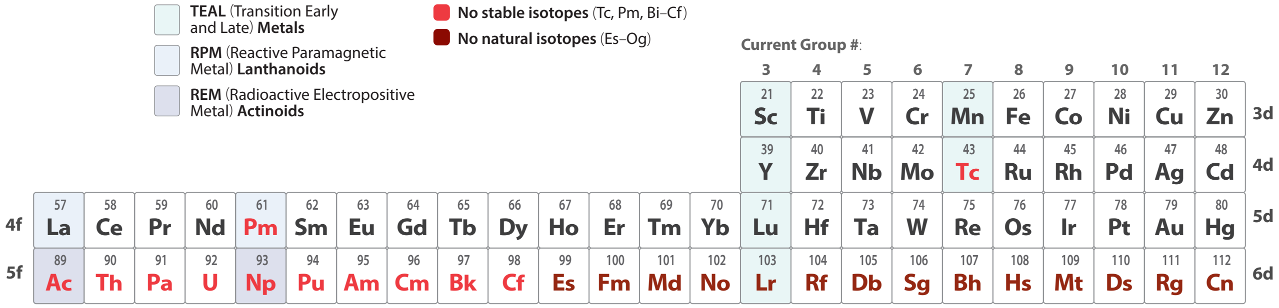
SECTION 1. **Ending the Group 3 Forever War**

One Periodic Table Forever War (others include the placements of H and He) has resulted in decades of unresolvable skirmishes and spilled ink over which set of elements belong in Group 3.

This ongoing Scylur-Scylac Debate (pronounced Skylur-Skylak) fundamentally involves a clash of normative beliefs over whether Lu-Lr or La-Ac should be placed below Sc-Y in the current standard periodic table column conventionally known as Group 3 (previously III/B/A) — with both sides mustering support from judiciously chosen chemical and physical properties.

The Group 3 Forever War will be shown to have been triggered by a single underlying cause: the artificial stacking of all d-periods into an unnatural d-block.

As Sc-Y-Lu-Lr consists of 3d–6d-period elements, while La-Ac are 4f–5f-period elements, the latest rally has pushed away from Scylac (Sc-Y-La-Ac) towards the Skylur formation which more clearly satisfies our innate pattern-matching organizational desire to keep the d-period elements uniformly stacked together:



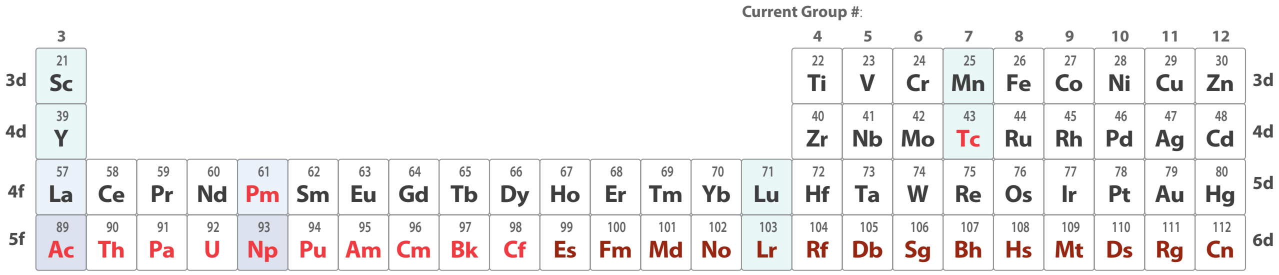
▢ **TEAL** (Transition Early and Late) **Metals**
▢ **RPM** (Reactive Paramagnetic Metal) **Lanthanoids**
▢ **REM** (Radioactive Electropositive Metal) **Actinoids**
● **No stable isotopes** (Tc, Pm, Bi–Cf)
● **No natural isotopes** (Es–Og)

Current Group #:

															3	4	5	6	7	8	9	10	11	12	
															21 Sc	22 Ti	23 V	24 Cr	25 Mn	26 Fe	27 Co	28 Ni	29 Cu	30 Zn	3d
															39 Y	40 Zr	41 Nb	42 Mo	43 Tc	44 Ru	45 Rh	46 Pd	47 Ag	48 Cd	4d
4f	57 La	58 Ce	59 Pr	60 Nd	61 Pm	62 Sm	63 Eu	64 Gd	65 Tb	66 Dy	67 Ho	68 Er	69 Tm	70 Yb	71 Lu	72 Hf	73 Ta	74 W	75 Re	76 Os	77 Ir	78 Pt	79 Au	80 Hg	5d
5f	89 Ac	90 Th	91 Pa	92 U	93 Np	94 Pu	95 Am	96 Cm	97 Bk	98 Cf	99 Es	100 Fm	101 Md	102 No	103 Lr	104 Rf	105 Db	106 Sg	107 Bh	108 Hs	109 Mt	110 Ds	111 Rg	112 Cn	6d

Figure 1a: Artificially stacking the d-periods has led to decades of unresolvable disputes over whether Group 3 of the collapsed print-form 18-column Standard Periodic Table (SPT-18) should consist of **Sc-Y-Lu-Lr** or **Sc-Y-La-Ac**.

However, there were (and are) very strong cases for why Sc and Y should share the same column with La and Ac to form a natural group. To the point where an only recently suggested compromise involved synthetically breaking up the 3d- and 4d-periods to maintain the Skylac ordering (Figure 1b). As we shall see, though it looks awkward, this is the only artificial variation that moves toward a natural solution:

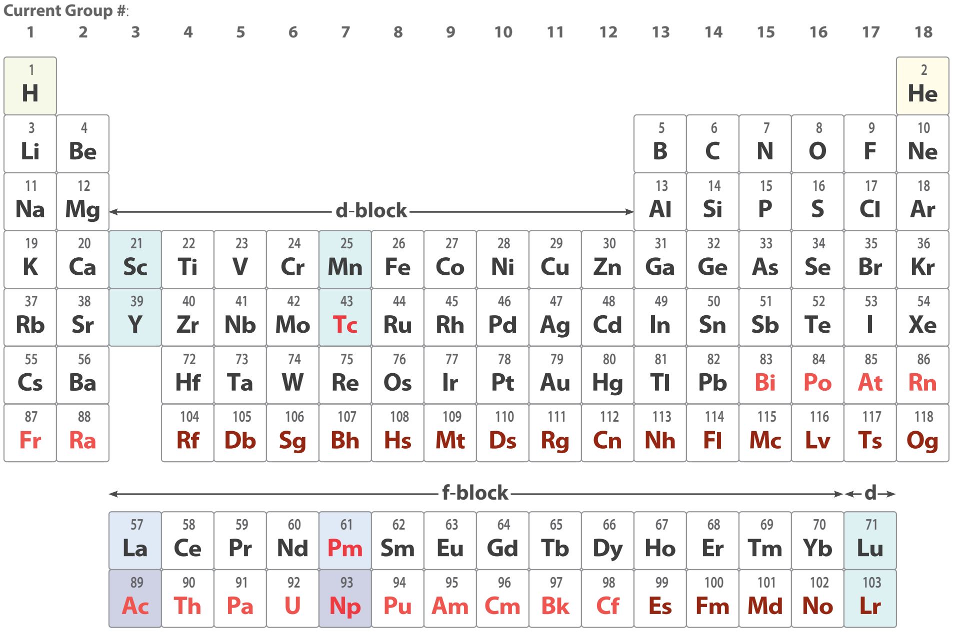


Current Group #:

	3															4	5	6	7	8	9	10	11	12	
3d	21 Sc															22 Ti	23 V	24 Cr	25 Mn	26 Fe	27 Co	28 Ni	29 Cu	30 Zn	3d
4d	39 Y															40 Zr	41 Nb	42 Mo	43 Tc	44 Ru	45 Rh	46 Pd	47 Ag	48 Cd	4d
4f	57 La	58 Ce	59 Pr	60 Nd	61 Pm	62 Sm	63 Eu	64 Gd	65 Tb	66 Dy	67 Ho	68 Er	69 Tm	70 Yb	71 Lu	72 Hf	73 Ta	74 W	75 Re	76 Os	77 Ir	78 Pt	79 Au	80 Hg	5d
5f	89 Ac	90 Th	91 Pa	92 U	93 Np	94 Pu	95 Am	96 Cm	97 Bk	98 Cf	99 Es	100 Fm	101 Md	102 No	103 Lr	104 Rf	105 Db	106 Sg	107 Bh	108 Hs	109 Mt	110 Ds	111 Rg	112 Cn	6d

Figure 1b: While the closest previous attempt towards a natural grouping, artificially stacking the d-periods into a d-block will always result in incorrect groups for the transition metals, lanthanoids, and actinoids, even if using this more recently suggested split d-block variation designed to rescue the **Sc-Y-La-Ac** column formation.

While Figure 1a may make it appear obvious that the Scylur-Scylac Debate should favour the Scylur form, it’s important to keep in mind that nearly everyone (including most professional chemists and physicists) only see and think of the Standard Periodic Table in its 18-column collapsed print form (SPT-18), where the f-block is artificially removed and placed beneath the table to reduce width — nominally for print convenience but primarily because it more closely meets humanity’s ocularcentric preference for visual bilateral symmetry:

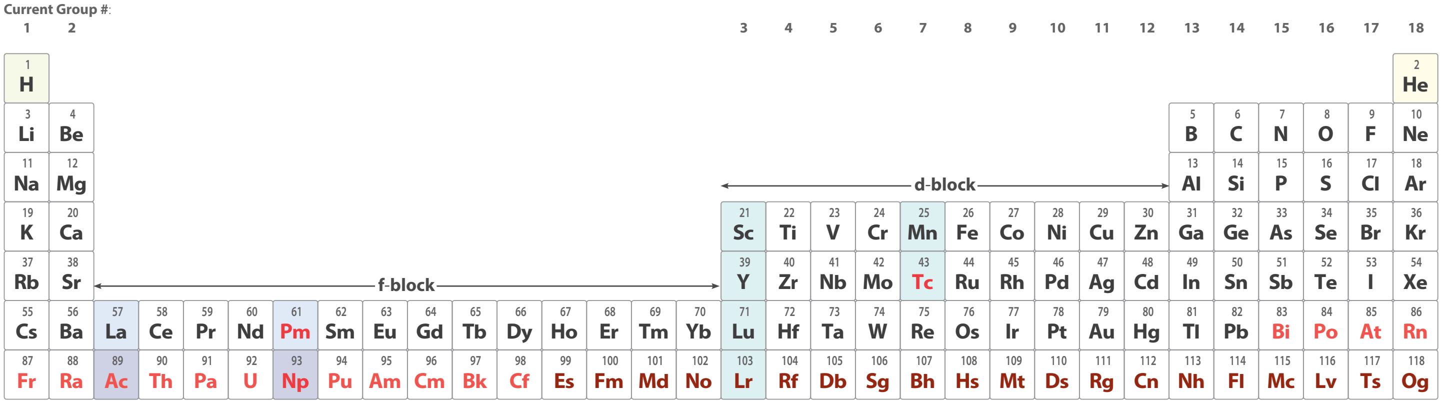


Current Group #:

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
1 H																	2 He
3 Li	4 Be											5 B	6 C	7 N	8 O	9 F	10 Ne
11 Na	12 Mg						d-block					13 Al	14 Si	15 P	16 S	17 Cl	18 Ar
19 K	20 Ca	21 Sc	22 Ti	23 V	24 Cr	25 Mn	26 Fe	27 Co	28 Ni	29 Cu	30 Zn	31 Ga	32 Ge	33 As	34 Se	35 Br	36 Kr
37 Rb	38 Sr	39 Y	40 Zr	41 Nb	42 Mo	43 Tc	44 Ru	45 Rh	46 Pd	47 Ag	48 Cd	49 In	50 Sn	51 Sb	52 Te	53 I	54 Xe
55 Cs	56 Ba		72 Hf	73 Ta	74 W	75 Re	76 Os	77 Ir	78 Pt	79 Au	80 Hg	81 Tl	82 Pb	83 Bi	84 Po	85 At	86 Rn
87 Fr	88 Ra		104 Rf	105 Db	106 Sg	107 Bh	108 Hs	109 Mt	110 Ds	111 Rg	112 Cn	113 Nh	114 Fl	115 Mc	116 Lv	117 Ts	118 Og
								f-block								d	
		57 La	58 Ce	59 Pr	60 Nd	61 Pm	62 Sm	63 Eu	64 Gd	65 Tb	66 Dy	67 Ho	68 Er	69 Tm	70 Yb	71 Lu	
		89 Ac	90 Th	91 Pa	92 U	93 Np	94 Pu	95 Am	96 Cm	97 Bk	98 Cf	99 Es	100 Fm	101 Md	102 No	103 Lr	

Figure 2a: Artificially stacking the d-periods will always result in incorrect group relationships for the transition metals, lanthanoids, and actinoids — including the recently suggested Group 3 **Sc** and **Y** variation of the collapsed print-form 18-column current Standard Periodic Table (SPT-18). The SPT-18 includes expedient artificial H and He placements that ignore chemical and physical relationships for nearly 100% of all atoms in the universe.

Instead of enabling us to constantly see and think about the table in its 32-column full glory (SPT-32), as well as pondering the normalized split-group numbering system (and the history of the 8- and 18-column tables):



Current Group #:

1	2															3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
1 H																															2 He
3 Li	4 Be																									5 B	6 C	7 N	8 O	9 F	10 Ne
11 Na	12 Mg																			d-block						13 Al	14 Si	15 P	16 S	17 Cl	18 Ar
19 K	20 Ca															21 Sc	22 Ti	23 V	24 Cr	25 Mn	26 Fe	27 Co	28 Ni	29 Cu	30 Zn	31 Ga	32 Ge	33 As	34 Se	35 Br	36 Kr
37 Rb	38 Sr							f-block								39 Y	40 Zr	41 Nb	42 Mo	43 Tc	44 Ru	45 Rh	46 Pd	47 Ag	48 Cd	49 In	50 Sn	51 Sb	52 Te	53 I	54 Xe
55 Cs	56 Ba	57 La	58 Ce	59 Pr	60 Nd	61 Pm	62 Sm	63 Eu	64 Gd	65 Tb	66 Dy	67 Ho	68 Er	69 Tm	70 Yb	71 Lu	72 Hf	73 Ta	74 W	75 Re	76 Os	77 Ir	78 Pt	79 Au	80 Hg	81 Tl	82 Pb	83 Bi	84 Po	85 At	86 Rn
87 Fr	88 Ra	89 Ac	90 Th	91 Pa	92 U	93 Np	94 Pu	95 Am	96 Cm	97 Bk	98 Cf	99 Es	100 Fm	101 Md	102 No	103 Lr	104 Rf	105 Db	106 Sg	107 Bh	108 Hs	109 Mt	110 Ds	111 Rg	112 Cn	113 Nh	114 Fl	115 Mc	116 Lv	117 Ts	118 Og

Figure 2b: Stacking the d-periods into a synthetic d-block results in incorrect element and group relationships for the transition metals, lanthanoids, and actinoids — seen here in the **Sc-Y-Lu-Lr** full-form 32-column current table (SPT-32). The SPT-32 also includes the same ad hoc H and He placements that suggest false relationships for nearly 100% of the atoms in the universe.

Unfortunately, the unnatural stacking of all the d-periods into a single d-block has been a built-in bug, not a feature, expected of every contender for the crown of official periodic table — including the ubiquitous current, and generally worldwide-accepted, unofficially standard IUPAC (International Union of Pure and Applied Chemistry) SPT-18 variant.

This bug so thoroughly corrupts our concept of what a proper table must look like that the artificial stacking of the d-periods into a single d-block is viewed as a foundational feature of the only other seriously considered contender, the 32-column Left-Step Periodic Table (LSPT-32).

Created in 1928 by French chemist Charles Janet, the LSPT-32 variant is sometimes preferred by physicists even though (and, in fact, because) it doubles down further by adding an additional artificial (theoretical) stacking of all the s-periods into a solid s-block — directly appealing to our very deep desire to neatly order the universe the way we want it to be rather than how it is:

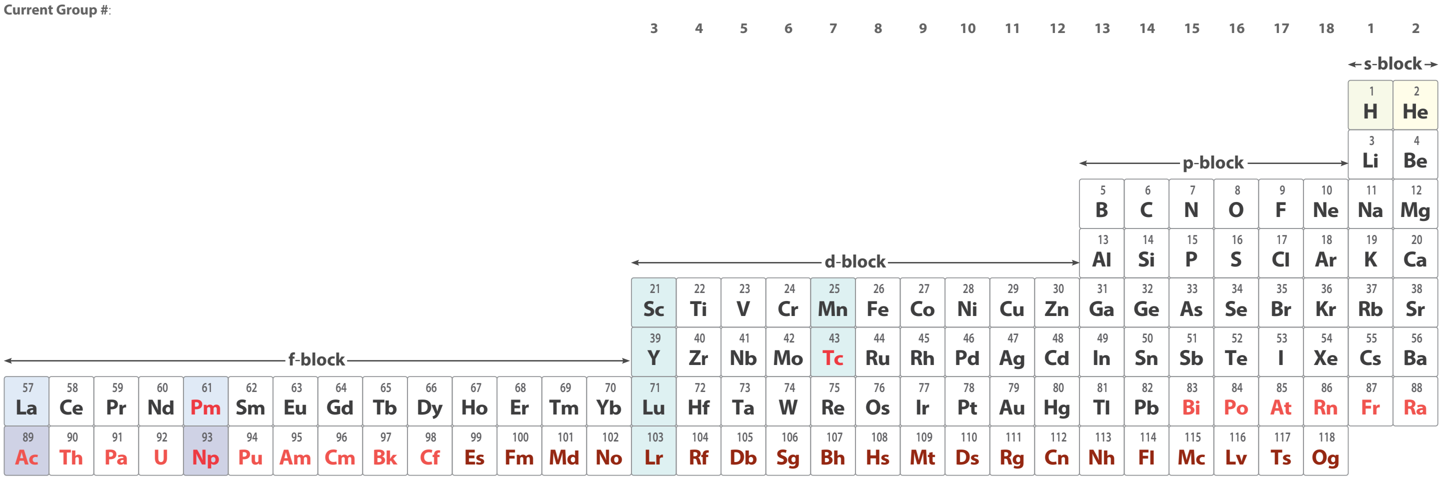


Figure 3: LSPT-32 with its eight Periods, broken group numbering, complete lack of bilateral symmetry, and artificial stacking of the d-periods as well as the s-periods (where H and He placements ignore chemical relationships for nearly 100% of all atoms).

It should always be kept in mind when looking at the collapsed print-form Standard Periodic Table (Figure 2a) — with its 18-column dropped f-block version formalized in 1944 — that this currently ubiquitous though unofficial iconic format includes admittedly incorrect physical and chemical relationships for close to 100% of the atoms in the universe (and almost 98% of the mass). Which is the same for its full form (Figure 2b).

Hydrogen (H) and Helium (He) have been judicially placed for expediency, simply because there have been no known solutions for their proper positioning despite many thousands of attempts. Just like the Scylur-Scylac Skirmishes, the placement of H and He are Periodic Table Forever Wars, where the accepted standard SPT-18 has the universe's two primary main elements synthetically situated to satisfy bilateral symmetry desires — as there is no possible consensus with the current format on where they should actually be placed and we have surrendered over finding a solution and settled for an uneasy truce.

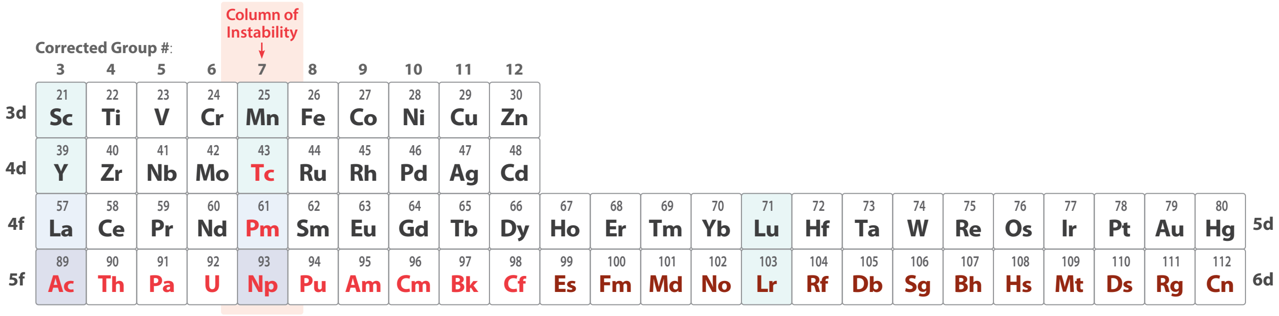
The Left-Step Periodic Table (Figure 3) contains similarly manufactured placements for H and He, though here based entirely on physically theoretical and organizational desires that entirely ignore chemical relationships, making this artificial variant even closer to 100% inaccurate.

Ending the Scylur-Scylac Debate

As we must continually adapt and scientifically reorient ourselves to the fact that the natural universe does not care how we wish it was, breaking tradition with the apopheniac sunk-cost fallacy of artificially stacking the d-periods into a solid d-block (Figures 1a-b, 2a-b, and 3) helps lead to an objective and descriptive means to verify which set of elements realistically belong in the current Group 3.

The out of sight, out of mind visual-mental obscuration of the true full form of the standard 32-column table (SPT-32) appears to be the main reason there have been so few (and mostly quantum-related) attempts to explain the seemingly random locations of entirely unstable 4d-period Technetium (Tc) and 4f-period Promethium (Pm).

However, correctly configuring the d-period and f-period positions instantly fixes these radioactive elements into their natural positions (supporting the Mattauch Isobar Rule), and is key to ending the Scylur-Scylac (current Group 3) Skirmishes while simultaneously developing a more scientifically descriptive periodic table. When the relationships between the d- and f-periods are correctly (non-synthetically) located — resulting in the reinforcing additional discovery of the Column of Instability (Mn-Tc-Pm-Np) — the protracted debate resolves for the naturally occurring Scylac ordering versus the artificially invented Scylur positioning (see Appendix F):



Corrected Group #:	3	4	5	6	7	8	9	10	11	12															
3d	21 Sc	22 Ti	23 V	24 Cr	25 Mn	26 Fe	27 Co	28 Ni	29 Cu	30 Zn															
4d	39 Y	40 Zr	41 Nb	42 Mo	43 Tc	44 Ru	45 Rh	46 Pd	47 Ag	48 Cd															
4f	57 La	58 Ce	59 Pr	60 Nd	61 Pm	62 Sm	63 Eu	64 Gd	65 Tb	66 Dy	67 Ho	68 Er	69 Tm	70 Yb	71 Lu	72 Hf	73 Ta	74 W	75 Re	76 Os	77 Ir	78 Pt	79 Au	80 Hg	5d
5f	89 Ac	90 Th	91 Pa	92 U	93 Np	94 Pu	95 Am	96 Cm	97 Bk	98 Cf	99 Es	100 Fm	101 Md	102 No	103 Lr	104 Rf	105 Db	106 Sg	107 Bh	108 Hs	109 Mt	110 Ds	111 Rg	112 Cn	6d

Figure 4a: The natural placement of the d- and f-periods unearths the reinforcing Column of Instability and results in corrected relationships for the current Groups 3–12 transition metals, lanthanoids, and actinoids.

