C2 atoms according to Aufbau principle.

 Construct a C2 periodic table like that shown below. The C2 periodic table is in sequence to Mendeleev’s periodic table.

 Now that analysis of base 2 numerals has resulted in the construction of a C2 periodic table, there is need to find out whether analysis of base 4 numerals will also culminate in the construction of a C4 periodic table.

5 **The C4 Periodic Pattern and the C4 Periodic Table**

Write natural numbers in base 4 and analyze the base 4 numerals as described above in sections 3 and 4. Analysis of the base 4 numerals shows that the C4 periodic pattern also conforms to the series where c is the construction index of the C4 periodic pattern and n is the index of the columns. The value of the construction index for the C4 periodic table is 4 and the maximum number of electrons per orbital of a C4 atom is 3.

The number of s p d f orbitals for the C4 periodic pattern can also be calculated by using the following general formula:

|  |  |  |
| --- | --- | --- |
| Sub-shell | Index |  |
| S | 1 | 1 |
| P | 2 | 4 |
| d | 3 | 7 |
| F | 4 | 10 |

Use the C4 periodic pattern to write electronic configurations for the C4 atoms and construct a C4 periodic table. This is also in sequence with Mendeleev’s periodic table.



|  |  |  |
| --- | --- | --- |
| The C4 Periodic Pattern Electronic Configuration | | |
| Atomic Number | Element | Electronic Configuration |
| 1 | X | 1 |
| 2 | X | 2 |
| 3 | X | 3 |
| 4 | X | 3,1 |
| 5 | X | 3,2 |
| 6 | X | 3,3 |
| 7 | X | 3,4 |
| 8 | X | 3,5 |
| 9 | X | 3,6 |
| 10 | X | 3,7 |
| 11 | X | 3,8 |
| 12 | X | 3,9 |
| 13 | X | 3,10 |
| 14 | X | 3,11 |
| 15 | X | 3,12 |
| 16 | X | 3,13 |
| 17 | X | 3,14 |
| 18 | X | 3,15 |
| 19 | X | 3,15,1 |
| 20 | X | 3,15,2 |
| 21 | X | 3,15,3 |
| 22 | X | 3,15,4 |
| 23 | X | 3,15,5 |
| 24 | X | 3,15,6 |
| 25 | X | 3,15,7 |
| 26 | X | 3,15,8 |
| 27 | X | 3,15,9 |
| 28 | X | 3,15,10 |
| 29 | X | 3,15,11 |
| 30 | X | 3,15,12 |
| 31 | X | 3,15,13 |
| 32 | X | 3,15,14 |
| 33 | X | 3,15,15 |
| 34 | X | 3,15,15,1 |
| 35 | X | 3,15,15,2 |
| 36 | X | 3,15,15,3 |
| 37 | X | 3,15,16,3 |
| 38 | X | 3,15,17,3 |
| 39 | X | 3,15,18,3 |
| 40 | X | 3,15,19,3 |
| 41 | X | 3,15,20,3 |
| 42 | X | 3,15,21,3 |
| 43 | X | 3,15,22,3 |
| 44 | X | 3,15,23,3 |
| 45 | X | 3,15,24,3 |
| 46 | X | 3,15,25,3 |
| 47 | X | 3,15,26,3 |
| 48 | X | 3,15,27,3 |
| 49 | X | 3,15,28,3 |
| 50 | X | 3,15,29,3 |
| 51 | X | 3,15,30,3 |
| 52 | X | 3,15,31,3 |
| 53 | X | 3,15,32,3 |
| 54 | X | 3,15,33,3 |
| 55 | X | 3,15,34,3 |
| 56 | X | 3,15,35,3 |
| 57 | X | 3,15,36,3 |
| 58 | X | 3,15,36,4 |
| 59 | X | 3,15,36,5 |
| 60 | X | 3,15,36,6 |
| 61 | X | 3,15,36,7 |
| 62 | X | 3,15,36,8 |
| 63 | X | 3,15,36,9 |
| 64 | X | 3,15,36,10 |
| 65 | X | 3,15,36,11 |
| 66 | X | 3,15,36,12 |
| 67 | X | 3,15,36,13 |
| 68 | X | 3,15,36,14 |
| 69 | X | 3,15,36,15 |
| 70 | X | 3,15,36,15,1 |
| 71 | X | 3,15,36,15,2 |
| 72 | X | 3,15,36,15,3 |
| 73 | X | 3,15,36,16,3 |
| 74 | X | 3,15,36,17,3 |
| 75 | X | 3,15,36,18,3 |
| 76 | X | 3,15,36,19,3 |
| 77 | X | 3,15,36,20,3 |
| 78 | X | 3,15,36,21,3 |
| 79 | X | 3,15,36,22,3 |
| 80 | X | 3,15,36,23,3 |
| 81 | X | 3,15,36,24,3 |
| 82 | X | 3,15,36,25,3 |
| 83 | X | 3,15,36,26,3 |
| 84 | X | 3,15,36,27,3 |
| 85 | X | 3,15,36,28,3 |
| 86 | X | 3,15,36,29,3 |
| 87 | X | 3,15,36,30,3 |
| 88 | X | 3,15,36,31,3 |
| 89 | X | 3,15,36,32,3 |
| 90 | X | 3,15,36,33,3 |
| 91 | X | 3,15,36,34,3 |
| 92 | X | 3,15,36,35,3 |
| 93 | X | 3,15,36,36,3 |
| 94 | X | 3,15,36,36,4 |
| 95 | X | 3,15,36,36,5 |
| 96 | X | 3,15,36,36,6 |
| 97 | X | 3,15,36,36,7 |
| 98 | X | 3,15,36,36,8 |
| 99 | X | 3,15,36,36,9 |
| 100 | X | 3,15,36,36,10 |
| 101 | X | 3,15,36,36,11 |
| 102 | X | 3,15,36,36,12 |
| 103 | X | 3,15,36,36,13 |
| 104 | X | 3,15,36,36,14 |
| 105 | X | 3,15,36,36,15 |
| 106 | X | 3,15,36,36,15,1 |
| 107 | X | 3,15,36,36,15,2 |
| 108 | X | 3,15,36,36,15,3 |
| 109 | X | 3,15,36,37,15,3 |
| 110 | X | 3,15,36,38,15,3 |
| 111 | X | 3,15,36,39,15,3 |
| 112 | X | 3,15,36,40,15,3 |
| 113 | X | 3,15,36,41,15,3 |
| 114 | X | 3,15,36,42,15,3 |
| 115 | X | 3,15,36,43,15,3 |
| 116 | X | 3,15,36,44,15,3 |
| 117 | X | 3,15,36,45,15,3 |
| 118 | X | 3,15,36,46,15,3 |
| 119 | X | 3,15,36,47,15,3 |
| 120 | X | 3,15,36,48,15,3 |
| 121 | X | 3,15,36,49,15,3 |
| 122 | X | 3,15,36,50,15,3 |
| 123 | X | 3,15,36,51,15,3 |
| 124 | X | 3,15,36,52,15,3 |
| 125 | X | 3,15,36,53,15,3 |
| 126 | X | 3,15,36,54,15,3 |
| 127 | X | 3,15,36,55,15,3 |
| 128 | X | 3,15,36,56,15,3 |
| 129 | X | 3,15,36,57,15,3 |
| 130 | X | 3,15,36,58,15,3 |
| 131 | X | 3,15,36,59,15,3 |
| 132 | X | 3,15,36,60,15,3 |
| 133 | X | 3,15,36,61,15,3 |
| 134 | X | 3,15,36,62,15,3 |
| 135 | X | 3,15,36,63,15,3 |
| 136 | X | 3,15,36,64,15,3 |
| 137 | X | 3,15,36,65,15,3 |
| 138 | X | 3,15,36,66,15,3 |
| 139 | X | 3,15,36,66,16,3 |
| 140 | X | 3,15,36,66,17,3 |
| 141 | X | 3,15,36,66,18,3 |
| 142 | X | 3,15,36,66,19,3 |
| 143 | X | 3,15,36,66,20,3 |
| 144 | X | 3,15,36,66,21,3 |
| 145 | X | 3,15,36,66,22,3 |
| 146 | X | 3,15,36,66,23,3 |
| 147 | X | 3,15,36,66,24,3 |
| 148 | X | 3,15,36,66,25,3 |
| 149 | X | 3,15,36,66,26,3 |
| 150 | X | 3,15,36,66,27,3 |
| 151 | X | 3,15,36,66,28,3 |
| 152 | X | 3,15,36,66,29,3 |
| 153 | X | 3,15,36,66,30,3 |
| 154 | X | 3,15,36,66,31,3 |
| 155 | X | 3,15,36,66,32,3 |