However, it should be noted that though the resolution ends in favour of the Skylac proponents, the correct natural ordering was not and could not be proven by any previously proposed theoretical or technical argument. Instead, as is so often the case, the discovery of the Column of Instability (Mn–Np) was accomplished in large part due to the often thankless efforts of experimental chemists and physicists.

Here again we stand on the shoulders of giants: first with English physicist Henry Moseley's breakthrough confirmation in 1914 that there were indeed missing elements with atomic numbers 43 and 61; followed up by the discovery in 1937 of the first of these radioactive elements, Technetium (^{43}Tc), by Italian chemist Carlo Perrier and physicist Emilio Segrè; and completed in 1945 with the production of this second unknown element with no stable isotopes, Promethium (^{61}Pm), by American chemists Jacob Marinsky, Lawrence Glendenin, and Charles Coryell.

These two unstable elements are themselves positioned within the much broader and protracted discoveries of the d-periods and f-periods. While 5d-element Gold (Au) was known and used by humans since at least the Paleolithic period (40,000 BC), Swedish chemist Carl Mosander first discovered 4f-element La in 1839. Lanthanum was found while studying a compound of 4f-element Cerium (Ce), which was itself discovered in 1803 by Swedish chemist Jöns Berzelius — who also discovered Selenium and Thorium, as well as introducing the modern chemical symbol nomenclature still used today (such as Se for Selenium).

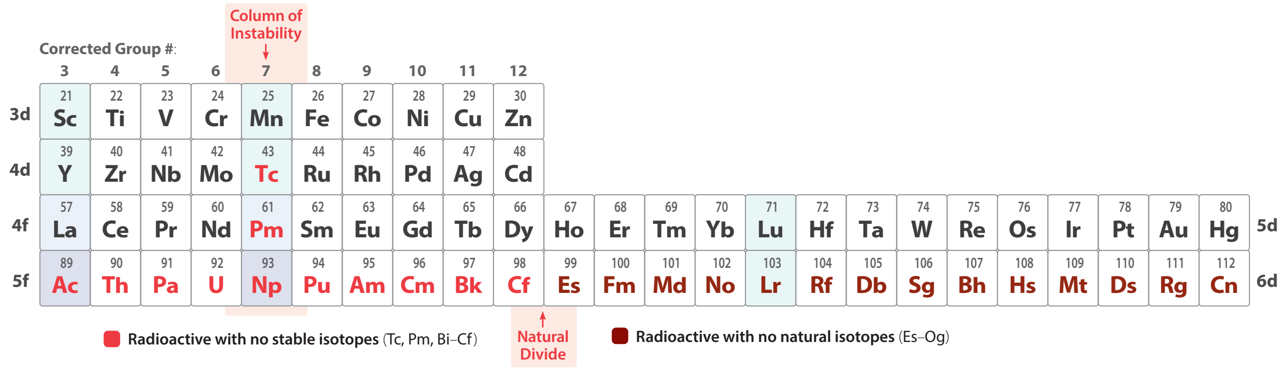
Mosander's further discovery of Erbium and Terbium unleashed the 4f Lanthanoid-series elements (by using German chemists Robert Bunsen and Gustav Kirchhoff's improved spectroscope) that were not fully understood until Moseley's X-ray spectroscopy work in 1913.

Though 5f Uranium (U) was discovered in 1789, its placement in the periodic table was misunderstood and it was initially thought to be a fourth series of transition metals. The discovery of the rest of the 5f-elements, the actinoids, is a story of 20th-century nuclear chemistry and physics, as most were first created synthetically in laboratories before being found in nature.

American chemist Glenn Seaborg began synthesizing new elements during the Manhattan Project in the 1940s, and eventually proposed the 'actinide concept,' suggesting they were part of a new inner transition series (similar to the lanthanoids) where the 5f orbitals were being filled.

Beginning with Neptunium and Plutonium in 1940, most of the actinoids were discovered in the years that followed at institutions like the University of California, Berkeley, and the Argonne National Laboratory. On the basis of electron structures, Seaborg proposed in 1944 that a new row (the Actinoids) be placed below the lanthanoids. While colleagues were skeptical, his predictions for the chemical properties of subsequent new elements proved correct, leading to a redrawing of the periodic table — disconnecting the f-periods and placing them below the rest of the elements.

The corrected placement of the d-periods and f-periods not only uncovers the Column of Instability (Mn-Tc-Pm-Np) but also reveals the Natural Divide between the Cf (naturally found) and Es (synthetically manufactured) radioactive elements — as well as a possible relationship with the now properly grouped Zn-Cd-Dy-Cf:

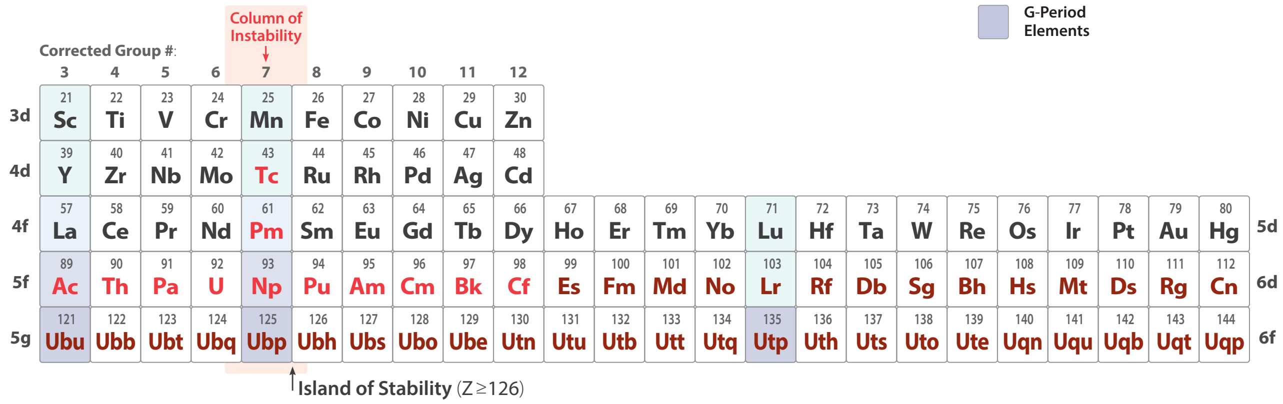


Corrected Group #:	3	4	5	6	7	8	9	10	11	12															
3d	21 Sc	22 Ti	23 V	24 Cr	25 Mn	26 Fe	27 Co	28 Ni	29 Cu	30 Zn															
4d	39 Y	40 Zr	41 Nb	42 Mo	43 Tc	44 Ru	45 Rh	46 Pd	47 Ag	48 Cd															
4f	57 La	58 Ce	59 Pr	60 Nd	61 Pm	62 Sm	63 Eu	64 Gd	65 Tb	66 Dy	67 Ho	68 Er	69 Tm	70 Yb	71 Lu	72 Hf	73 Ta	74 W	75 Re	76 Os	77 Ir	78 Pt	79 Au	80 Hg	5d
5f	89 Ac	90 Th	91 Pa	92 U	93 Np	94 Pu	95 Am	96 Cm	97 Bk	98 Cf	99 Es	100 Fm	101 Md	102 No	103 Lr	104 Rf	105 Db	106 Sg	107 Bh	108 Hs	109 Mt	110 Ds	111 Rg	112 Cn	6d

Figure 4b: The natural placement of the d- and f-periods unearths the Column of Instability (Mn-Tc-Pm-Np) as well as the Natural Divide between the Cf (natural) and Es (synthetic) radioactive elements.

As we will discuss later (Rule 16), a natural (and therefore scientific) table must necessarily affirm both Chemistry and Physics, and the proper placement of the d- and f-periods uncovers the physical radioactivity of the Column of Instability as well as the physical radioactivity of the Natural Divide.

The corrected form further reveals support for the recently proposed Island(s) of Stability of theoretical physics as being located Z > 125, or at least Z ≠ 125:



Corrected Group #:	3	4	5	6	7	8	9	10	11	12															
3d	21 Sc	22 Ti	23 V	24 Cr	25 Mn	26 Fe	27 Co	28 Ni	29 Cu	30 Zn															
4d	39 Y	40 Zr	41 Nb	42 Mo	43 Tc	44 Ru	45 Rh	46 Pd	47 Ag	48 Cd															
4f	57 La	58 Ce	59 Pr	60 Nd	61 Pm	62 Sm	63 Eu	64 Gd	65 Tb	66 Dy	67 Ho	68 Er	69 Tm	70 Yb	71 Lu	72 Hf	73 Ta	74 W	75 Re	76 Os	77 Ir	78 Pt	79 Au	80 Hg	5d
5f	89 Ac	90 Th	91 Pa	92 U	93 Np	94 Pu	95 Am	96 Cm	97 Bk	98 Cf	99 Es	100 Fm	101 Md	102 No	103 Lr	104 Rf	105 Db	106 Sg	107 Bh	108 Hs	109 Mt	110 Ds	111 Rg	112 Cn	6d
5g	121 Ubu	122 Ubb	123 Ubt	124 Ubq	125 Ubp	126 Ubh	127 Ubs	128 Ubo	129 Ube	130 Utn	131 Utu	132 Utb	133 Utt	134 Utq	135 Utp	136 Uth	137 Uts	138 Uto	139 Ute	140 Uqn	141 Uqu	142 Uqb	143 Uqt	144 Uqp	6f

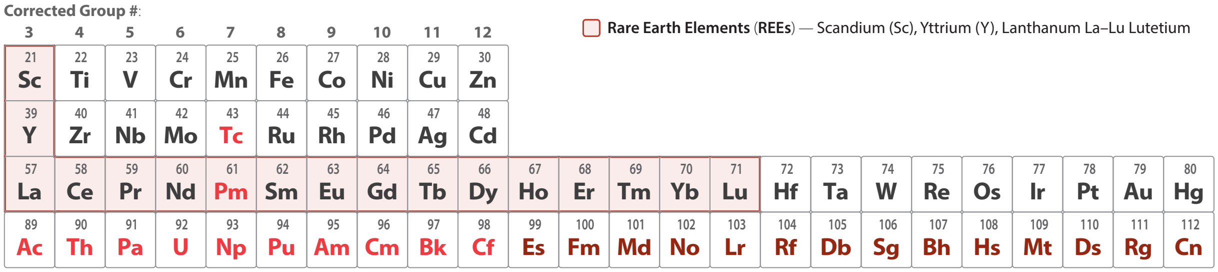
Figure 4c: The natural placement of the d- and f-periods also unearths the extended Column of Instability (Mn-Tc-Pm-Np-125), supporting the theoretical Islands of Stability as potentially existing at Z ≥ 126.

Just as there are doubts about ever discovering an optimum periodic table (understandable considering the amount of time and efforts that have been put in), there are also doubts of ever discovering any 5g-period elements — or even of synthesizing one of the two 8s-period elements — mostly due to completionist beliefs that the table is now full and any further experimentation is therefore either pointless or doomed to fail.

However, history teaches us never to underestimate the creative resourcefulness of experimental chemists and physicists and their evolving technical capabilities; we need to understand why the universe is the way it is and not how we want it to be; and this paper will propose a potentially objective solution that might help begin removing convictions that the periodic table has been completed or finished with its current form.

Properly placing and then exploring the correct chemical and physical relationships between the Rare Earth Elements (REE) — a historical misnomer as they aren't at all rare — isn't merely an aesthetic choice but a fundamental directive considering the monumental impacts these critically important metals have had and will continue to have on future science, research, experiments, technologies, and geopolitics.

A stronger acronym to describe these elements might then be the **MEDIATES** (Magnetic Essential Dispersed Integral Advanced Technology Economically Strategic) **Earth Metals**. Though, considering these indispensable specialty metals are plentiful yet scattered throughout specific regions and as difficult to bargain or trade for as they are to extract, the M could also stand for Monopolized.



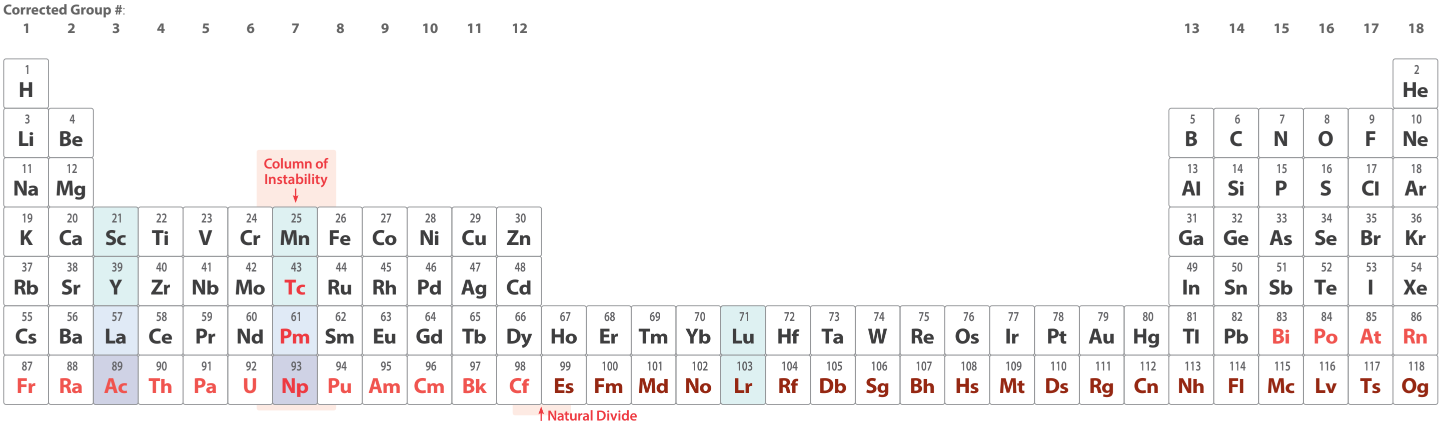
Corrected Group #:

☐ **Rare Earth Elements** (**REEs**) — Scandium (Sc), Yttrium (Y), Lanthanum La–Lu Lutetium

	3	4	5	6	7	8	9	10	11	12															
3d	21 Sc	22 Ti	23 V	24 Cr	25 Mn	26 Fe	27 Co	28 Ni	29 Cu	30 Zn															
4d	39 Y	40 Zr	41 Nb	42 Mo	43 Tc	44 Ru	45 Rh	46 Pd	47 Ag	48 Cd															
4f	57 La	58 Ce	59 Pr	60 Nd	61 Pm	62 Sm	63 Eu	64 Gd	65 Tb	66 Dy	67 Ho	68 Er	69 Tm	70 Yb	71 Lu	72 Hf	73 Ta	74 W	75 Re	76 Os	77 Ir	78 Pt	79 Au	80 Hg	5d
5f	89 Ac	90 Th	91 Pa	92 U	93 Np	94 Pu	95 Am	96 Cm	97 Bk	98 Cf	99 Es	100 Fm	101 Md	102 No	103 Lr	104 Rf	105 Db	106 Sg	107 Bh	108 Hs	109 Mt	110 Ds	111 Rg	112 Cn	6d

Figure 4d: The correct placement of the d- and f-periods maintains the known Rare Earth Element relationships without requiring the introduction of the more recently suggested artificial split d-block variation (Figure 1b).

The full 32-column Corrected Standard Periodic Table (CSPT-32) positions the 58 transition metals, lanthanoids, and actinoids into their natural d- and f-period arrangements, as well as revealing their properly integrated group and periodic relationships:



Corrected Group #:

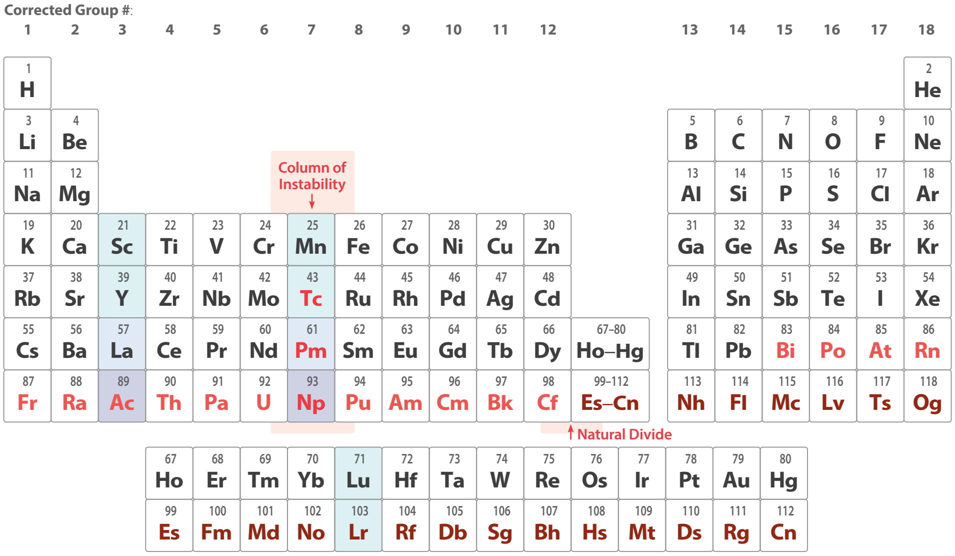
Column of Instability ↓

1	2	3	4	5	6	7	8	9	10	11	12															13	14	15	16	17	18
1 H																															2 He
3 Li	4 Be																									5 B	6 C	7 N	8 O	9 F	10 Ne
11 Na	12 Mg																									13 Al	14 Si	15 P	16 S	17 Cl	18 Ar
19 K	20 Ca	21 Sc	22 Ti	23 V	24 Cr	25 Mn	26 Fe	27 Co	28 Ni	29 Cu	30 Zn															31 Ga	32 Ge	33 As	34 Se	35 Br	36 Kr
37 Rb	38 Sr	39 Y	40 Zr	41 Nb	42 Mo	43 Tc	44 Ru	45 Rh	46 Pd	47 Ag	48 Cd															49 In	50 Sn	51 Sb	52 Te	53 I	54 Xe
55 Cs	56 Ba	57 La	58 Ce	59 Pr	60 Nd	61 Pm	62 Sm	63 Eu	64 Gd	65 Tb	66 Dy	67 Ho	68 Er	69 Tm	70 Yb	71 Lu	72 Hf	73 Ta	74 W	75 Re	76 Os	77 Ir	78 Pt	79 Au	80 Hg	81 Tl	82 Pb	83 Bi	84 Po	85 At	86 Rn
87 Fr	88 Ra	89 Ac	90 Th	91 Pa	92 U	93 Np	94 Pu	95 Am	96 Cm	97 Bk	98 Cf	99 Es	100 Fm	101 Md	102 No	103 Lr	104 Rf	105 Db	106 Sg	107 Bh	108 Hs	109 Mt	110 Ds	111 Rg	112 Cn	113 Nh	114 Fl	115 Mc	116 Lv	117 Ts	118 Og

↑Natural Divide

Figure 5a: With the Corrected Standard Periodic Table (CSPT-32), the natural placement of the d- and f-periods maintains Group 3 **Sc**, **Y**, **La**, and **Ac** ordering, corrects Groups 4–12 ordering, and uncovers the Column of Instability and Natural Divide.

As does the more visually appealing (near symmetrical and width-conscious) collapsed print-form CSPT-18, which also highlights reevaluating the artificial conventional displacement of the 14 f- and d-period columns that are ignored and skipped over (expediently not worthy of Group status), compounding the traditional Main Group that similarly ignores the transitions by jumping from 1–2 to 13–18 (an 8-column table leftover legacy):



Corrected Group #:

Column of Instability ↓

1	2	3	4	5	6	7	8	9	10	11	12		13	14	15	16	17	18
1 H																		2 He
3 Li	4 Be												5 B	6 C	7 N	8 O	9 F	10 Ne
11 Na	12 Mg												13 Al	14 Si	15 P	16 S	17 Cl	18 Ar
19 K	20 Ca	21 Sc	22 Ti	23 V	24 Cr	25 Mn	26 Fe	27 Co	28 Ni	29 Cu	30 Zn		31 Ga	32 Ge	33 As	34 Se	35 Br	36 Kr
37 Rb	38 Sr	39 Y	40 Zr	41 Nb	42 Mo	43 Tc	44 Ru	45 Rh	46 Pd	47 Ag	48 Cd		49 In	50 Sn	51 Sb	52 Te	53 I	54 Xe
55 Cs	56 Ba	57 La	58 Ce	59 Pr	60 Nd	61 Pm	62 Sm	63 Eu	64 Gd	65 Tb	66 Dy	67–80 Ho–Hg	81 Tl	82 Pb	83 Bi	84 Po	85 At	86 Rn
87 Fr	88 Ra	89 Ac	90 Th	91 Pa	92 U	93 Np	94 Pu	95 Am	96 Cm	97 Bk	98 Cf	99–112 Es–Cn	113 Nh	114 Fl	115 Mc	116 Lv	117 Ts	118 Og

↑Natural Divide

67 Ho	68 Er	69 Tm	70 Yb	71 Lu	72 Hf	73 Ta	74 W	75 Re	76 Os	77 Ir	78 Pt	79 Au	80 Hg
99 Es	100 Fm	101 Md	102 No	103 Lr	104 Rf	105 Db	106 Sg	107 Bh	108 Hs	109 Mt	110 Ds	111 Rg	112 Cn

Figure 5b: The natural placement of the d- and f-periods in the 18-column collapsed print form of the Corrected Standard Periodic Table (CSPT-18) maintains Group 3 **Sc**, **Y**, **La**, and **Ac**, corrects Groups 4–12 ordering, and reveals the Column of Instability and Natural Divide — all while maintaining a more appealing bilaterally symmetrical and width-conscious form.

Now that the non-synthetic configurations of (and natural relationships between) the d- and f-periods have been uncovered, prohibiting the artificial stacking of d-periods into a d-block can be cemented into a rule and placed within a more comprehensive set of rules towards discovering an optimally scientific periodic table.

SECTION 2. **Periodic Table Rules**

The following heuristic devices are designed to facilitate natural tables and avoid artificial constructs.