| 156 | X | 3,15,36,66,33,3 |
| 157 | X | 3,15,36,66,34,3 |
| 158 | X | 3,15,36,66,35,3 |
| 159 | X | 3,15,36,66,36,3 |
| 160 | X | 3,15,36,66,36,4 |
| 161 | X | 3,15,36,66,36,5 |
| 162 | X | 3,15,36,66,36,6 |
| 163 | X | 3,15,36,66,36,7 |
| 164 | X | 3,15,36,66,36,8 |
| 165 | X | 3,15,36,66,36,9 |
| 166 | X | 3,15,36,66,36,10 |
| 167 | X | 3,15,36,66,36,11 |
| 168 | X | 3,15,36,66,36,12 |
| 169 | X | 3,15,36,66,36,13 |
| 170 | X | 3,15,36,66,36,14 |
| 171 | X | 3,15,36,66,36,15 |
| 172 | X | 3,15,36,66,36,15,1 |
| 173 | X | 3,15,36,66,36,15,2 |
| 174 | X | 3,15,36,66,36,15,3 |
| 175 | X | 3,15,36,66,37,15,3 |
| 176 | X | 3,15,36,66,38,15,3 |
| 177 | X | 3,15,36,66,39,15,3 |
| 178 | X | 3,15,36,66,40,15,3 |
| 179 | X | 3,15,36,66,41,15,3 |
| 180 | X | 3,15,36,66,42,15,3 |
| 181 | X | 3,15,36,66,43,15,3 |
| 182 | X | 3,15,36,66,44,15,3 |
| 183 | X | 3,15,36,66,45,15,3 |
| 184 | X | 3,15,36,66,46,15,3 |
| 185 | X | 3,15,36,66,47,15,3 |
| 186 | X | 3,15,36,66,48,15,3 |
| 187 | X | 3,15,36,66,49,15,3 |
| 188 | X | 3,15,36,66,50,15,3 |
| 189 | X | 3,15,36,66,51,15,3 |
| 190 | X | 3,15,36,66,52,15,3 |
| 191 | X | 3,15,36,66,53,15,3 |
| 192 | X | 3,15,36,66,54,15,3 |
| 193 | X | 3,15,36,66,55,15,3 |
| 194 | X | 3,15,36,66,56,15,3 |
| 195 | X | 3,15,36,66,57,15,3 |
| 196 | X | 3,15,36,66,58,15,3 |
| 197 | X | 3,15,36,66,59,15,3 |
| 198 | X | 3,15,36,66,60,15,3 |
| 199 | X | 3,15,36,66,61,15,3 |
| 200 | X | 3,15,36,66,62,15,3 |
| 201 | X | 3,15,36,66,63,15,3 |
| 202 | X | 3,15,36,66,64,15,3 |
| 203 | X | 3,15,36,66,65,15,3 |
| 204 | X | 3,15,36,66,66,15,3 |
| 205 | X | 3,15,36,66,66,16,3 |
| 206 | X | 3,15,36,66,66,17,3 |
| 207 | X | 3,15,36,66,66,18,3 |
| 208 | X | 3,15,36,66,66,19,3 |
| 209 | X | 3,15,36,66,66,20,3 |
| 210 | X | 3,15,36,66,66,21,3 |
| 211 | X | 3,15,36,66,66,22,3 |
| 212 | X | 3,15,36,66,66,23,3 |
| 213 | X | 3,15,36,66,66,24,3 |
| 214 | X | 3,15,36,66,66,25,3 |
| 215 | X | 3,15,36,66,66,26,3 |
| 216 | X | 3,15,36,66,66,27,3 |
| 217 | X | 3,15,36,66,66,28,3 |
| 218 | X | 3,15,36,66,66,29,3 |
| 219 | X | 3,15,36,66,66,30,3 |
| 220 | X | 3,15,36,66,66,31,3 |
| 221 | X | 3,15,36,66,66,32,3 |
| 222 | X | 3,15,36,66,66,33,3 |
| 223 | X | 3,15,36,66,66,34,3 |
| 224 | X | 3,15,36,66,66,35,3 |
| 225 | X | 3,15,36,66,66,36,3 |
| 226 | X | 3,15,36,66,66,36,4 |
| 227 | X | 3,15,36,66,66,36,5 |
| 228 | X | 3,15,36,66,66,36,6 |
| 229 | X | 3,15,36,66,66,36,7 |
| 230 | X | 3,15,36,66,66,36,8 |
| 231 | X | 3,15,36,66,66,36,9 |
| 232 | X | 3,15,36,66,66,36,10 |
| 233 | X | 3,15,36,66,66,36,11 |
| 234 | X | 3,15,36,66,66,36,12 |
| 235 | X | 3,15,36,66,66,36,13 |
| 236 | X | 3,15,36,66,66,36,14 |
| 237 | X | 3,15,36,66,66,36,15 |