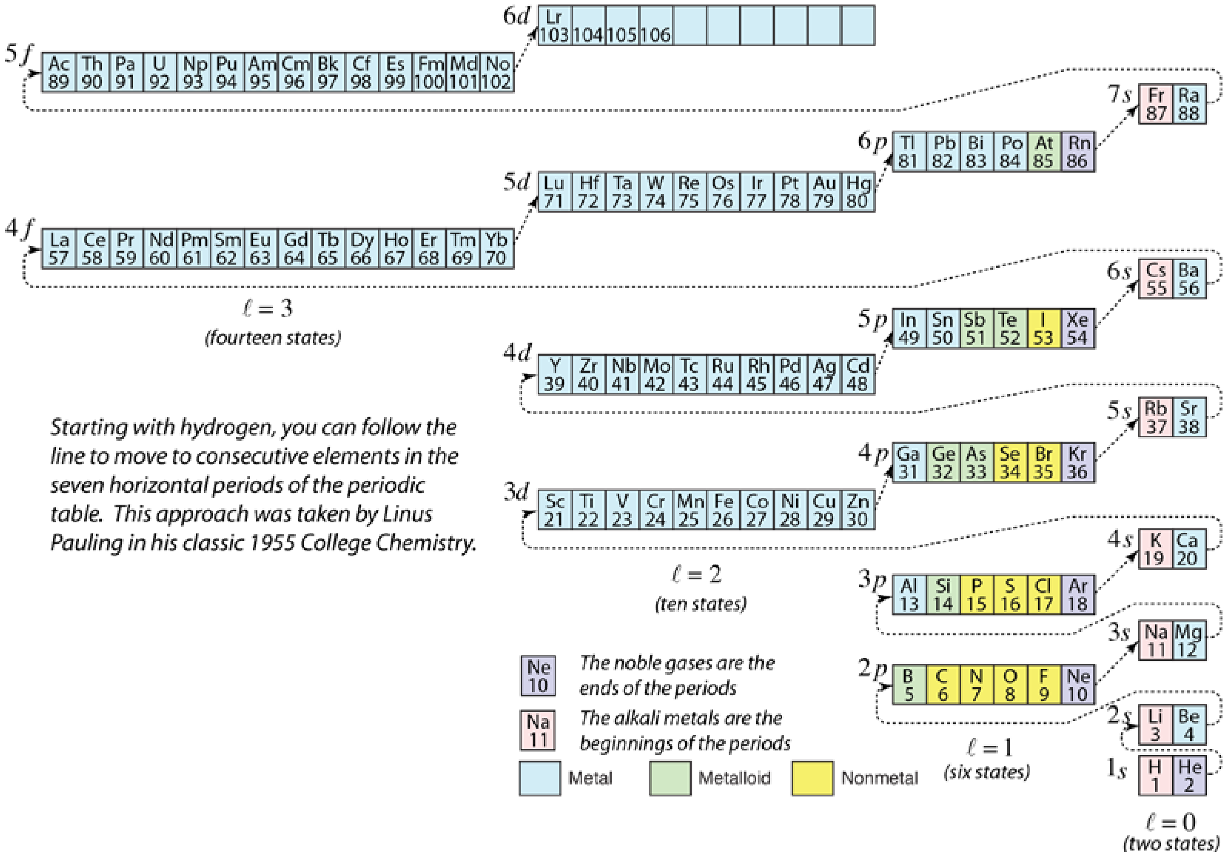
1. **Atomic Number Rule**: elements should be arranged to follow their sequentially increasing number of protons (Z). Even if unwieldy, the arrangement and design should further allow the incorporation of all isotopes (number of neutrons, N, per nuclides charts) for each element in order to maintain their informational, chemical, and physical relationships (see Rule 16).

2. **Orbital Filling Rule**: periods (with their elements) should be positioned to mirror natural orbital filling:

1s → 2s → 2p → 3s → 3p → 4s → 3d → 4p → 5s → 4d → 5p → 6s → 4f → 5d → 6p → 7s → 5f → 6d → 7p → 8s → 5g → (...)

This natural sequence of periods (and their elements) should necessarily and straightforwardly lead to a scientifically optimum periodic table.

Instead, attempts to follow this natural orbital filling, yet still strictly adhere to the organizational compulsion of stacking periods into uniform unnatural blocks (here based on the principal quantum number) requires convoluted solutions that entirely ignore the Scientific Method's fundamental admonition to follow Occam's Razor (the law of parsimony):



Starting with hydrogen, you can follow the line to move to consecutive elements in the seven horizontal periods of the periodic table. This approach was taken by Linus Pauling in his classic 1955 College Chemistry.

The noble gases are the ends of the periods

The alkali metals are the beginnings of the periods

Figure 6a: Creating an orbital filling diagram based purely on organizational adherence to the principal quantum number requires convoluted and labyrinthine constructs. Exactly like the Left-Step Periodic Table, this artificial stacking of periods into uniform blocks to satisfy the desire to neatly order like-numbered periods into their separate columns results in theoretical physical compositions that ignore natural chemical relationships.

It should be noted that this labyrinthine construct is simply Janet's Left-Step Periodic Table (LSPT-32) flipped on its head as an equally artificial construct designed to follow purely physical theories and organizational desires (following the **n + ℓ rule** and forcibly stacking the same periods into the same columns) while ignoring known chemical relationships (Rule 16).

Following the Orbital Filling Rule (2) as well as the relative energy of the electron shells (adhering to how the natural universe is rather than how we want it to be), leads to a corrected orbital filling chart that follows physical and chemical relationships rather than manufactured organizational desires:

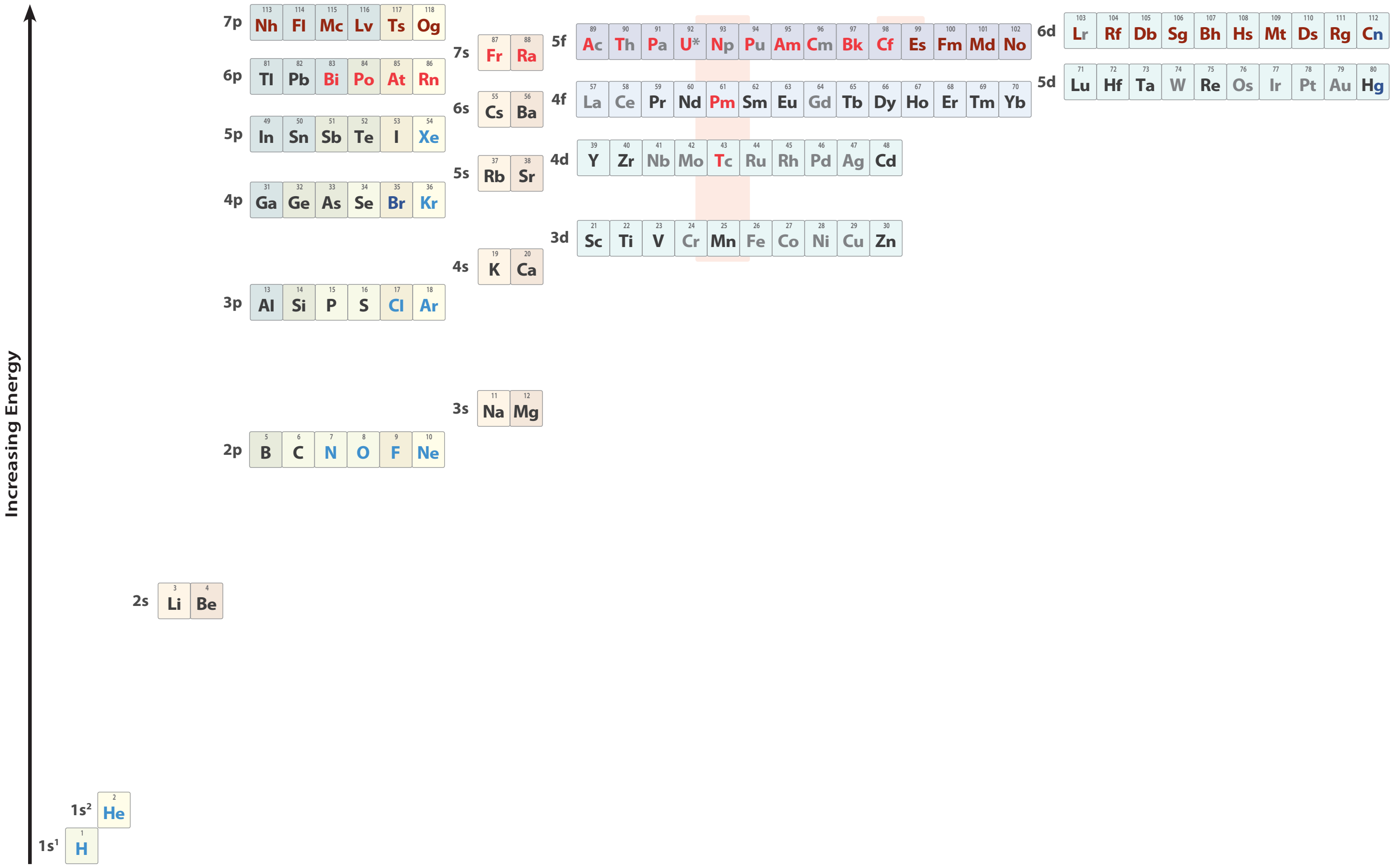


Figure 6b: Mirroring the relative energy of the electron shells leads to a corrected orbital filling chart that follows physical and chemical relationships rather than desired and imposed organizational ones.

3. **Second S Rule**: reflecting the Orbital Filling Rule (2), periods should be placed such that a new and different kind of period follows every second s-period:

2s is followed by 2p
4s is followed by 3d
6s is followed by 4f
8s is followed by 5g
(...)

4. **Bypassing Roadblocks Rule**: functionally related to the Second S Rule (3) — where two s-periods always appear before a new and different kind of period — periods (with their elements) should be placed so that every natural orbital filling roadblock is followed (bypassed) by a new and different kind of period:

0s before 1s — Free Proton Roadblock before H; Alpha Particle Roadblock before He | electron instabilities
1s before 2s — Mass-5 Roadblock before Li; Mass-8 Roadblock before Be | neutron instabilities
2p before 3s
3d before 4p
4f before 5d
5g before 6f
(...)

As per the above, the Rule 3 progression of a new and different kind of period following every second s-period can also be thought of as beginning at 0s...

Where the 1s-elements (H–He) occur after two distinct roadblocks: the 0s Free Proton (p or H^{1+}) Roadblock with one proton (one quarter-filled nuclear shell) and zero electrons (no electron shells) before $1s^1$ Hydrogen, which is substantively different to that of the 0s Alpha Particle (α or He^{2+}) Roadblock with its two protons and two neutrons (one completely filled nuclear shell) and zero electrons (no electron shells) before $1s^2$ Helium.

While the 2s-elements (Li–Be) also occur after two distinct roadblocks: the Mass-5 Roadblock (^5He and ^5Li) before ^{6}Lithium ($2s^1$), and the substantively different Mass-8 Roadblock (^8Li and ^8Be) before ^{9}Beryllium ($2s^2$).

There are no further electron roadblocks (per p and α) or neutron mass roadblocks (per 5 and 8) that prevent sequentially increasing atomic number element formation for the rest of the periodic table — which is a fundamental reason the simpler duplet $1s^1$ (H), $1s^2$ (He), and 2s-elements (Li–Be) are naturally different than the later and increasingly more complex elements.

Additionally, no further elements have stable isotopes that are so underrepresented as ^2H is for Hydrogen (only .01%) and ^3H is for Helium (only .0002%) — opening the possibility for Mass 2 and Mass 3 to be considered pre- or proto-roadblocks.

From this perspective, the entire periodic table could be viewed as a series of element formation roadblocks caused by the more physical electron (including orbitals, charges, ionizations, and relativistic effects) and neutron instabilities (such as isotopes, magic numbers, ratios, spin pairings, and radioactivities) in relation to the more chemical electron instabilities (including ions, bondings, affinities, and oxidations):

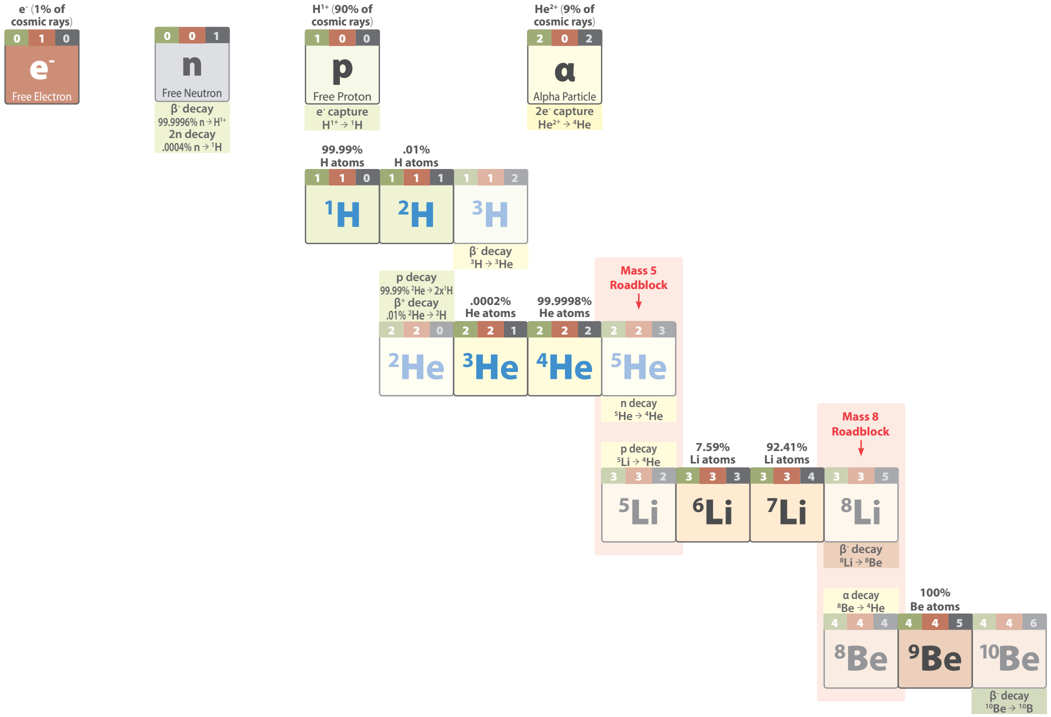
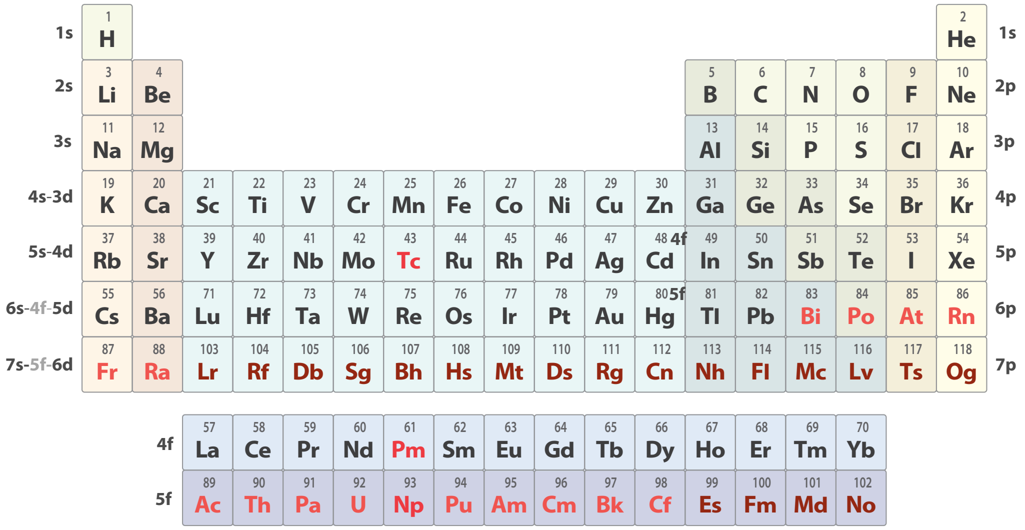


Figure 6c: Location of pre- and proto-elements including p (H^{1+}) and α (H^{2+}), and the Mass 5- and 8-Roadblocks.

After realizing an Emergent Universe model and understanding that elements evolve from and through Information → Physics → Chemistry → Biology (Rule 16), it becomes clear that Chemistry begins at the 1s-shell level with the rise of valence electron interactions:

Information < Planck level
Physics ≥ Planck level (including Free Electrons and 0s-shell Free Protons and Alpha Particles)
Chemistry ≥ 1s electron orbital shell
Biology ≥ biochemical macromolecules

5. **Transition Period Rule**: the period naming convention should be updated to more properly focus on the orbitals themselves — visually making it clear that Period 3 consists of the 3s- and 3p-periods — to help prevent an artificial period sequencing (horizontal packing) of row blocks similar to the unnatural vertical stacking of d- and s-periods (see Rule 7) into column blocks.

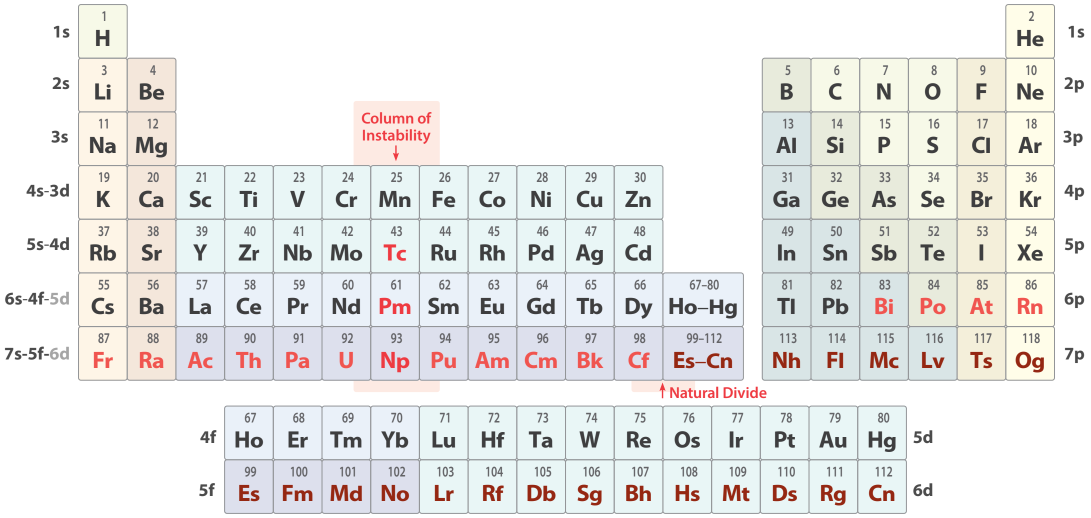


1s	1 H																	2 He	1s
2s	3 Li	4 Be											5 B	6 C	7 N	8 O	9 F	10 Ne	2p
3s	11 Na	12 Mg											13 Al	14 Si	15 P	16 S	17 Cl	18 Ar	3p
4s-3d	19 K	20 Ca	21 Sc	22 Ti	23 V	24 Cr	25 Mn	26 Fe	27 Co	28 Ni	29 Cu	30 Zn	31 Ga	32 Ge	33 As	34 Se	35 Br	36 Kr	4p
5s-4d	37 Rb	38 Sr	39 Y	40 Zr	41 Nb	42 Mo	43 Tc	44 Ru	45 Rh	46 Pd	47 Ag	48 **4f** Cd	49 In	50 Sn	51 Sb	52 Te	53 I	54 Xe	5p
6s-4f-5d	55 Cs	56 Ba	71 Lu	72 Hf	73 Ta	74 W	75 Re	76 Os	77 Ir	78 Pt	79 Au	80 **5f** Hg	81 Tl	82 Pb	83 Bi	84 Po	85 At	86 Rn	6p
7s-5f-6d	87 Fr	88 Ra	103 Lr	104 Rf	105 Db	106 Sg	107 Bh	108 Hs	109 Mt	110 Ds	111 Rg	112 Cn	113 Nh	114 Fl	115 Mc	116 Lv	117 Ts	118 Og	7p

4f	57 La	58 Ce	59 Pr	60 Nd	61 Pm	62 Sm	63 Eu	64 Gd	65 Tb	66 Dy	67 Ho	68 Er	69 Tm	70 Yb
5f	89 Ac	90 Th	91 Pa	92 U	93 Np	94 Pu	95 Am	96 Cm	97 Bk	98 Cf	99 Es	100 Fm	101 Md	102 No

Figure 7a: For the current collapsed print-form Standard Periodic Table (SPT-18), the traditional Periods 1 through 7 obscure the natural orbital and periodic relationships.

The traditional row housing of Periods 1–7 also obscures the more built-up recent realization that s- and p-period elements do not share orderly sequential characteristics within (horizontally across) their periods compared to their much stronger up-and-down vertical group trends — unlike the d-period elements which show significant trends horizontally across their periods and the f-period elements which sequentially display an even higher degree of similarity across their periods.



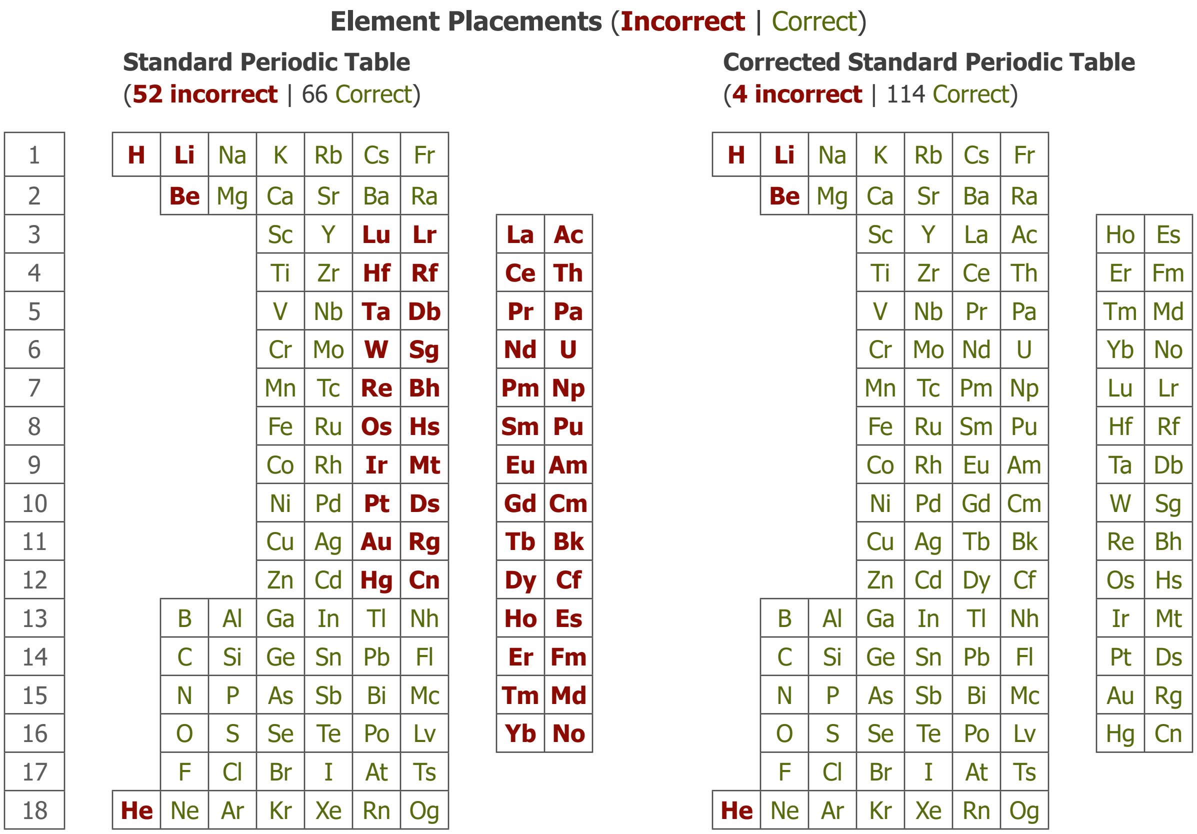
1s	1 H																		2 He	1s
2s	3 Li	4 Be													5 B	6 C	7 N	8 O	9 F	10 Ne	2p
3s	11 Na	12 Mg													13 Al	14 Si	15 P	16 S	17 Cl	18 Ar	3p
4s-3d	19 K	20 Ca	21 Sc	22 Ti	23 V	24 Cr	25 Mn	26 Fe	27 Co	28 Ni	29 Cu	30 Zn			31 Ga	32 Ge	33 As	34 Se	35 Br	36 Kr	4p
5s-4d	37 Rb	38 Sr	39 Y	40 Zr	41 Nb	42 Mo	43 Tc	44 Ru	45 Rh	46 Pd	47 Ag	48 Cd			49 In	50 Sn	51 Sb	52 Te	53 I	54 Xe	5p
6s-4f-5d	55 Cs	56 Ba	57 La	58 Ce	59 Pr	60 Nd	61 Pm	62 Sm	63 Eu	64 Gd	65 Tb	66 Dy	67–80 Ho–Hg		81 Tl	82 Pb	83 Bi	84 Po	85 At	86 Rn	6p
7s-5f-6d	87 Fr	88 Ra	89 Ac	90 Th	91 Pa	92 U	93 Np	94 Pu	95 Am	96 Cm	97 Bk	98 Cf	99–112 Es–Cn		113 Nh	114 Fl	115 Mc	116 Lv	117 Ts	118 Og	7p

4f	67 Ho	68 Er	69 Tm	70 Yb	71 Lu	72 Hf	73 Ta	74 W	75 Re	76 Os	77 Ir	78 Pt	79 Au	80 Hg	5d
5f	99 Es	100 Fm	101 Md	102 No	103 Lr	104 Rf	105 Db	106 Sg	107 Bh	108 Hs	109 Mt	110 Ds	111 Rg	112 Cn	6d

Figure 7b: With the collapsed print-form Corrected Standard Periodic Table (CSPT-18), the traditional Periods 1 through 7 obscure the orbital and periodic relationships.

This renaming would also make it clear that the only other considered contender for standard periodic table, the Left-Step (LSPT-32), consists of eight periods (Periods 1–8) that contain different orbital sequences.

6. **Splinter Group Rule**: an objective table should not contain periods where elements are artificially split up to satisfy traditional yet unnatural groups, including those containing too many exceptions to be considered groups. Following this, it might be necessary to part ways with the now straightforwardly synthetic historical group congregations of the current standard table — especially since the unnatural placements of Hydrogen in Group 1 and Helium in Group 18 already mean that the current Standard Table is known to be ≈100% incorrect, implying false relationships for the vast majority of the natural universe. With H and He artificially stacked over the Alkalis and Alkaline Earths, the LSPT contender is also ≈100% factually wrong.



Element Placements (**Incorrect** | Correct)

Standard Periodic Table
(**52 incorrect** | 66 Correct)

1	**H**	**Li**	Na	K	Rb	Cs	Fr		
2		**Be**	Mg	Ca	Sr	Ba	Ra		
3				Sc	Y	**Lu**	**Lr**	**La**	**Ac**
4				Ti	Zr	**Hf**	**Rf**	**Ce**	**Th**
5				V	Nb	**Ta**	**Db**	**Pr**	**Pa**
6				Cr	Mo	**W**	**Sg**	**Nd**	**U**
7				Mn	Tc	**Re**	**Bh**	**Pm**	**Np**
8				Fe	Ru	**Os**	**Hs**	**Sm**	**Pu**
9				Co	Rh	**Ir**	**Mt**	**Eu**	**Am**
10				Ni	Pd	**Pt**	**Ds**	**Gd**	**Cm**
11				Cu	Ag	**Au**	**Rg**	**Tb**	**Bk**
12				Zn	Cd	**Hg**	**Cn**	**Dy**	**Cf**
13		B	Al	Ga	In	Tl	Nh	**Ho**	**Es**
14		C	Si	Ge	Sn	Pb	Fl	**Er**	**Fm**
15		N	P	As	Sb	Bi	Mc	**Tm**	**Md**
16		O	S	Se	Te	Po	Lv	**Yb**	**No**
17		F	Cl	Br	I	At	Ts		
18	**He**	Ne	Ar	Kr	Xe	Rn	Og		

Corrected Standard Periodic Table
(**4 incorrect** | 114 Correct)

1	**H**	**Li**	Na	K	Rb	Cs	Fr		
2		**Be**	Mg	Ca	Sr	Ba	Ra		
3				Sc	Y	La	Ac	Ho	Es
4				Ti	Zr	Ce	Th	Er	Fm
5				V	Nb	Pr	Pa	Tm	Md
6				Cr	Mo	Nd	U	Yb	No
7				Mn	Tc	Pm	Np	Lu	Lr
8				Fe	Ru	Sm	Pu	Hf	Rf
9				Co	Rh	Eu	Am	Ta	Db
10				Ni	Pd	Gd	Cm	W	Sg
11				Cu	Ag	Tb	Bk	Re	Bh
12				Zn	Cd	Dy	Cf	Os	Hs
13		B	Al	Ga	In	Tl	Nh	Ir	Mt
14		C	Si	Ge	Sn	Pb	Fl	Pt	Ds
15		N	P	As	Sb	Bi	Mc	Au	Rg
16		O	S	Se	Te	Po	Lv	Hg	Cn
17		F	Cl	Br	I	At	Ts		
18	**He**	Ne	Ar	Kr	Xe	Rn	Og		

Figure 8: Comparing the incorrect placement of elements (and groupings) of the SPT-18 and CSPT-18.

Though, with only four imperfectly placed elements, the Corrected Standard Periodic Table (CSPT) may seem a drastic improvement over the 52 incorrectly placed elements of the current Standard Periodic Table (SPT-18), it should be remembered that Hydrogen (H) constitutes nearly 92% of the atoms and 74% of the mass in the universe, while Helium (He) constitutes approximately 8% of the atoms in the universe and 24% of its mass.

Which means that both periodic tables contain incorrect group and period chemical and physical relationships for the two elements supplying almost 98% of the mass and close to 100% of the atoms in the universe.

Along with the many chemical and physical differences between H and He and the other elements within their imposed groups (Appendices B and C), finding the proper placement of the universe's two dominant elements (along with the other fifty misplaced elements of the current standard tale) cannot just be human-centrically hand-waved away as a mere inconvenience to be ignored based on local needs, desires, concerns, or uses.

The Left-Step Periodic Table is not included in the graphic because, as stated before, the LSPT-32 almost entirely ignores chemical relationships by artificial stacking the s-periods into an s-block, the d-periods into a d-block, and the f-periods into an isolated f-block to satisfy theoretical concepts.

Similar to the Standard Table, the Left-Step also has 52 incorrectly placed elements for nearly identical reasons — not including the many artificial relationships these misplacements produce for both tables.

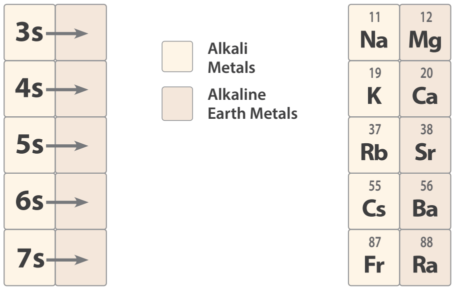
7. **Elemental Evolution Rule**: a scientifically accurate table should reflect the natural evolution of elements within the Emergent Universe (Rule 16). For example, chemically and physically unique $1s^1$ Hydrogen (H) is so fundamentally unlike the rest of its imposed Group 1 column elements that there is no realistic way in which it belongs with the Alkali Metals (see Appendix B). In fact, Hydrogen, as the first and therefore least informationally complex element to evolve, is so chemically and physically unrelated to any other element that it belongs in no group except its own.

Similarly, $1s^2$ Helium (He) does not belong in the same group column with the p^6 gases, and is equally so chemically and physical different than every other element that it too belongs in no group but its own.

Also, though to a lesser extent, $2s^1$ Li and $2s^2$ Be, as duplet elements, do not follow the **octet rule** (through the duplicating **duplet rule**) and should not be artificially stacked in the same s-block as the ≥3s-period octet gases (Rules 8a, 8b, and 9).

8. **Block Stacking Rule**: along with the Transition Periods Rule (5), which prevents the artificially packing of unrelated periods into a single horizontal period or sequence (serially connecting distinct periods), the Block Stacking Rule states that natural tables should not contain artificial stacking of unrelated periods into solid vertical blocks for purely aesthetic purposes, and consists of four parts:

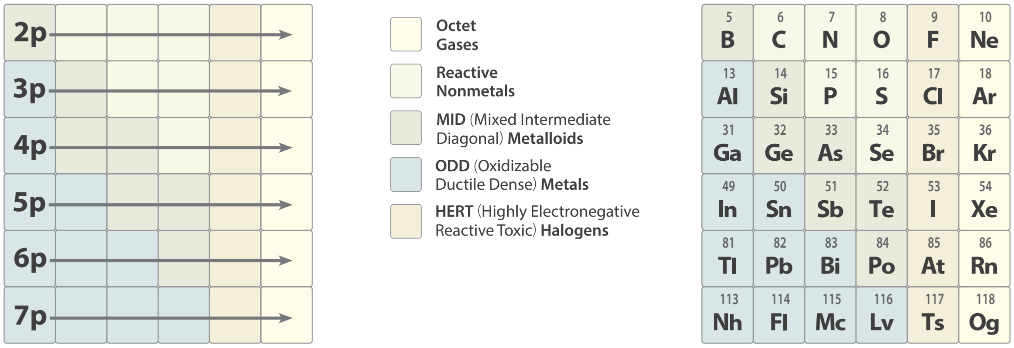
8a. **S-Block Rule**: s-periods beyond 2s (and their >2s-elements) should be stacked together in a corrected s-block to support the **octet rule** without the unnatural inclusion of physically and chemically unrelated or less-related elements such as the duplet H, He, Li, or Be;



11 Na	12 Mg
19 K	20 Ca
37 Rb	38 Sr
55 Cs	56 Ba
87 Fr	88 Ra

Figure 9a: The S-Block Rule supports the stacking of the s^1 (Na-K-Rb-Cs-Fr) and s^2 (Mg-Ca-Sr-Ba-Ra) elements of the ≥3s-periods.

8b. **P-Block Rule**: the p-periods (and their p-elements) should be stacked together in a single p-block so that they follow the **octet rule** without the unnatural inclusion of physically or chemically unrelated and unconnected elements such as H or He. Though the solid-block stacking of the p-periods is uncontroversial, the exact categorization types of its elements still are (see Section 4);



5 B	6 C	7 N	8 O	9 F	10 Ne
13 Al	14 Si	15 P	16 S	17 Cl	18 Ar
31 Ga	32 Ge	33 As	34 Se	35 Br	36 Kr
49 In	50 Sn	51 Sb	52 Te	53 I	54 Xe
81 Tl	82 Pb	83 Bi	84 Po	85 At	86 Rn
113 Nh	114 Fl	115 Mc	116 Lv	117 Ts	118 Og

Figure 9b: The P-Block Rule supports the uncontroversial stacking of the p-periods.

8c. **D- and F-Blocks Rule**: the current d-periods should not be artificially stacked into a single solid d-block but instead consist of stacked 3d- and 4d-periods over stacked 4f- and 5f-periods, which would further be placed in relation to stacked 5d- and 6d-periods to incorporate the Column of Instability; and

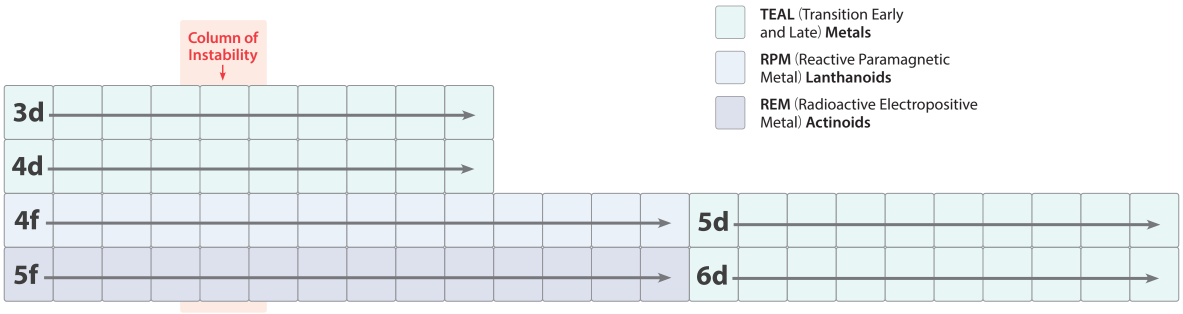


Figure 9c: The D- and F-Blocks Rule clarifies how the 3d- and 4d-periods should be stacked over the 4f- and 5f-periods and their orientation to the 5d- and 6d-periods.

8d. **Column of Instability Rule**: all periods after the s- and p-periods should be stacked in order to incorporate the Column of Instability (Mn-Tc-Pm-Np). This means that the 3d- and 4d-periods should be stacked over the 4f- and 5f-periods to form the Mn-Tc-Pm-Np Column, and then further stacked over a potential 5g-period to form the extended Column of Instability (Mn-Tc-Pm-Np-125), supporting the proposed Island(s) of Stability of recent theoretical physics as located Z > 125, or at least Z ≠ 125.

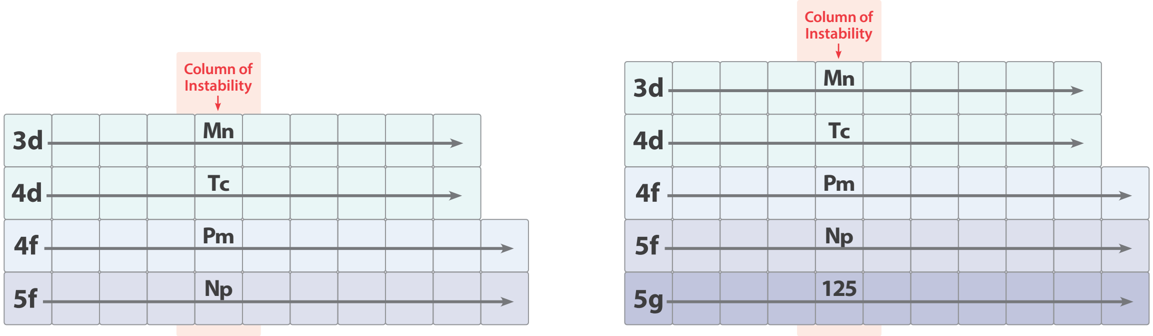


Figure 9d: The Column of Instability Rule supports and reinforces the proper positions of the d- and f-periods.

Note: Rules 8a, 8c, and 8d highlight the unnaturalness of the theoretical Janet Left-Step Periodic Table (LSPT-32) contender, with its artificially stacked d-period, f-period, and s-period blocks that sacrifice chemical group relationships for the sake of purely physical (microscopic) relationships (see Rule 16).

9. **Octet Agreement Rule**: the p-periods and s-periods should be connected so that they follow the chemical **eight-electron** (or **octet**) **rule** of thumb reflecting the theory that Main Group elements (p-periods and the connected ≥3s-periods element blocks) tend to bond in such a way that each atom has eight electrons in its valence shell (s^2p^6 or p^6s^2), giving it the same electronic configuration as noble/inert gases.

Again, 1s (He and He) and 2s (Li and Be) s-elements — which are instead controlled by the **two-electron** (or **duet** or **duplet**) **rule** where two valence (outer shell) electrons (s^2) is a more stable configuration — should not be included in the Octet Agreement Rule, as per Block Stacking Rule 8a.

This relationship may at first appear unnatural, as the structure of the Standard Periodic Tables (both 32- and 18-column), as well as the Corrected Standard Periodic Tables, visually and mentally obscure these known **octet rule** relationships, and the connected periods must be visualized as offset wraparounds shown below with the right-side dotted line (Li and Be instead following the misleadingly related **duplet rule**):

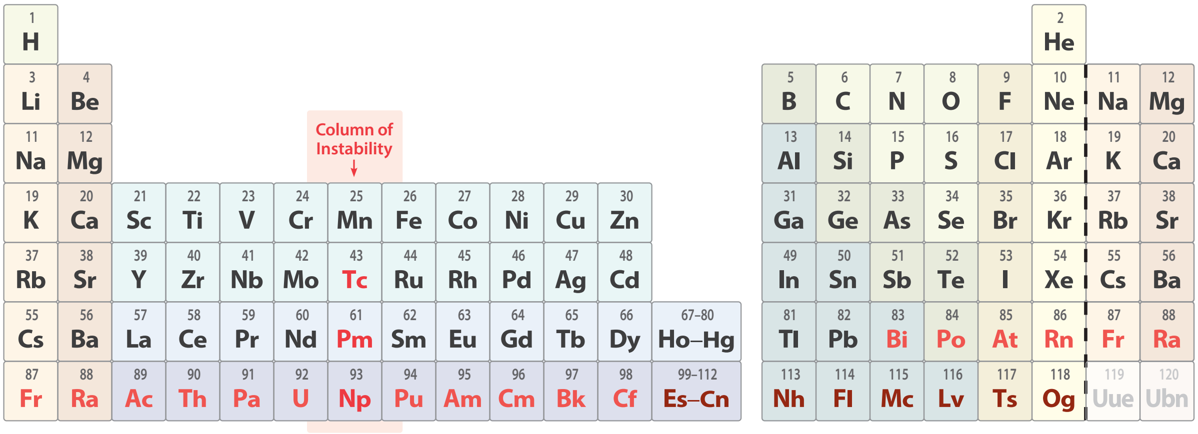


Figure 10: The Octet Agreement can be obscured unless the table is visualized as an offset wraparound.

10. **Orbital Sharing Rule**: the **18-electron rule** tends to be obeyed by transition metal molecules, which corresponds to the utilization of valence d-, s-, and p-orbitals to form bonding and non-bonding orbitals. However, unlike the **octet rule** for Main Group elements, transition metals do not closely obey this traditional

rule and the valence electron count can vary between 12 and 18 — which begs the question as to whether it's actually a rule or also just designed to similarly follow the **octet rule**. The periods for these elements should be placed so that anomalous ground state electron configurations (*including those recently calculated by German chemist W. H. Eugen Schwarz) are connected to the shared orbit periods:

Period	Name	Symbol	Z	Configuration	Period	Name	Symbol	Z	Configuration
3d	Chromium*	Cr	24	[Ar] $4s^1\ 3d^5$	**5d**	Tungsten*	W	74	[Xe] $6s^1\ 4f^{14}\ 5d^5$
	Iron*	Fe	26	[Ar] $4s^1\ 3d^7$		Osmium*	Os	76	[Xe] $6s^1\ 4f^{14}\ 5d^7$
	Cobalt*	Co	27	[Ar] $4s^1\ 3d^8$		Iridium*	Ir	77	[Xe] $6s^1\ 4f^{14}\ 5d^8$
	Nickel*	Ni	28	[Ar] $4s^1\ 3d^9$		Platinum	Pt	78	[Xe] $6s^1\ 4f^{14}\ 5d^9$
	Copper	Cu	29	[Ar] $4s^1\ 3d^{10}$		Gold	Au	79	[Xe] $6s^1\ 4f^{14}\ 5d^{10}$
4d	Niobium*	Nb	41	[Kr] $5s^1\ 4d^4$	**5f**	Actinium	Ac	89	[Rn] $7s^2\ 5f^0\ 6d^1$
	Molybdenum	Mo	42	[Kr] $5s^1\ 4d^5$		Thorium	Th	90	[Rn] $7s^2\ 5f^0\ 6d^2$
	Technetium*	Tc	43	[Kr] $5s^1\ 4d^6$		Protactinium	Po	91	[Rn] $7s^2\ 5f^2\ 6d^1$
	Ruthenium	Ru	44	[Kr] $5s^1\ 4d^7$		Uranium	U	92	[Rn] $7s^2\ 5f^3\ 6d^1$
	Rhodium*	Rh	45	[Kr] $5s^0\ 4d^9$		Neptunium	Np	93	[Rn] $7s^2\ 5f^4\ 6d^1$
	Palladium	Pd	46	[Kr] $5s^0\ 4d^{10}$		Plutonium	Pu	94	[Rn] $7s^2\ 5f^6\ 6d^0$
	Silver	Ag	47	[Kr] $5s^1\ 4d^{10}$		Curium	Cm	96	[Rn] $7s^2\ 5f^7\ 6d^1$
4f	Lanthanum	La	57	[Xe] $6s^2\ 4f^0\ 5d^1$	**6d**	Lawrencium	Lr	103	[Rn] $7s^2\ 5f^{14}\ 6d^0\ 7p^1$
	Cerium	Ce	58	[Xe] $6s^2\ 4f^1\ 5d^1$					
	Gadolinium	Gd	64	[Xe] $6s^2\ 4f^7\ 5d^1$					

Figure 11a: Orbital shell sharing for the 3d-, 4d-, 4f-, 5d-, 5f-, and 6d-periods (including the recent Schwarz calculations).