6 **The Periodic Table Series Formula**

The capacity of the C2 periodic table is 39, the capacity of the C3 periodic table (Mendeleev’s periodic table) is 118, and the capacity of the C4 periodic table is 237.

39 = 19 +20

118 = 59 + 59 = (19 + 20 +20) + (19 +20 +20)

237 = 79 + 79 +79 = (19 + 20 +20 +20) + (19 +20 +20 +20) + (19 +20 +20 +20)

39, 118, and 237 are related by the expression 19(c – 1) + 20(c – 1)2 where c is the construction index.

19(c – 1) + 20(c – 1)2

= 19(c – 1) + 20(c2 – 2c + 1)

= 19c -19 + 20c2 – 40c + 20

= 20c2 – 21c + 1

It follows that, theoretically, there is a periodic table for every positive integer with a capacity of 20c2 – 20c + 1(elements), where c is the construction index of the periodic table in question, and c equals one plus the maximum number of electrons per orbital.

Let be the maximum number of elements that a periodic table can carry.

7 **The Construction Index Formulae**

The construction index is denoted by the letter c. In the C2 periodic table, c = 2; in the C3 periodic table (Mendeleev’s periodic table), c = 3; in the C4 periodic table, c = 4; and so forth. There is a periodic table for every positive integer, and the periodic tables together constitute an infinite sequence of patterns of Mendeleev’s periodic table. The electronic configurations in the entire sequence of periodic tables form an enormous cascading system of numbers. The following construction index formulae can be used to zero on or assess every single periodic table in the series:

1. The maximum number of electrons per orbital
2. The number of orbitals in each of the s, p, d and f sub-shells

where n is the index of the sub-shell

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Sub-shell | | | Periodic table or Term | | | | | | |
|  | n | an | C=0 | C=1 | C=2 | C=3 | C=4 | C=5 | . . . |
| s | 1 |  | 1 | 1 | 1 | 1 | 1 | 1 | . . . |
| p | 2 |  | 0 | 1 | 2 | 3 | 4 | 5 | . . . |
| d | 3 |  | -1 | 1 | 3 | 5 | 7 | 9 | . . . |
| f | 4 |  | -2 | 1 | 4 | 7 | 10 | 13 | . . . |

Note in Mendeleev’s periodic table, c = 3

1. The number of A groups in the entire periodic table
2. The number of A groups in the s block
3. The number of A groups in the p block
4. The number of elements in the s block
5. The capacity of the p block elements
6. The number of B groups in the periodic table
7. The capacity of the d block elements
8. The number of elements in the f block



8 **Conclusion**

In the general formula for the periodic patterns, the factor determines the maximum number of electrons per orbital, and the factor determines the maximum number of orbitals per subshell of an atom.

3 for Mendeleev’s periodic table

where n is the principal quantum number

The maximum number of potential orbitals in the s, p, d and f sub-shells are 1, 3, 9, and 27 respectively, for all atoms in Mendeleev’s periodic table.

The formula, gives the maximum number of elements a periodic table can carry; hence, a periodic table can be considered as a set with number of elements. Each element in the periodic table is defined by its unique atomic number and electronic configuration. In the periodic table series, at at at at and so forth. There is only one element in the first term. The second term is an empty set; it is empty in the sense that its elements are not defined in terms of atomic number and electronic configuration. This is the same as saying at subatomic particles are not organized to form atoms. The third term is the smallest periodic table in the series with a maximum of 39 elements. Its elements have the simplest electronic structure. The fourth term is Mendeleev’s periodic table. Every term or periodic table in the series is identified by the maximum number of electrons per orbital of the atom. In the periodic table series, the terms or periodic tables are arranged in the increasing order of complexity and diversity. In other words, the periodic tables are arranged in a vertical relationship. Mendeleev’s periodic table is 3 electron steps form the one-element term at the beginning of the series.