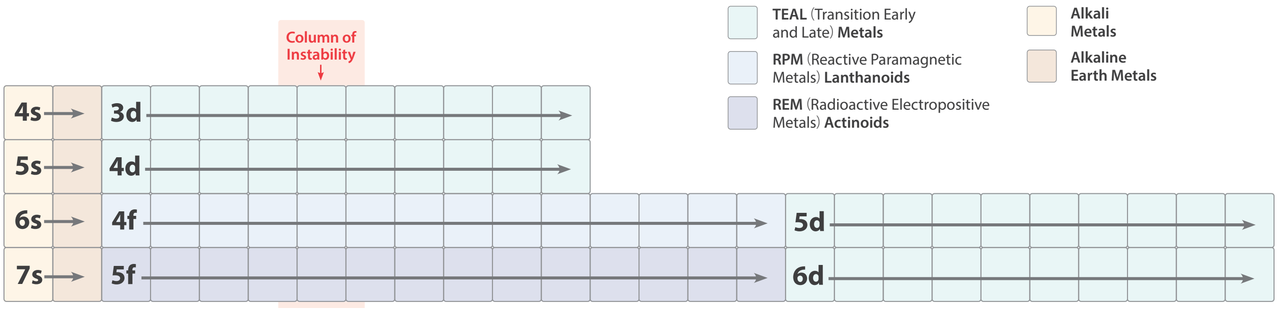
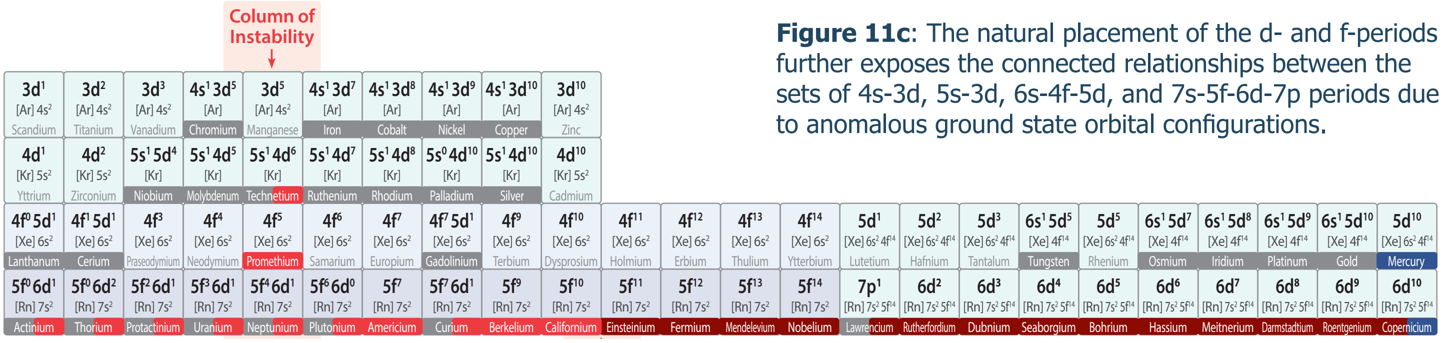


Figure 11b: The natural placement of the d- and f-periods further exposes the connected relationships between the sets of 4s-3d, 5s-4d, 6s-4f-5d, and 7s-5f-6d-7p period sequences.

10a. the 3d-period anomalies (Cr, Fe, Co, Ni, Cu) share shells with the 4s-period;
10b. the 4d-period anomalies (Nb, Mo, Tc, Ru, Rh, Pd, Ag) share shells with the 5s-period;
10c. the 4f-period anomalies (La, Ce, Gd) share shells with the 5d-period;
10d. the 5d-period anomalies (W, Os, Ir, Pt, Au) share shells with the 6s-period;
10e. the 5f-period anomalies (Ac, Th, Po, U, Np, Pu, Cm) share shells with the 6d-period; and
10f. the 6d-period anomaly (Lr) shares shells with the 7p-period:



$3d^1$ [Ar] $4s^2$ Scandium	$3d^2$ [Ar] $4s^2$ Titanium	$3d^3$ [Ar] $4s^2$ Vanadium	$4s^1\ 3d^5$ [Ar] Chromium	$3d^5$ [Ar] $4s^2$ Manganese	$4s^1\ 3d^7$ [Ar] Iron	$4s^1\ 3d^8$ [Ar] Cobalt	$4s^1\ 3d^9$ [Ar] Nickel	$4s^1\ 3d^{10}$ [Ar] Copper	$3d^{10}$ [Ar] $4s^2$ Zinc														
$4d^1$ [Kr] $5s^2$ Yttrium	$4d^2$ [Kr] $5s^2$ Zirconium	$5s^1\ 5d^4$ [Kr] Niobium	$5s^1\ 4d^5$ [Kr] Molybdenum	$5s^1\ 4d^6$ [Kr] Technetium	$5s^1\ 4d^7$ [Kr] Ruthenium	$5s^1\ 4d^8$ [Kr] Rhodium	$5s^0\ 4d^{10}$ [Kr] Palladium	$5s^1\ 4d^{10}$ [Kr] Silver	$4d^{10}$ [Kr] $5s^2$ Cadmium														
$4f^0\ 5d^1$ [Xe] $6s^2$ Lanthanum	$4f^1\ 5d^1$ [Xe] $6s^2$ Cerium	$4f^3$ [Xe] $6s^2$ Praseodymium	$4f^4$ [Xe] $6s^2$ Neodymium	$4f^5$ [Xe] $6s^2$ Promethium	$4f^6$ [Xe] $6s^2$ Samarium	$4f^7$ [Xe] $6s^2$ Europium	$4f^7\ 5d^1$ [Xe] $6s^2$ Gadolinium	$4f^9$ [Xe] $6s^2$ Terbium	$4f^{10}$ [Xe] $6s^2$ Dysprosium	$4f^{11}$ [Xe] $6s^2$ Holmium	$4f^{12}$ [Xe] $6s^2$ Erbium	$4f^{13}$ [Xe] $6s^2$ Thulium	$4f^{14}$ [Xe] $6s^2$ Ytterbium	$5d^1$ [Xe] $6s^2\ 4f^{14}$ Lutetium	$5d^2$ [Xe] $6s^2\ 4f^{14}$ Hafnium	$5d^3$ [Xe] $6s^2\ 4f^{14}$ Tantalum	$6s^1\ 5d^5$ [Xe] $4f^{14}$ Tungsten	$5d^5$ [Xe] $6s^2\ 4f^{14}$ Rhenium	$6s^1\ 5d^7$ [Xe] $4f^{14}$ Osmium	$6s^1\ 5d^8$ [Xe] $4f^{14}$ Iridium	$6s^1\ 5d^9$ [Xe] $4f^{14}$ Platinum	$6s^1\ 5d^{10}$ [Xe] $4f^{14}$ Gold	$5d^{10}$ [Xe] $6s^2\ 4f^{14}$ Mercury
$5f^0\ 6d^1$ [Rn] $7s^2$ Actinium	$5f^0\ 6d^2$ [Rn] $7s^2$ Thorium	$5f^2\ 6d^1$ [Rn] $7s^2$ Protactinium	$5f^3\ 6d^1$ [Rn] $7s^2$ Uranium	$5f^4\ 6d^1$ [Rn] $7s^2$ Neptunium	$5f^6\ 6d^0$ [Rn] $7s^2$ Plutonium	$5f^7$ [Rn] $7s^2$ Americium	$5f^7\ 6d^1$ [Rn] $7s^2$ Curium	$5f^9$ [Rn] $7s^2$ Berkelium	$5f^{10}$ [Rn] $7s^2$ Californium	$5f^{11}$ [Rn] $7s^2$ Einsteinium	$5f^{12}$ [Rn] $7s^2$ Fermium	$5f^{13}$ [Rn] $7s^2$ Mendelevium	$5f^{14}$ [Rn] $7s^2$ Nobelium	$7p^1$ [Rn] $7s^2\ 5f^{14}$ Lawrencium	$6d^2$ [Rn] $7s^2\ 5f^{14}$ Rutherfordium	$6d^3$ [Rn] $7s^2\ 5f^{14}$ Dubnium	$6d^4$ [Rn] $7s^2\ 5f^{14}$ Seaborgium	$6d^5$ [Rn] $7s^2\ 5f^{14}$ Bohrium	$6d^6$ [Rn] $7s^2\ 5f^{14}$ Hassium	$6d^7$ [Rn] $7s^2\ 5f^{14}$ Meitnerium	$6d^8$ [Rn] $7s^2\ 5f^{14}$ Darmstadtium	$6d^9$ [Rn] $7s^2\ 5f^{14}$ Roentgenium	$6d^{10}$ [Rn] $7s^2\ 5f^{14}$ Copernicium

Figure 11c: The natural placement of the d- and f-periods further exposes the connected relationships between the sets of 4s-3d, 5s-3d, 6s-4f-5d, and 7s-5f-6d-7p periods due to anomalous ground state orbital configurations.

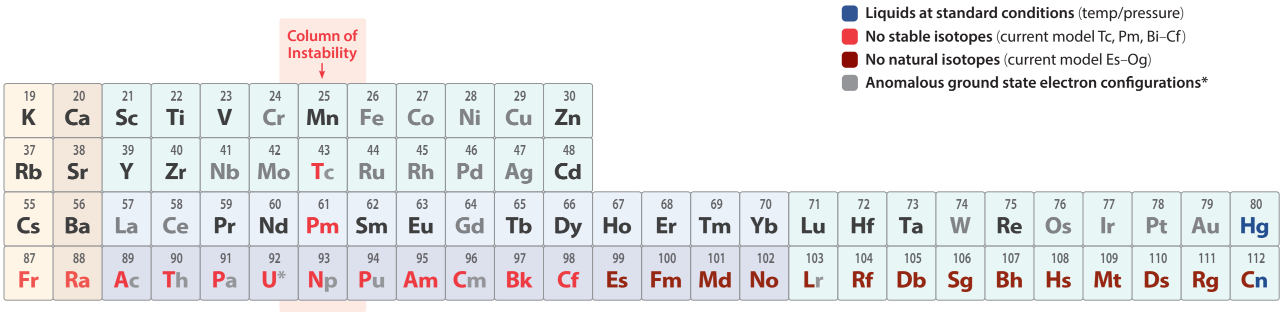
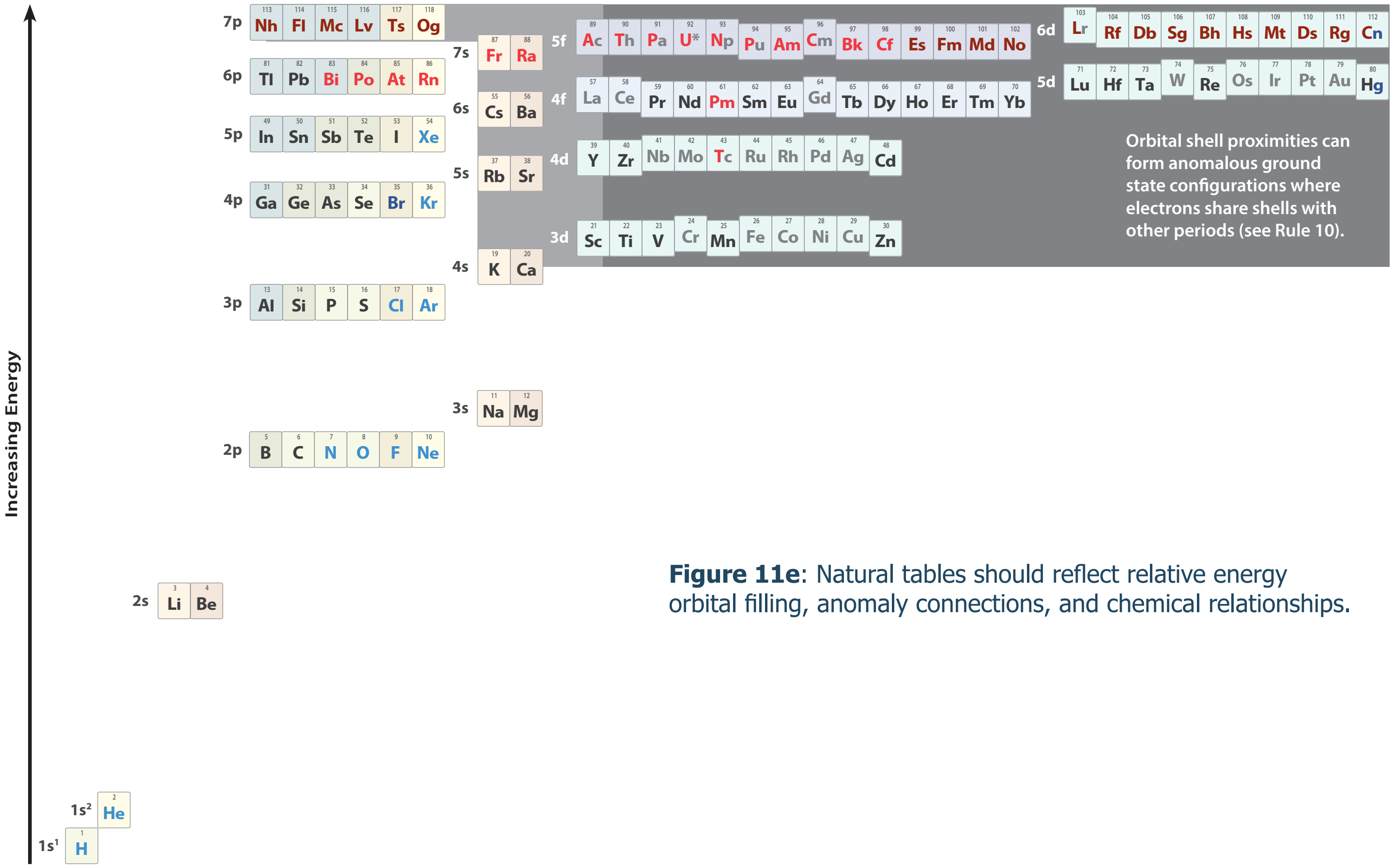


Figure 11d: The natural placement of the d- and f-periods further exposes the connected relationships between the sets of 4s-3d, 5s-3d, 6s-4f-5d, and 7s-5f-6d-7p periods due to anomalous ground state orbital configurations.

The 6d-Lr anomalously shares shells with the 7p-period, signaling the two periods need to be connected:



Orbital shell proximities can form anomalous ground state configurations where electrons share shells with other periods (see Rule 10).

Figure 11e: Natural tables should reflect relative energy orbital filling, anomaly connections, and chemical relationships.

11. **Mind the Gap Rule**: there should be no artificial gaps between elements (or periods of elements) for purely aesthetic reasons — such as unnatural spaces between groups. Janet's Left-Step Periodic Table (LSPT-32) has no such gaps which is one of the reasons it may be preferred by theoretical physicists despite not fully supporting chemical trends and relationships (see Rule 16).

Table	**Full Name**	**Artificial Gaps**
SPT-32	Standard Periodic Table (full form)	H—He | Be—B | Mg—Al | Ca—Sc | Sr—Y
SPT-18	Standard Periodic Table (collapsed print form)	H—He | Be—B | Mg—Al | Ca—Lu/Hf | Ra—Lr/Rf
CSPT-32	Corrected Standard Periodic Table (full form)	H—He | Be—B | Mg—Al | Zn—Ga | Cd—In
CSPT-18	Corrected Standard Periodic Table (collapsed print form)	H—He | Be—B | Mg—Al | Zn—Ga | Cd—In
LSPT-32	Left-Step Periodic Table	None

Figure 12: Periodic table variants and their visually artificial (and obscuration of) gaps between periods and elements.

The flip side is that there should be no missing gaps, with any natural gaps being clearly and physically indicated (with space) so they are not obscured. Current SPT variations often do not place the natural gap between the 6s-period and 5d-period (where the 4f-period should be located) or between the 7s-period and the 6d-period (where the 5f-period should be located) — instead removing and lowering the f-periods, with connecting dotted lines or similar, and thereby completely obscuring the gap to preserve bilateral symmetry.

12. **Natural Notations Rule**: to avoid obscuring chemical and physical connections, the following (as well as past, present, or future) inclusions should be visually noted to aid learning, understanding, and discoveries:

> 12a. **Period Notation Rule**: per Rule 5, the current numerical notation, where the seven Periods refer to seven horizontal rows of artificially connected though distinct period orbitals, should be updated to individually numbered and lettered natural periods (1s-period instead of Period 1);
>
> 12b. **0s Rule**: the locations of the 0s-period non-shells of the Free Proton (no stable electrons) before Hydrogen and the Alpha Particle (no stable electrons) before Helium should be visibly marked as part of placing H and He in their natural positions and to satisfy their physical relationships (Rule 16);
>
> 12c. **Mass Roadblocks Rule**: all mass roadblocks, including the Mass 5-Roadblock (no stable nucleus) before Li and the Mass-8 Roadblock (no stable nucleus) before Be, should be indicated — as they currently aren't included in any known periodic table, obscuring their natural positions and physical relationships;
>
> 12d. **Column of Instability Rule**: the discovered column should be clearly identified, highlighting the grouping relationship of the radioactive elements Tc and Pm, which may lead to research into whether the remaining stable Manganese isotope is as similarly unstable as Bismuth (or why not); and
>
> 12e. **Natural Divide Rule**: the position of the discovered Natural Divide between the Cf (naturally occurring) and Es (synthetically manufactured) radioactive elements should be indicated to help inspire interest in uncovering any potential relationship between the Natural Divide and the Zn-Cd-Dy-Cf Group uncovered after correctly configuring the d- and f-periods. The Natural Divide would be disproven and removed upon confirmed discovery that a currently considered synthetic element occurs naturally.

13. **Divergent Elements Rule**: to avoid obscuring the phase states of elements at standard conditions for temperature and pressure, those elements with anomalous ground state electron configurations, and those that are naturally or synthetically radioactive, such elements should be clearly labelled to aid learning, understanding, and discoveries:

> 13a. **Gases Rule**: clearly labelling which elements form gases (11 so far) at standard conditions might spark research into whether some underlying mechanism can be built from first principles to explain why (and not just how) they are in this state — especially within the p-block. Three possible visual solutions are given below:

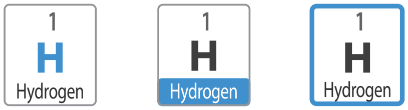


Figure 13a: Gases Rule and potential visual solutions.

> Further, visually labelling the elements forming different phases of matter at various other specific temperatures and pressures within one-offs and interactive tables would help clarify inherent trends for students and researchers;
>
> 13b. **Liquids Rule**: clearly labelling elements forming liquids (three so far) at standard conditions could inspire interest into whether some underlying mechanism can be built from first principles to

explain why (and not just how) — specifically the reasons only $4p^5$ Bromine (Br) of all the p-block elements forms such a liquid, an element not at the end of a period unlike $5d^{10}$ Mercury (Hg) and $6d^{10}$ Copernicium (Cn):

Figure 13b: potential visual solutions for the Liquids Rule.

Further, labelling the elements forming different phases of matter at various other considered temperatures and pressures within one-off and interactive tables would help clarify inherent trends for students and researchers;

13c. **Anomalous Configurations Rule**: visually indicating the many elements in (and so far only in) the d- and f-periods that form anomalous ground state electron configurations (see Rule 10) may lead to further realizations as to why;

Figure 13c: suggested visual solutions for the Anomalous Configurations Rule.

13d. **Natural Radioactives Rule**: the natural radioactive elements with no stable isotopes should be labelled more clearly than the current square bracket system (a solution created for printing in black-and-white) — as the lack of which has led, for example, to obscuring and missing the relationship between the radioactive elements Tc and Pm and the Column of Instability (Mn–125);

Figure 13d: Natural Radioactives Rule visual solutions.

13e. **Synthetic Radioactives Rule**: the synthetic (lab-created) radioactive elements with no natural isotopes should be labelled in a distinctly different manner than the natural radioactive elements — as the lack of which has so far led to missing the discovery of the Natural Divide between the Cf (naturally found) and Es (synthetically manufactured) radioactive elements, relationships between other natural and synthetic radioactives, as well as any potential relationship between the Natural Divide and the Zn-Cd-Dy-Cf Group uncovered after properly configuring the d- and f-periods;

Figure 13e: Visual solutions for the Synthetic Radioactives Rule.

13f. **Exceptional Hybrids Rule**: when elements are divergent in more than one way, there should be a hybrid visual identification system allowing users to easily discern the combined characteristics.

Figure 13f: Hybrid Rule with two potential visual solutions.

14. **Formerly-Known-as-Noble Rule**: the noble gases should no longer be misnomered because of unscientific historical beliefs concerning purity, eugenics, and bloodlines (versus modern DNA, genomics, and epigenetics) where nobles were somehow superior because they only mixed or inbred with their own kind — which translated to these gases being ideally complete because their outer eight-electron valence shell were full and thus interacted little (kept to themselves) while also not easily forming bonds with unrelated elements.

Mistakenly attaching this somehow romantic convention to such gases has led to further fallacies including inventing and then conflating the so-called **duplet rule** with the **octet rule** to justify artificially including He in the Group 18 noble/inert gases, despite He's full outer two-electron valence s-period shell being unlike the other gases with their full outer eight-electron valence p-period shells (see Appendix C).

This forced correlation has also predisposed placing these mixed duplet and octet gases to the far right in SPT and CSPT variants (Figure 10) in order to visually reinforce the idealized completionist desire for both shells and periods — which was satisfied in 2002 when a research team led by Yuri Oganessian discovered element 118, Oganesson (Og), filling in the seventh period and the 118th last empty slot of the current standard periodic table.

However, any finishing of the periodic table is (and should be) a moving target, as the Left-Step Periodic Table (LSPT-32) alone, with its artificially stacked s-block, still requires the discovery of elements 119 and 120 to satisfy the same desire for ideal completionism — which, along with its complete lack of bilateral symmetry, is another reason it hasn't been widely adopted.

As well, to just normatively decide no more elements shall be discovered is to ignore history and the progressive evolution of science through the ongoing creative efforts of experimental chemists and physicists.

15. **Keys to Success Rule**: keys should not just be thrown on the table, but instead designed to reflect evolving understandings concerning the chemical and physical natures of elements. While the types and type definitions of similar elements must necessarily continue evolving — along with the mnemonic devices to keep up with ever advancing scientific knowledge — the following acronyms may help to clarify, learn, and remember the perpetually developing elemental type classifications:

> 15a. **HYDROGEN** (**H**): the simplest element $1s^1$ Hydrogen is its own classification type with properties unlike any other element (see Appendix B), and can be represented by its name and symbol, **HYDROGEN** (High Yielding Diatomic Reducing Omnipresent Gas Explosive Neutral) **H** —
>
> Yielding High numbers of protons when ionized and through solar energy (the proton-proton chain in stars which creates Helium), Highly Yielding water when combusted, and with the Highest Yield of energy content per unit of mass, Hydrogen is Diatomic in molecular form (H_2), is a very common and important Reducing agent, is Omnipresent as the element with the greatest total mass and number of atoms in the universe, is a Gas at standard conditions, is Explosive when introduced to heat, catalysts, and sparks, and is dependably Neutral, predominantly occurring with one positive proton and one negative electron (^1H) though very rarely with an additional neutral neutron (^2H);
>
> 15b. **HELIUM** (**He**): substantively more complex than Hydrogen (including the three-body problem), and occurring with a nucleus of two protons and two neutrons orbited by two electrons (^4H), or extremely rarely with only one neutron (^3H), duplet $1s^2$ Helium is in its own group and classification with properties unlike those of any other element (see Appendix C) and can also be represented by its name and symbol, **HELIUM** (Highest-Energy Low-Interacting Uniquely Monatomic) **He** —
>
> Too stable for most chemical reactions (with the highest inertness/stability), Helium has the Highest first ionization Energy of any element, a significant amount of Energy is required to excite its electrons to Higher levels, and has very High nuclear-binding Energy per nucleon, which is why it's an incredibly stable nucleus and a product of both nuclear fusion (in stars where its formation from Hydrogen releases exponentially immense amounts of energy) and radioactive decay (where the emission of Helium nuclei alpha particles releases large amounts of energy), its Low-Interaction in almost all chemical and physical contexts is a defining hallmark, it is incredibly Unique compared to all other elements (including exhibiting the lowest boiling and melting points, as well as entering a state of superfluidity below 2.17K), and is Monatomic under normal conditions;
>
> 15c. **Lithium** (**Li**): though it shares distant chemical similarities with the more complex 3s–7s-period octet elements (see Appendix D), $2s^1$ Li is its own duplet element as per English chemist Eric Scerri's

enhanced uniqueness effect required of the first elements, and can be represented by its name and symbol **LITHIUM** (Lightest Ionic Tarnishing Hydridic Igniting Unstable Monovalent) **Li** —

The Lightest of all metals, Lithium easily forms Ions and Ionic bonds and compounds when reacting with nonmetals, Tarnishes rapidly when exposed to air and moisture, readily forms Hydrides, is highly flammable and Ignites through thermal runaway, is chemically Unstable (highly reactive), and with a hallmark property of Monovalency (having only one s-electron in its second/outermost shell);

15d. **Beryllium** (**Be**): $2s^2$ Be is its own duplet type, per Scerri's enhanced uniqueness effect required of the first elements, even if in a chemically distant relationship with the more complex 3s–7s-period octet elements (see Appendix E), and can be remembered by its own name and symbol, **BERYLLIUM** (Bivalent Electronegative Radiolucent Young's Light Low Insoluble Unusual Malignant) **Be** —

Its Bivalent cation nature a defining chemical property, Beryllium has unusually high Electronegativity for a metal (especially for an alkaline earth metal), is Radiolucently transparent to electromagnetic radiation, has the highest Young's Modulus stiffness to-weight ratio (6x stiffer than steel), is very Light as the fourth element (while also very strong), has very Low neutron absorption, thermal expansion, and density, is Insoluble in water and most common solvents, has a distinctively Unusual covalent character (due to its small size, high charge density, and electronegativity), and is extremely Malignant towards humans (as a carcinogenic dust causing incurable Beryllium Disease);

15e. **PLAIDS** (Packing-Lower Alloying Intermediate Diverse Semiconductor) **Metalloids**: discouraged from using the term Semi-Metals, with its specific meaning in solid-state physics, these elements share common properties and a classification most often including Boron (B), Silicon (Si), Germanium (Ge), Arsenic (As), Antimony (Sb), Tellurium (Te), and Polonium (Po) —

Where the Metalloid PLAIDS (in honour of Scottish physicist Maxwell) tend to have a Packing efficiency Lower than most metals, more easily form Alloys, have Intermediate electronegativity and ionization energies, are Diverse as part of their location along the Amphoteric Divide (zigzag staircase line separating the metals from nonmetals), which is also the reason they are Semiconductors in between the conducting metals and insulating nonmetals;

15f. **CANOERS** (Covalent Attractive Networking Organogenic Electronegative Reactive Structural) **Nonmetals**: no longer shoehorning Hydrogen (H) into this element classification type, it typically includes Carbon (C), Nitrogen (N), Oxygen (O), Phosphorus (P), Sulfur (S), and Selenium (Se) —

The Nonmetal CANOERS acronym (in honour of the First Nations) represents shared properties of Covalent bonding, electron Attractiveness, Network-formation (chiral, cyclic, complex, and chaining), Organogenic essentialness for organic matter and living organisms, Electronegativity, Reactivity (redox-flexibility with multiple oxidations states), and their important Structural roles in countless compounds, crystals, and molecules;

14g. **HORDES** (Halidic Oxidizing Reactive Diatomic Electronegative Salt-forming) **Halogens**: includes Fluorine (F), Chlorine (Cl), Bromine (Br), Iodine (I), Astatine (At), and Tennessine (Ts) —

The Halogen HORDES (referring to how dangerously overwhelming their elemental forms are to us), very easily form Halides, are strong Oxidizing agents, are Diatomic in their elemental forms, have high Electronegativity, and very readily form Salts (from which the term Halogen originates);

15h. **UNREACTIVES** (Unbonded Null Resistant Electronegativity Aerogen Chargeless Thermally Individually Volatilly Electronically Stable) **Octet Gases**: replacing the misnomers Noble (Rule 14) and Inert (as these gases do form compounds, particularly Xenon) — for the element categorization including Neon (Ne), Argon (Ar), Krypton (Kr), Xenon (Xe), Radon (Rn), and Oganesson (Og) —

The Octet Gas UNREACTIVES are Unbonded with no strong chemical bonds (covalent, ionic, or metallic), have close to Null reactivity or ion formation, are Resistant to losing or gaining electrons, have Null or Resistant Electronegativity (close to zero or undefined), are Aerogens (naturally occurring in air, along with recent aerogen research), are Chargeless (normally non-conductive with equal numbers of protons and electrons), Thermally stable (resistant to decomposition or change due to heat), Individual (separate monatomic atoms that don't form gas molecules), characteristically defined by their Volatility (readily and consistently vaporizing at relatively low temperatures), and a signature property is their Electron configuration with complete (8) outer valence electron shells making them extremely (Chemically, Thermally, Individually, Volatilly, and Electronically) Stable;

15i. **MONOVALENTS** (Melting Oxidizing Never One Violent Ample Light Electropositive Non-intermetallic Tendency Stored) **Alkali Metals**: form a category consisting of Sodium (Na), Potassium (K) Rubidium (Rb), Cesium (Cs), and Francium (Fr) —

The Alkali Metal MONOVALENTS have exceptionally low Melting points, are strong Oxidizing agents, are Never freely found in nature due to their extreme reactivity, have a fundamentally defining characteristic of One valence electron in the outer s-orbital, experience Violent and often explosive reactions with water (and Halogens), have the largest or Amplest atomic and ionic radii as a signature, are very Light metals (most float in water) with low densities, boiling points, and ionization energies, are the most Electropositive of all elements, do Not form intermetallic compounds with transition metals; have the Tendency to exclusively form +1 ionic compounds, and are very well know for having to be Stored under oils or inert atmospheres due to their intense reactivity to air;

15j. **DIVALENTS** (Distinctive Ionic Vigorous Aqueous Latticing Exclusive Tendencies Structural) **Alkaline Earth Metals**: consisting of Magnesium (Mg), Calcium (Ca), Strontium (Sr), Barium (Ba), and Radium (Ra) —

The Alkaline Earth Metal DIVALENTS are known for their Distinctive flame colours used to identify them, almost exclusively form Ionic compounds, are Vigorously reactive (but not as violent as the Alkalis), for their unique Aqueous nature (specifically their vigorous reactions with water, as simple hydrated cations compared to other metals, and their resulting alakaline hydroxides in aqueous solutions), for forming stronger ionic Lattices in compounds, for their Exclusive oxidation states of +2 due to their valency, for easily forming stable nitrides but more fundamentally for their Non-transition properties (not having the partially d-orbitals of the metals), for their Tendencies to lose two electrons (form +2 ions) to achieve stable octet gas configurations, and for being Structural (much more than the alkalis) within construction, biology, and geology (hence the name Earth Metals);

15k. **GLAZED** (Generally Leaden Amphoteric Zintl Electronegative Directional) **Metals**: replacing the generic Other Metals or Poor Metals and sometimes misnomered Post-Transition Metals (as Aluminum, the most abundant of the so-called Post-Transition Metals, and the third most abundant element on Earth, comes before not after the Transition Metals) most often include Aluminum (Al), Gallium (Ga), Indium (In), Tin (Sn), Thallium (Tl), Lead (Pb), Bismuth (Bi), Nihonium (Nh), Flerovium (Fl), Moscovium (Mc), and Livermorium (Lv) —

The GLAZED Metals (referring to their common use as anti-corrosion coatings) are Generally Leaden (like lead, heavier and duller than other metal types), are Amphoteric and can act as both acids and bases (also forming both acidic and basic compounds), participate in Zintl phases (acting as complex anions, they readily form intermetallic compounds with electropositive metals), are uniquely more Electronegative than most metals, and are also more Directionally covalent bonding (existing in between the non-directional metallic bonding of true metals and the purely directionally covalent-bonding nonmetals);

15l. **D-PERIODS** (D-orbital Paramagnetic Extensive Reactant Interstitial Oxidations Distinctly Similar) **Transition Metals**: consisting of the 3d-period (Scandium Sc–Zn Zinc) and 4d-period (Yttrium Y–Cd Cadmium) earlier transitions, as well as the 5d-period (Lutetium Lu–Hg Mercury) and 6d-period (Lawrencium Lr–Cn Copernicium) later transitions, called later as the 5d-period occurs after the 4f-period and the 6d-period occurs after the 5f-period —

With the Transition Metal D-PERIODS, their characteristic properties are fundamentally due to partially filled D-orbitals in the elements (with their intermediate electronegativity) and oxidation states forming unique bonds, their predominant Paramagnetic behaviour due to unpaired d-electrons, Extensive coordination chemistry utilizing d-orbitals to form complexes with predictable geometries (octahedral, tetrahedral, and square planar), Reactant coordination that allows them to dominate homogeneous and heterogeneous catalysis including rich and diverse organometallic compounds (direct metal-carbon bonds), Interstitial compound formation (not true alloys or molecular compounds) that often have enhanced physical properties (high tensile, melting, and boiling points, along with mechanical strength while still metallic conductors), their Oxidation variability (4–7 different stable states unlike the usual 1–2), their very Distinctively coloured compounds (d-d electron transitions), and their usually exhibiting great Similarities horizontally across their periods;

15m. **COMMITTED** (Contracting Orbital Magnetic Malleable Inseparable Trivalent Transparent Electropositive Distinctive) **Lanthanoids**: consist of the 4f-period elements (Lanthanum La–Yb Ytterbium) —

The COMMITTED Lanthanoids (referring to the necessary efforts required for extracting and separating them) highlights their Orbital Contraction across the 4f-period (known as the lanthanide contraction with its steadily decreasing atomic and ionic radii), range of Magnetic properties (from diamagnetic to strongly paramagnetic and even ferromagnetic), Malleable nature (can be hammered or pressed without breaking), Multivalency with multiple oxidation states (dominated by +3 but with notable exceptions for +2 and +4), Inseparable difficulty in isolating them from their ores and mixtures, intrinsic Trivalent natures (overwhelmingly towards +3 oxidation states), often unique Transparency in compounds, high Electropositivity, and exhibiting Distinctive chemical and optical (luminescent and with varied compound colours) behaviours;

15n. **COVERUPS** (Contracting Orbital Variable Electropositive Radioactive Unstable Paramagnetic Sensitive) **Actinoids**: which consist of the 5f-period elements (Actinium Ac–No Nobelium) —

The Actinoid COVERUPS (you need to cover up to protect yourself from these incredibly dangerous elements which are also incredibly useful for nuclear, scientific, and medical research) represents their Contracting Orbitals across the 5f-period (known as the actinide contraction, with its progressive decrease in atomic and ionic radii), their more Variable oxidation states than the more trivalent lanthanoids (resulting in much more complex and diverse chemistry), even more Electropositivity and reactivity than the lanthanoids, Radioactivity as a defining characteristic, Unpredictability due to their diverse and variable oxidation states (as very heavy elements their relativistic effects significantly effects electron behaviour and theoretical predictions, with their inherent instability requiring specialized handling while also limiting the data available about them), are more Paramagnetic than the lanthanoids, and are Sensitive to environmental conditions due to their electronic structures where the 5f-electrons are more exposed than the 4f-electrons of the lanthanoids (leading to more complex states and bonding behaviours); and

15o. **Category Type Rule**: categorized elements should not be a visual blob of uniform colour, as this obscures their individual adherence to the proposed category's terms for inclusion, but should instead readily indicate the increase and decrease of those shared properties relative to each other (possibly as different shades, tints of colour, or weighted gradients) to avoid the artificial appearance of sameness across horizontal periods, vertical groups, or where elements are spread across groups and periods (primarily the p-block) — which would also support Scerri's enhanced uniqueness effect required of the first elements of Groups.

16. **All Inclusive Rule**: an optimal table should satisfy all sciences by mirroring the elemental evolution of the natural Emergent Universe as it continues to evolve from and through our (so far) main branches:

1. Information → 2. Physics → 3. Chemistry → 4. Biology

Realizing Physics evolved from the more fundamental level of Information means that just as Physics is a much more evolved and complex form or kind of Information, Chemistry is a much more evolved and complex form or kind of Physics, and Biology is a much more evolved and complex form or kind of Chemistry.

The more fundamental (less evolved and less complex) the branch of science, the later it will be discovered:

4. Biology	dates and discoverers lost to prehistory (parentage, lifecycles, ...)
3. Chemistry	dates and discoverers lost to history (fire, herbs, ...)
2. Physics	1687 – English physicist Isaac Newton's *Mathematical Principles of Natural Philosophy* is published (while spending most of his efforts on alchemy-chymistry)
1. Information	1948 – American mathematician and electrical engineer Claude Shannon's "A Mathematical Theory of Communication" is published

Though this discovery sequence may seem to be the reverse of natural evolution, the realizations that lead to ever more fundamental understandings of the universe require ever more evolved and complex beings and societies, as well as their built-up education and learning systems, information transfer advancements, theoretical sciences, technology facilities, and research environments.

Utilizing the heuristic device of German mathematician Kurt Goëdel's unprovable axioms within any system level — where the inability to find a solution (proof) at the more complex level is evidence that it might only be found at a more fundamental level — suggests that something that cannot be solved at the level of Physics could find a resolution at the deeper level of Information. An example of this is Scottish physicist James Maxwell's Demon, which could never have been resolved within Physics but was explainable at the Information level even with our very initial exploratory steps.

Similarly, the irreconcilability of Physic's Gravity and Quantum Mechanics will only be unified at the Information level, which is understood to be below and underneath the Planck scale.

Knowing that an objective periodic table should reflect the natural evolution of the elements within the Emergent Universe, with a correct form satisfying and sustaining all branches of science, should help displace any subjective belief in or deference to the notion of interest-dependent tables or different tables for different purposes.

If a table only works for Physics (like the LSPT), it is not a true periodic table. If it only works for Chemistry (such as not containing the radioactive Column of Instability), it is not a true periodic table.

Despite being developed primarily through the discoveries of similar chemical relationships, reactions, and valence interactions, a natural table will also contain known physical relationships such as radioactivity as well as being capable of incorporating upcoming and more recently understood physical relationships such as relativistic effects (per the work of Finnish chemist Pekka Pyykkö).

That the solution to an optimum table has not been found through either physics or chemistry (including consensus on the placement of Hydrogen, the placement of Helium, and the placement of elements in Group 3) indicates achieving an objective table might require appealing to a more fundamental level — beginning with informational evolution up to quarks, into the 0s-non-electron-shells of Free Protons and Alpha Particles, and then onwards through the 1s-, 2s-, and ever more complex elements.

17. **Bell Curve Rule**: as with everything, a true periodic table should follow some natural bell curve distribution. At one end of the curve an objective periodic table cannot exist as just one period (or one line of elements as exemplified by the physics-oriented nuclides charts) and, at the other end of the curve, a periodic table cannot exist as one vertical column of elements (or even just one vertically stacked group of periods).

There cannot be solely row periodic relationships or solely column group relationships — the number of periods and groups must move through artificial relations until the non-synthetic number of periods and groups and their positioning supports natural chemical and physical relationships between all periods and elements.

Similarly, at one end of one curve the periodic table should not be purely a Chemistry construct, just as at the other end it should not be designed to purely satisfy theories from Physics.

18. **Missing Links Rule**: As it is human nature to look for and find relationships between seemingly disparate data, arguably one of the primary reasons for the evolution of religions into the eventual rise of science, this drive unfortunately also makes it inevitable that artificial tables will lead to artificial connections. All previous (or future) added-value relationships should be reevaluated (or evaluated) in relation to the Periodic Table Rules (including the correct stacking of the d- and f-periods as well as properly placing $1s^1$, $1s^2$, and the 2s-elements, as well as the possibly optimal table found in Section 3), and then visually added where needed:

> 18a. **Triads**: in 1829, German chemist Johann Döbereiner called upon the pervasive rule of three to suggest elements could be grouped in triads based on the atomic weight (and physical state and colour) of the middle element being approximately the average of the other two — where a Group (n) element of Period (m) was the average weight of two Group (n) elements from Periods (m-1) and (m+1).
>
> While the ratio generally worked between some of the first known or predicted elements, it was ultimately discarded for not being consistent or strictly accurate for all elements;
>
> 18b. **Law of Octaves**: English chemist John Newlands' 1865 proposal was that, as with intervals in musical octaves, when elements are arranged in order of increasing atomic mass every eighth has similar properties to the first — a Group (n) element is similar to a Group (n +7) element. The law was soon found limiting by only accurately predicting elemental properties up to Calcium, and inconsistent for failing to account for heavier elements and the octet gases.
>
> However, the ghost of this law still haunts the table with the very real possibility that elemental periodicity involving the number 8 (and 5 and 10) is relevant beyond mere numerology;
>
> 18c. **Amphoteric Divide**: as early as 1869, Russian chemist Dmitri Mendeleev referenced a dividing line between metals and nonmetals, though it first appeared visually within a periodic table in 1906 thanks to Scottish chemist Alexander Smith. A staircase or zigzag line separating (through and between) these metalloids to highlight that they exhibit intermediate or bridging properties — with its location and usefulness still debated as the spectrum between metallic and nonmetallic characteristics is a more gradual gradient than a sharp line.
>
> If retained, it would have to be shifted to fit in with the corrected periods and groups (Section 3);
>
> 18d. **Octet Rule**: in 1916, American physical chemist Gilbert Lewis observed that for most elements, the inertness of noble gases was due to their stable electron configurations, which other atoms strive to achieve by losing, gaining, or sharing electrons. For most elements this stable state meant having eight electrons in their outermost valence shell (an octet), mirroring the electron configuration of Neon, Argon, and the other heavier noble gases. As the **octet rule** only applies to the current Main Group elements, Groups 1–2 (sometimes not including Hydrogen) and Groups 13–18, the rule will need to be adjusted to include the correctly renumbered groups of an optimal table (Section 3).
>
> As well, the inclusion of duplets He, Li, and Be, will also need to be reconsidered;
>
> 18e. **Duplet Rule**: in 1916, Lewis also recognized that elements in the first period, Hydrogen and Helium, are a special case of the **octet rule**, where their outermost shell (the first energy shell) can only hold a maximum of two electrons. These elements therefore achieve stability by having a full valence shell of two electrons (or duplet) mirroring the electron configuration of Helium.
>
> While the **octet rule** is more widely applicable and taught, the duplet rule was a crucial part of his original theory to explain the bonding behaviour of the simplest and most abundant element, Hydrogen;

18f. **18-Electron Rule**: in 1921, American chemist and physicist Irving Langmuir extended Lewis's electron-pair bonding theory by proposing a guideline to explain the stability of certain transition metal compounds, where these complexes had a total of 18 valence electrons which he counted as a stability standard for these compounds. The **18-electron rule** tends to be obeyed by transition metal molecules, which corresponds to the utilization of valence d-, s-, and p-orbitals to form bonding and non-bonding orbitals.

However, unlike the **octet rule** for Main Group elements, transition metals do not closely obey this traditional rule and the valence electron count can vary between 12 and 18 — which begs the question as to whether it's actually a rule or also just designed (like the **duplet rule**) to similarly follow the **octet rule**;

18g. **Effective Atomic Number** (EAN) **Rule**: in 1923, English chemist Nevil Sidgwick further developed Langmuir's **18-electron rule** where a stable transition metal complex would have an EAN equal to the atomic number of the next noble gas in that period. The EAN is the sum of the metal's own electrons and the electrons donated by the ligands, focusing on the total valence number of electrons (2 from the s-orbitals, 6 from the p-orbitals, and 10 from the d-orbitals).

Again, unlike the **octet rule** for Main Group elements, transition metals do not closely obey this traditional rule and the valence electron count can vary between 12 and 18 — which also begs the question as to whether it's actually a rule or further designed (like the **duplet rule**) to follow the **octet rule**;

18d. **Inert Pair Effect**: in 1927, Sidgwick coined the term to describe the observations (starting decades before) that in some heavier p-block metals (traditionally Groups 13–16) the outermost s-electrons appeared to be inert or resistant to participation in bonding. Unlike the predicted results, this leads to the stabilization of an oxidation state that is two less than the group's expected maximum oxidations state (Thallium frequently forms +1 compounds rather than the expected +3). Where the effect is still valid, it should be carried over to the correctly renumbered groups (Section 3);

18e. **Knight's Move**: in 1991, South African chemist Michael Laing proposed chemical relationships for Knight's Move elements in the lower-right quadrant of the current standard table form — between elements of Group (n) and Period (m) and elements of Group (n+2) and Period (m+1). Despite a shared love for chess (and *Alice in Wonderland*), these relationships may need to be renamed and restructured (with the underlying mechanisms further investigated) as some of these Knight's Moves are obscured when groups and periods are properly ordered and renumbered (Section 3);

18f. **Isodiagonality**: the term Isodiagonality was coined by English chemist Geoff Rayner-Canham in 2011. Similar to the area location of the Knight's Move of the lower-right quadrant, Isodiagonality develops and expands an earlier recognition (by at least Newlands and Mendeleev, though probably even earlier) of chemical relationships between some elements in the upper-left quadrant of the current standard table form — for a Group (n) and Period (m) element and an element of Group (n+1) and Period (m+1) and then an element of Group (n+2) and Period (m+2), continuing. After the non-synthetic arrangement of the periods (particularly the relation of the 3s–7s-periods to the p-block), and the related group renumbering (with new element groupings after properly placing the d- and f-periods), current and additional relationships will need to be confirmed and found (Section 3); and

18g. **N+10**: in 2012, Rayner-Canham proposed that, in the current standard form, similar electronic structures create specific linkages in chemical formulas and behaviour between Group (n) members and corresponding Group (n+10) members, especially for their highest oxidations states. Solidifying and expanding earlier work by Laing (1989) and English chemist David Michael Mingos (1989), these relationships can also be shown in their polyatomic atoms and aqueous behaviours. Such connections are maintained though the link may need to be renamed and restructured to avoid obscuration after the groups are correctly ordered and renumbered — while the known-to-be-problematic Group 1 and

11 and Group 2 and 12 linkages should be reevaluated after fixing the currently incorrect placements of Li and Be (Section 3).

19. **Over-Extended Rule**: any scientifically objective table should be able to incorporate new elements (atomic numbers beyond 118), as well as their periodic and group relationships — considering twelve elements have been discovered in the last 40+ years by lead researchers and German physicists (German) Münzenberg (three) and Sigurd Hofmann (three), and lead researcher and Russian physicist Yuri Oganessian (six).

When experimental chemists and physicists synthesize the two 8s-elements (119 Uue and 120 Ubn) or generate any one of the 18 5g-period elements (121 Ubu–138 Uto), the current table would necessarily be expanded to a 50-column format and become the extended Standard Periodic Table (SPT-50):

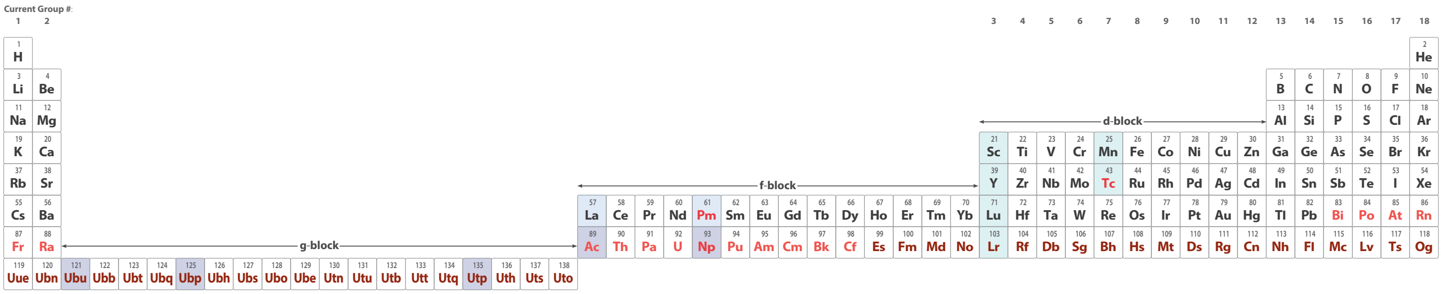


Figure 14a: 8s-and 5g-period placement for the 50-column Standard Periodic Table (SPT-50) with its eight Periods.

Which are the same issues for an extended 50-column Left-Step Periodic Table (LSPT-50):

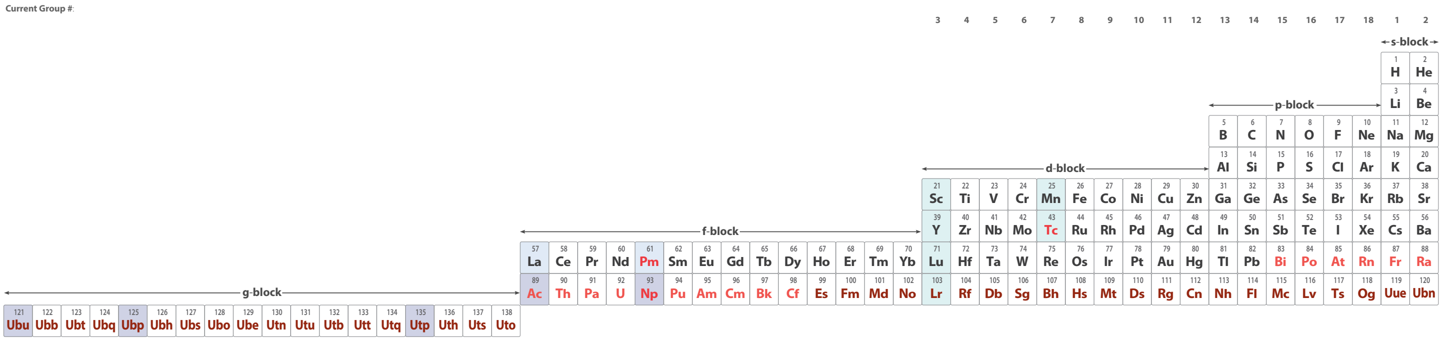


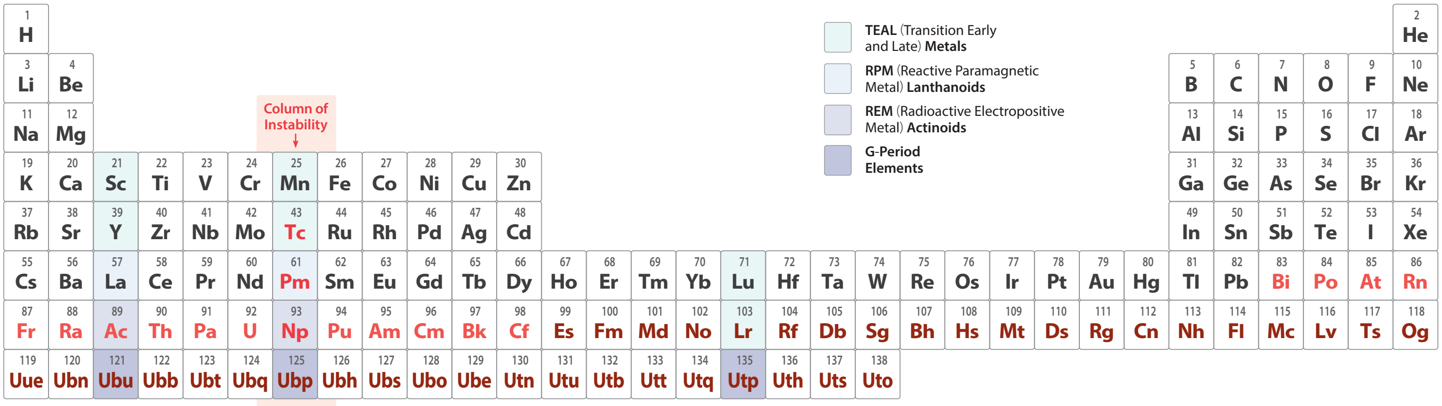
Figure 14b: 8s-and 5g-period placement for the 50-column Left-Step Periodic Table (LSPT-50) with its nine Periods.

Though an even more obscuring collapsed print form would be introduced as a further compromise to convenience for at least the collapsed print-form current standard SPT-18 (with the 5g period placed farther below the dropped f-periods), this would inherently be even less natural with no apparent natural relationships shown between any of the new 5g-period elements and the known 4f- or 5f- (or 3d- or 4d-) elements.

Remembering also that, should only one element in the 5g period be synthesized, there would be awkward and unnatural gaps in the extended Standard and Left-Step full forms. This, despite the entire purpose of a periodic table being to visually reinforce the natural chemical and physical relationships between elements and their group and periods.

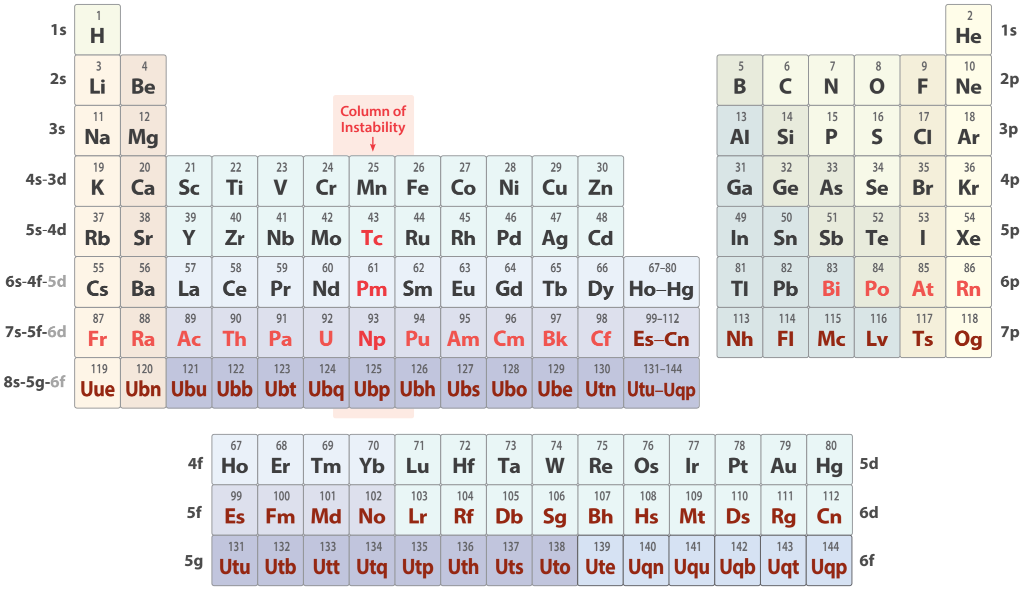
However, just as with the current standard table, where lack of consensus over the placements of H and He (98% of the mass and nearly 100% of the atoms in the universe) is ignored for expediency, the potential 8s- and 5g-periods are yet another case of kicking the can down the road as a problem for future scientists under the guise of believing and then deciding there will never be even one additional new element.

Whereas an extended Corrected Standard Periodic Table (CSPT-32) not only maintains the relationships between the 4f- and 5f-elements and any new 5g-period elements, but also makes clear the relationships between those and the 3d- and 4d-periods — as well as extending the Column of Instability to Mn–125:



1 H																															2 He
3 Li	4 Be																									5 B	6 C	7 N	8 O	9 F	10 Ne
11 Na	12 Mg																									13 Al	14 Si	15 P	16 S	17 Cl	18 Ar
19 K	20 Ca	21 Sc	22 Ti	23 V	24 Cr	25 Mn	26 Fe	27 Co	28 Ni	29 Cu	30 Zn															31 Ga	32 Ge	33 As	34 Se	35 Br	36 Kr
37 Rb	38 Sr	39 Y	40 Zr	41 Nb	42 Mo	43 Tc	44 Ru	45 Rh	46 Pd	47 Ag	48 Cd															49 In	50 Sn	51 Sb	52 Te	53 I	54 Xe
55 Cs	56 Ba	57 La	58 Ce	59 Pr	60 Nd	61 Pm	62 Sm	63 Eu	64 Gd	65 Tb	66 Dy	67 Ho	68 Er	69 Tm	70 Yb	71 Lu	72 Hf	73 Ta	74 W	75 Re	76 Os	77 Ir	78 Pt	79 Au	80 Hg	81 Tl	82 Pb	83 Bi	84 Po	85 At	86 Rn
87 Fr	88 Ra	89 Ac	90 Th	91 Pa	92 U	93 Np	94 Pu	95 Am	96 Cm	97 Bk	98 Cf	99 Es	100 Fm	101 Md	102 No	103 Lr	104 Rf	105 Db	106 Sg	107 Bh	108 Hs	109 Mt	110 Ds	111 Rg	112 Cn	113 Nh	114 Fl	115 Mc	116 Lv	117 Ts	118 Og
119 Uue	120 Ubn	121 Ubu	122 Ubb	123 Ubt	124 Ubq	125 Ubp	126 Ubh	127 Ubs	128 Ubo	129 Ube	130 Utn	131 Utu	132 Utb	133 Utt	134 Utq	135 Utp	136 Uth	137 Uts	138 Uto												

Figure 15a: 8s- and 5g-period placements for the 32-column full form Corrected Standard Periodic Table (CSPT-32).



1s	1 H																		2 He	1s
2s	3 Li	4 Be												5 B	6 C	7 N	8 O	9 F	10 Ne	2p
3s	11 Na	12 Mg												13 Al	14 Si	15 P	16 S	17 Cl	18 Ar	3p
4s-3d	19 K	20 Ca	21 Sc	22 Ti	23 V	24 Cr	25 Mn	26 Fe	27 Co	28 Ni	29 Cu	30 Zn		31 Ga	32 Ge	33 As	34 Se	35 Br	36 Kr	4p
5s-4d	37 Rb	38 Sr	39 Y	40 Zr	41 Nb	42 Mo	43 Tc	44 Ru	45 Rh	46 Pd	47 Ag	48 Cd		49 In	50 Sn	51 Sb	52 Te	53 I	54 Xe	5p
6s-4f-5d	55 Cs	56 Ba	57 La	58 Ce	59 Pr	60 Nd	61 Pm	62 Sm	63 Eu	64 Gd	65 Tb	66 Dy	67–80 Ho–Hg	81 Tl	82 Pb	83 Bi	84 Po	85 At	86 Rn	6p
7s-5f-6d	87 Fr	88 Ra	89 Ac	90 Th	91 Pa	92 U	93 Np	94 Pu	95 Am	96 Cm	97 Bk	98 Cf	99–112 Es–Cn	113 Nh	114 Fl	115 Mc	116 Lv	117 Ts	118 Og	7p
8s-5g-6f	119 Uue	120 Ubn	121 Ubu	122 Ubb	123 Ubt	124 Ubq	125 Ubp	126 Ubh	127 Ubs	128 Ubo	129 Ube	130 Utn	131–144 Utu–Uqp							

4f	67 Ho	68 Er	69 Tm	70 Yb	71 Lu	72 Hf	73 Ta	74 W	75 Re	76 Os	77 Ir	78 Pt	79 Au	80 Hg	5d
5f	99 Es	100 Fm	101 Md	102 No	103 Lr	104 Rf	105 Db	106 Sg	107 Bh	108 Hs	109 Mt	110 Ds	111 Rg	112 Cn	6d
5g	131 Utu	132 Utb	133 Utt	134 Utq	135 Utp	136 Uth	137 Uts	138 Uto	139 Ute	140 Uqn	141 Uqu	142 Uqb	143 Uqt	144 Uqp	6f

Figure 15b: 8s-, 5g-, and 6f-period placement for the 18-column collapsed print-form Corrected Standard Periodic Table (CSPT-18).

20. **Broken Symmetry Rule**: an objective table should follow the descriptive rules of science including the avoidance of any artificiality designed to satisfy human normative desires for bilateral symmetry — again guarding ourselves against remodelling the universe from how it is into how we want it to be. Versus a more generalized Copernican Principle, the beautiful appeal of non-mathematical bilateral symmetry based on local biology and human attractiveness should not be projected onto and into scientific equations and theories.

Unfortunately, it's highly likely this not-even-just-wrong basis for approval will continue, despite recent understandings of just how fundamentally essential asymmetry is for and to our very existence: the baryon asymmetry; the galactic distribution asymmetry; the CMB asymmetry; and the asymmetry of time.

While the list of uneven handedness is extensive, a few further examples should suffice. Physically, only left-handed quarks interact with the charged weak force and all neutrinos are left-handed. Chemically and biologically, we live in constant relation to the chirality of right-handed molecules versus left-handed molecules (thalidomide), the right-handedness of DNA and RNA and left-handedness of amino acids and proteins, the general right-handedness of humans, and the distinct handedness (though often exaggerated) between the very left and right brain hemispheres we use to seek these narcissistic mirrored reflections.

Artificial bilateral symmetry should not be the basis for deciding the correctness of a periodic table. Even though the collapsed print-form Corrected Standard Periodic Table (CSPT-18) is a substantial improvement over the current collapsed print-form worldwide SPT-18, the desire for visual perfectionism still leads to artificially placing H, He, and Li-Be merely to form a more bilaterally symmetric model — all the while claiming it's for print convenience and immediate practical uses as there has been no consensus on placement solutions. Yet none of this justifies not standardizing the less artificial full-form version of the current standard table.

SECTION 3. **Realizing a Natural Periodic Table**

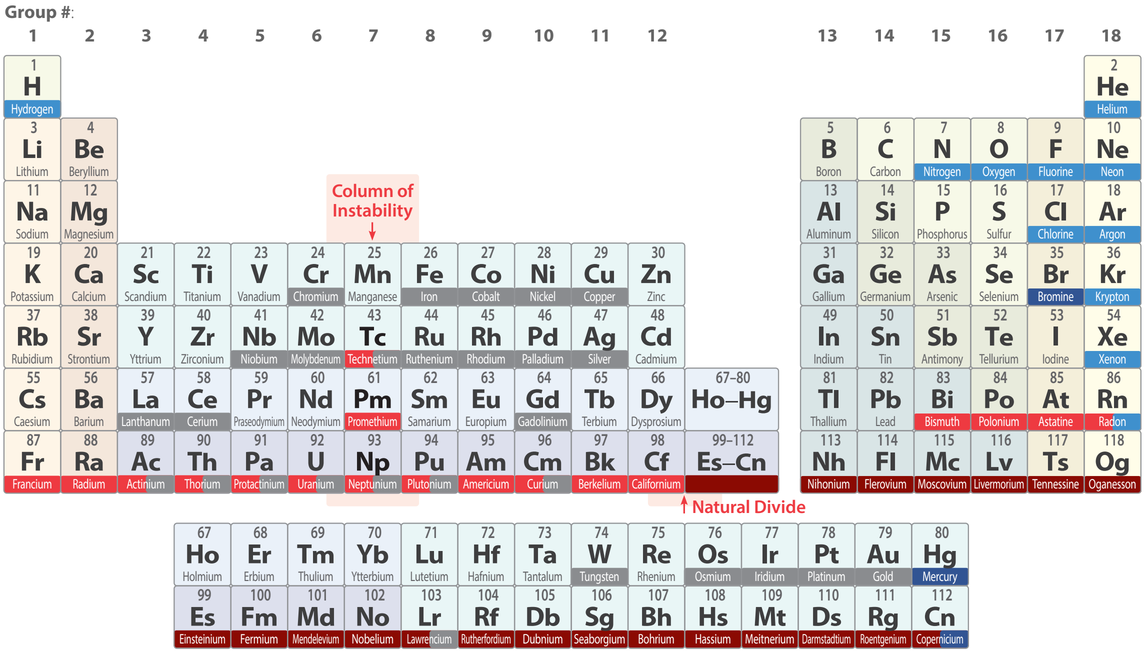
Though it is a verifiable fact — openly available to anyone taking even a cursory look at the surface details — that the current Standard Periodic Table (SPT-18) is ≈100% incorrect, it continues to be positioned and taught as a world-renown exemplar.

The current periodic table is not a scientific image, it's a religious icon.

Even if based solely on the incorrect positioning of Hydrogen and Helium, which, after having given up on finding results with consensus, are simply sewn Frankenstein-style onto the current unofficially standard table and dragged along like vestigial organs for purely expedient purposes and local immediate use, somehow it has become scientifically acceptable to continue supporting and sharing false chemical and physical relationships (the entire purpose of a periodic table) for nearly 100% of the atoms in the universe.

These are the exact same issues with the Left-Step Periodic Table contender which is even closer to 100% inaccurate because it further ignores chemical relationships (again, the main point of a periodic table).

By incorporating the revealed natural relationships between the d-periods and f-periods — which automatically includes the Column of Instability and Natural Divide — the Corrected Standard Periodic Table (CSPT-18) follows many of the Periodic Table Rules discussed in Section 2:



Group #:

1	2	3	4	5	6	7	8	9	10	11	12		13	14	15	16	17	18
1 H Hydrogen																		2 He Helium
3 Li Lithium	4 Be Beryllium												5 B Boron	6 C Carbon	7 N Nitrogen	8 O Oxygen	9 F Fluorine	10 Ne Neon
11 Na Sodium	12 Mg Magnesium												13 Al Aluminum	14 Si Silicon	15 P Phosphorus	16 S Sulfur	17 Cl Chlorine	18 Ar Argon
19 K Potassium	20 Ca Calcium	21 Sc Scandium	22 Ti Titanium	23 V Vanadium	24 Cr Chromium	25 Mn Manganese	26 Fe Iron	27 Co Cobalt	28 Ni Nickel	29 Cu Copper	30 Zn Zinc		31 Ga Gallium	32 Ge Germanium	33 As Arsenic	34 Se Selenium	35 Br Bromine	36 Kr Krypton
37 Rb Rubidium	38 Sr Strontium	39 Y Yttrium	40 Zr Zirconium	41 Nb Niobium	42 Mo Molybdenum	43 Tc Technetium	44 Ru Ruthenium	45 Rh Rhodium	46 Pd Palladium	47 Ag Silver	48 Cd Cadmium		49 In Indium	50 Sn Tin	51 Sb Antimony	52 Te Tellurium	53 I Iodine	54 Xe Xenon
55 Cs Caesium	56 Ba Barium	57 La Lanthanum	58 Ce Cerium	59 Pr Praseodymium	60 Nd Neodymium	61 Pm Promethium	62 Sm Samarium	63 Eu Europium	64 Gd Gadolinium	65 Tb Terbium	66 Dy Dysprosium	67–80 Ho–Hg	81 Tl Thallium	82 Pb Lead	83 Bi Bismuth	84 Po Polonium	85 At Astatine	86 Rn Radon
87 Fr Francium	88 Ra Radium	89 Ac Actinium	90 Th Thorium	91 Pa Protactinium	92 U Uranium	93 Np Neptunium	94 Pu Plutonium	95 Am Americium	96 Cm Curium	97 Bk Berkelium	98 Cf Californium	99–112 Es–Cn	113 Nh Nihonium	114 Fl Flerovium	115 Mc Moscovium	116 Lv Livermorium	117 Ts Tennessine	118 Og Oganesson

67 Ho Holmium	68 Er Erbium	69 Tm Thulium	70 Yb Ytterbium	71 Lu Lutetium	72 Hf Hafnium	73 Ta Tantalum	74 W Tungsten	75 Re Rhenium	76 Os Osmium	77 Ir Iridium	78 Pt Platinum	79 Au Gold	80 Hg Mercury
99 Es Einsteinium	100 Fm Fermium	101 Md Mendelevium	102 No Nobelium	103 Lr Lawrencium	104 Rf Rutherfordium	105 Db Dubnium	106 Sg Seaborgium	107 Bh Bohrium	108 Hs Hassium	109 Mt Meitnerium	110 Ds Darmstadtium	111 Rg Roentgenium	112 Cn Copernicium

Figure 16: The collapsed print form of the Corrected Standard Periodic Table (CSPT-18) incorporates and satisfies nearly but not every Periodic Table Rule.

But it cannot follow all of them. The CSPT-18 still stacks duplet $1s^2$ Helium over the p^6 octet gases, and still places the physically and chemically unrelated $1s^1$ Hydrogen over the Group 1 Alkali Metals. Once again forsaking nearly the entire universe (H and He) simply for the sake of expediency and bilateral symmetry.

Just as with the standard table, the CSPT's group numbering is recognizably artificial, where it's either obscured by the 18-column collapsed print-form (CSPT-18) or straightforwardly incomplete in its 32-column full form (CSPT-32) — maintaining the unnatural gap we've seen (with the SPT-18 and SPT-32) between Groups 1–2 and 3–18 that entirely omits the 28 f-period elements and excludes them from any grouping.

After reordering the d- and f-period elements into their non-synthetic column groups with the now Corrected Standard formats, it becomes apparent that the traditional group nomenclature supports conventional relationships that no longer exist.

Carried over as a historical legacy (created before the f-periods were discovered), alongside the current lack of consensus over the positions of H (which shouldn't be in Group 1) and He (which shouldn't be in Group 18) as well as the content disagreements regarding Group 3, collapsing the full form simply for space and bilateral symmetry has resulted in the ongoing retention of an obsolete and artificial numbering system.

If the group relationships are non-objective because the elements contained in them are incorrect (based on the outdated unnatural stacking of the d-periods), then holding onto an antiquated group numbering (which already skips the 14 columns of f-period elements) is also unscientific — especially if the reasoning is merely to continue smoothly referencing and comparing like groupings when it is already known that Group 3 has no consensus, Group 1 is incorrect as it includes Hydrogen, and Group 18 is inaccurate by including Helium.

In other words, with the discovery of the CSPT, only Groups 13–17 of the current standard group numbering system contain the correct elements and their natural chemical and physical relationships (five groups out of the 18, or only five groups out of 32 when the f-elements are properly included). As well, the artificially conflating period numbering system, where the traditional Periods 1–7 obscure the orbital periodicity of the elements (Period 3 instead of the 3s- and 3p-periods), has led to an additionally calcified system that also straightforwardly does not work with at least the two other tables discussed. With the Left-Step and its eight periods that contain different orbitals, and with the CSPT-18 after it necessarily reorders which orbitals appear in Periods 4–7 (after the d- and f-period reconfiguration).

Which means that almost the entire current Group and Period numbering systems continue merely for the sake of convention and ease of citation (just like the placements of H and He), despite the entire scientific purpose and point of the table being to visually reinforce and transmit the vertical group and horizontal period physical and chemical relationships between the elements.

The Periodic Table Rules expose the many unresolvable issues with the collapsed print-form 18-, full 32-, and extended 50-column Standard Tables, as well as many of the same fundamental issues with the newly presented collapsed print-form 18-, full 32-, and extended 50-column Corrected Standard Tables.

Periodic Table Rules	**SPT-18**	**SPT-32**	**CSPT-32**	**CSPT-18**
1. Atomic Number	obscured, gaps	obscured, gaps	obscured, gaps	obscured, gaps
2. Orbital Filling	incorrect d- and f-	incorrect d- and f-	correct	correct
3. Second S	obscured, gaps, d- and f-	obscured, gaps, f- and d-	obscured, gaps	obscured, gaps
4. Bypassing Roadblocks	p, ɑ, 5, 8, 3s, p-s, d-, f-	p, ɑ, 5, 8, 3s, p-s, d-, f-	p, ɑ, 5, 8, 3s, p-s, d-, f-	p, ɑ, 5, 8, 3s, p-s, d-, f-
5. Transition Period	improvable	improvable	improvable	improvable
6. Splinter Group	52 incorrect, 66 correct	52 incorrect, 66 correct	4 incorrect, 114 correct	4 incorrect, 114 correct
7. Elemental Evolution	$1s^1$, $1s^2$, 2s, d-, f-, column	$1s^1$, $1s^2$, 2s, d-, f-, column	$1s^1$, $1s^2$, 2s	$1s^1$, $1s^2$, 2s
8. Block Stacking	2s, d- and f-, column	2s, d- and f-, column	2s	2s
9. Octet Agreement	He–Li-Be (s^2), obscured	He–Li-Be (s^2), obscured	He–Li-Be (s^2), obscured	He–Li-Be (s^2), obscured
10. Orbital Sharing	f- and d-, 7p obscured	f- and d-, 7p obscured	7p obscured	7p obscured
11. Mind the Gap	5 artificial gaps	5 artificial gaps	5 artificial gaps	5 artificial gaps
12. Natural Notations	improvable, missing	improvable, missing	improvable, missing	improvable, missing
13. Divergent Elements	improvable	improvable	improvable	improvable
14. Formerly Noble	improvable	improvable	correct	correct
15. Keys to Success	improvable	improvable	improvable	improvable
16. All Inclusive	many physical missing	many physical missing	some physical missing	some physical missing
17. Bell Curve	7 Periods (missing 1–2)	7 Periods (missing 1–2)	7 Periods (missing 1–2)	7 Periods (missing 1–2)
18. Missing Links	often zigzag, improvable	often zigzag, improvable	improvable	improvable
19. Over-Extended	lost/incorrect relationships	lost/incorrect relationships	correct	correct
20. Broken Symmetry	unscientific/artificial	correct	correct	unscientific/artificial

Figure 17: Highlighting the current SPT and proposed CSPT variants in relation to the Periodic Table Rules.

The Left-Step Periodic Table (LSPT), though containing the same (and additional) issues, was again not included as it is based on purely physical theories and does not usefully support chemical relationships.

Considering this, and rather than supplying more ammunition to further entrench the territorial disputes of the Periodic Table Forever Wars — including where to place Hydrogen and Helium and which elements belong in the artificial Group 3 historical designation — it seemed more fruitful to conduct a one-to-one mapping of the elemental evolution of the Emergent Universe:

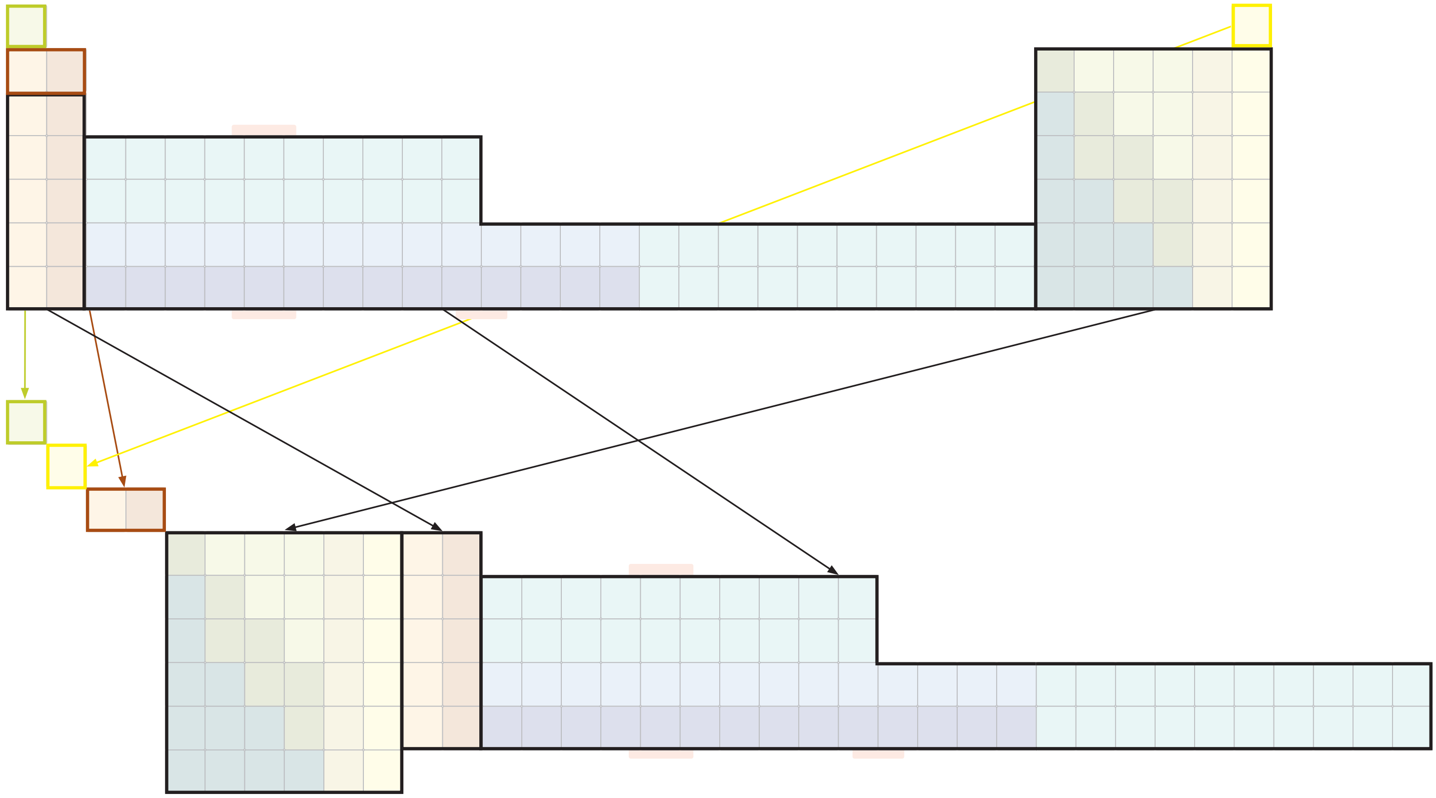


Figure 18: Reordering the periodic relationships of the 32-column full-form Corrected Standard Periodic Table (top) to follow natural elemental evolution led to the discovery of the Right Step Periodic Table (bottom).

At first glance the Right Step Periodic Table (RSPT) may seem like a radical reworking of the current standard table. However, when examined more closely, it becomes apparent that the Right Step instead echoes a familiar shape we've seen before (Figures 6b and 11e). The new RSPT form is simply the widely known orbital filling chart flipped on its head:

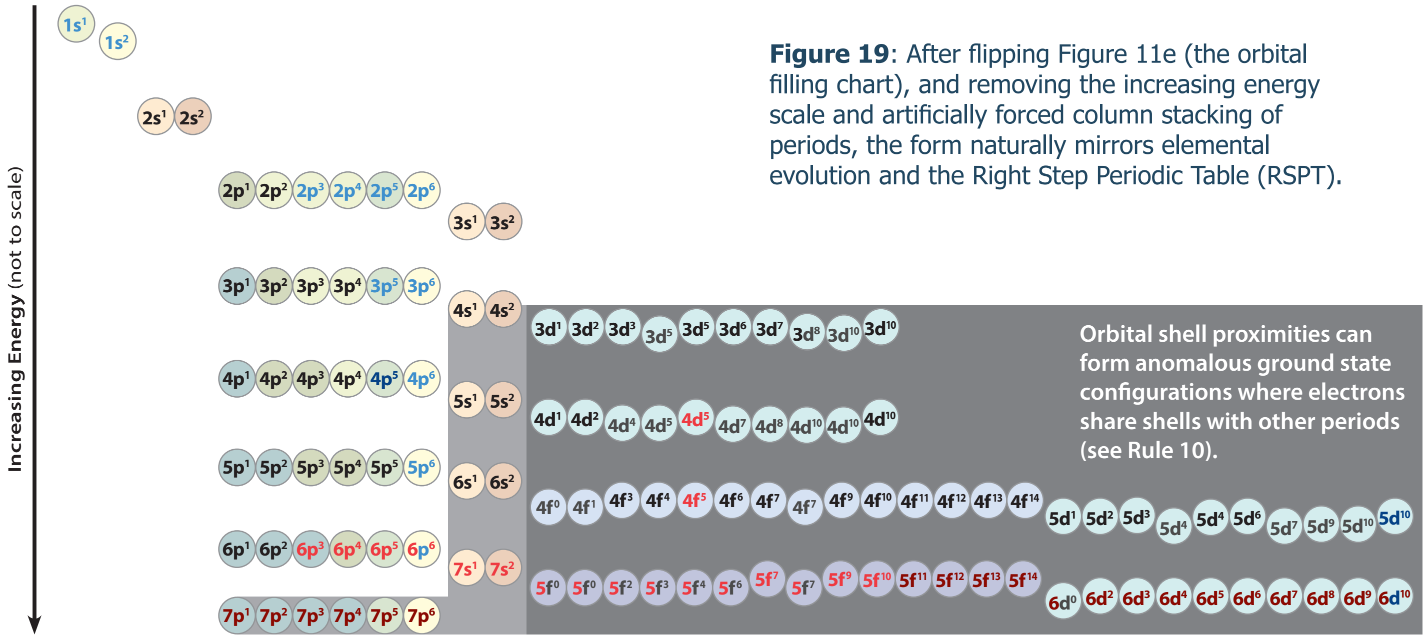


Figure 19: After flipping Figure 11e (the orbital filling chart), and removing the increasing energy scale and artificially forced column stacking of periods, the form naturally mirrors elemental evolution and the Right Step Periodic Table (RSPT).

Orbital shell proximities can form anomalous ground state configurations where electrons share shells with other periods (see Rule 10).

The natural orbital filling of elements (Figure 19) appears to precisely parallel the one-to-one mapping of natural elemental evolution (Figure 18) which resulted in the Right Step Periodic Table.

The RSPT retains the shared orbital relationships of the 4s–7s-periods and the d- and f-periods (along with the lone 7p-period connection) as well as the natural filling order of the 2p–7p-period orbitals before the 3s–8s-period orbitals — while non-synthetically placing H, He, and Li-Be to satisfy all known roadblocks and visually reinforce the recognized informational, chemical, and physical differences these first elements exhibit in comparison to every previously and currently proposed Group ordering.

The RSPT also enables a more straightforward understanding of orbital filling, while visually reinforcing that p-shells supersede third and subsequent s-shells; d-shells supersede third and subsequent p-shells, and f-shells supersede third and subsequent d-shells:

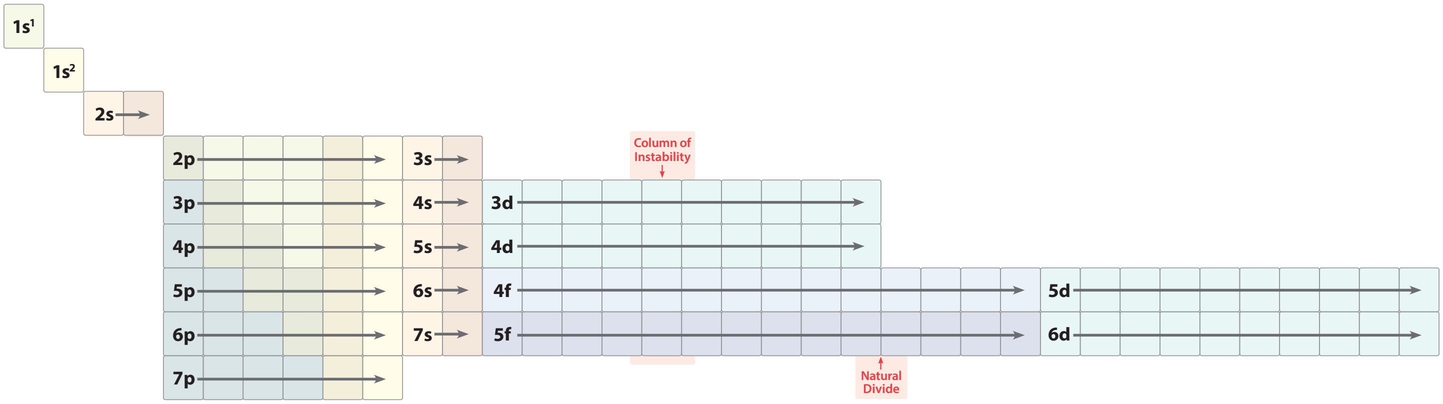


Figure 20: The form of the Right Step Periodic Table (RSPT) follows the natural orbital filling of the Aufbau Principle.

After the proper placements of the d- and f-periods were discovered for the Corrected Standard Periodic Tables (CSPT-32 and CSPT-18), following the natural evolution of the elements (and their orbital filling order) in an Emergent Universe led to a straightforward reconfiguration that satisfies every Periodic Table Rule and objectively maintains confirmed and expected chemical and physical relationships. Recognizing horizontal space requirements and expectations, the RSPT-36 can readily be truncated into a more compact step-down form (RSPT-22) for print convenience without breaking or obscuring periodic and group relationship — unlike the displaced f-periods (or d-periods) of the collapsed SPT-18 and CSPT-18 variants:

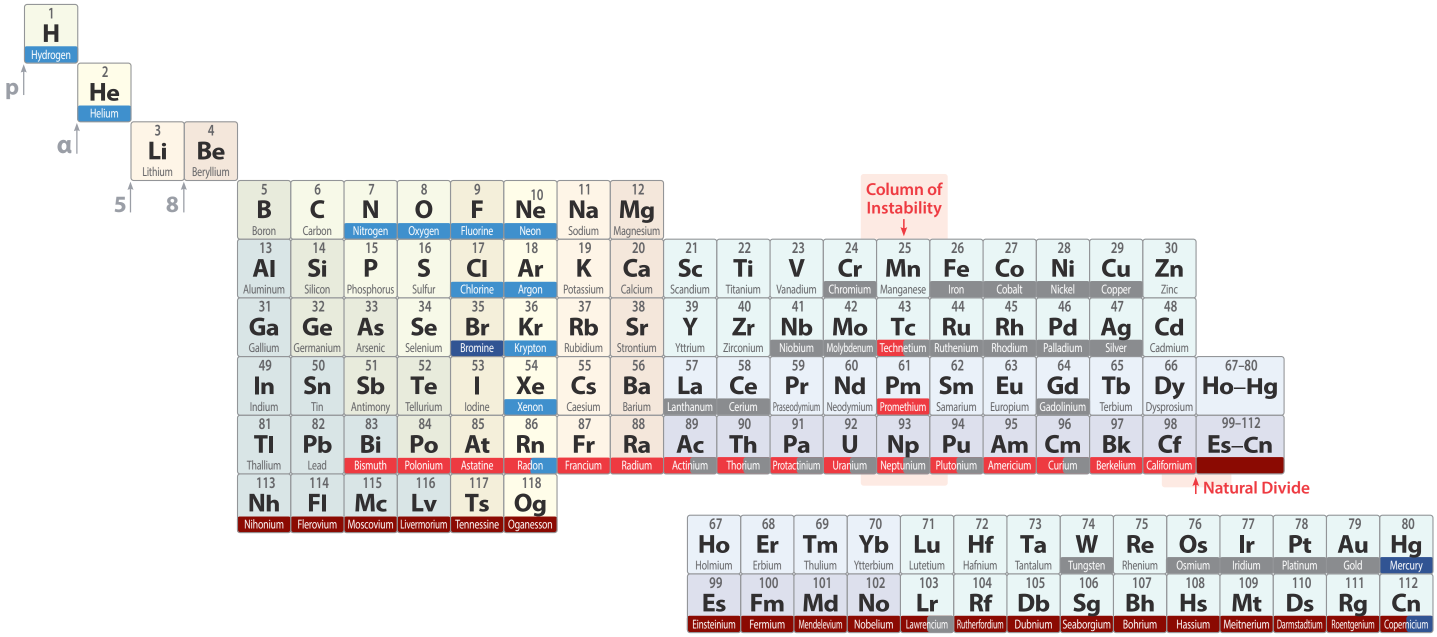


Figure 21: The Right Step Periodic Table step-down form (RSPT-22) truncates the table for print convenience while maintaining relationships between Groups and Periods and without giving in to desires for bilateral symmetry.

By reverse engineering elemental evolution into its two-dimensional matrix form, the RSPT maintains the corrected d- and f-period relationships (which bypassed the Group 3 Scylac-Scylur Debate) as well as bypassing the two forever wars over the placements of H and He — which no longer need to be coerced into traditional Group columns after judiciously hunting for strained chemical or physical similarities. Likewise, Hydrogen no longer requires its other expedient resolution of floating untethered above all other elements:

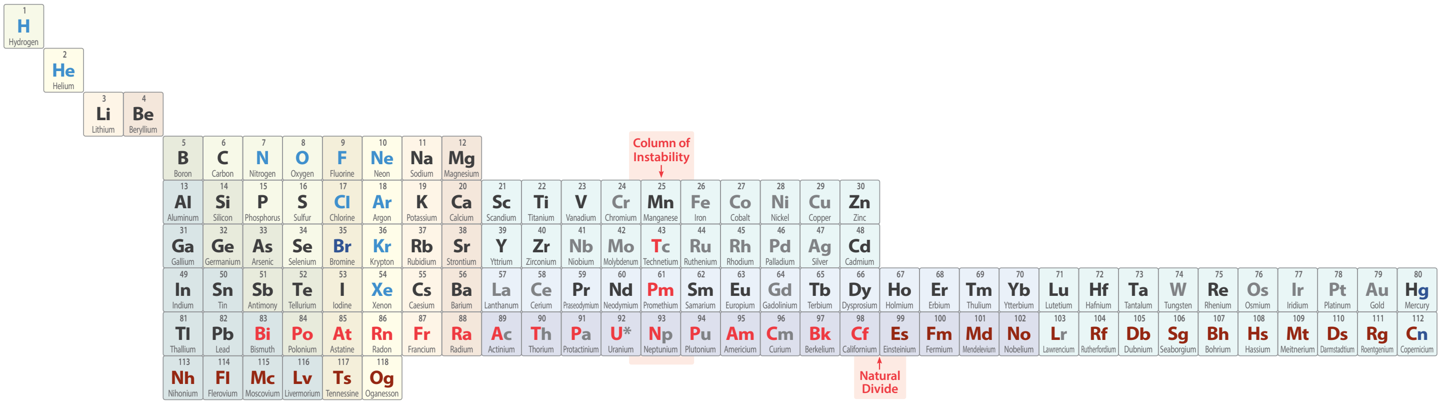


Figure 22: By emulating the elemental evolution of the Emergent Universe, the Right Step Periodic Table (RSPT) satisfies every Periodic Table Rule and maintains natural chemical and physical relationships.

When three more of the next six elements leading up to the Mn–125 Column of Instability are synthesized — with the new g-block consisting of 18 elements — the RSPT correctly and elegantly incorporates further discoveries as well as maintaining and extending the known group and period relationships:

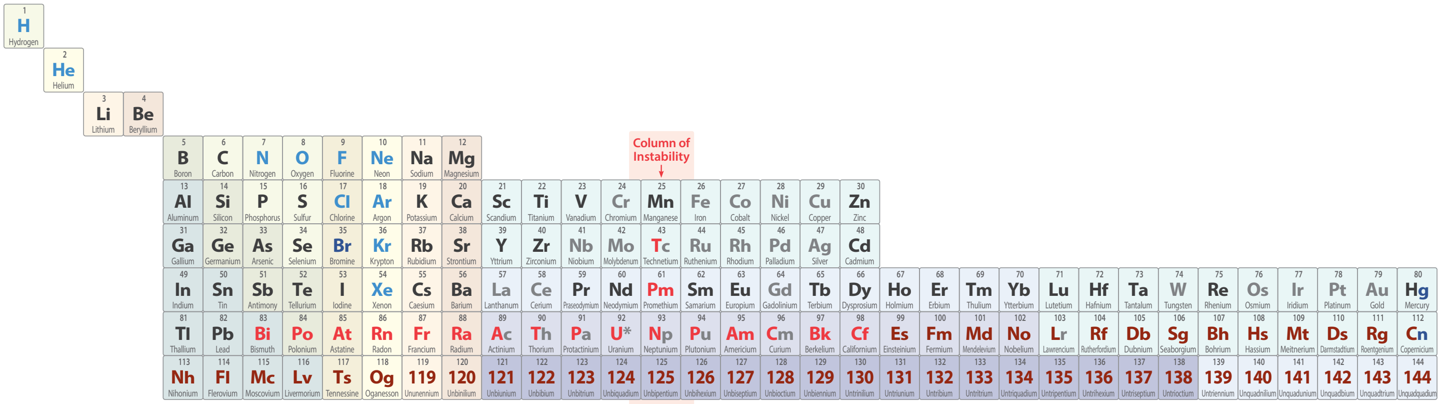


Figure 23: The extended Right Step Periodic Table correctly and elegantly incorporates new element discoveries.

The RSPT naturally positions H, He, and Li–Be based on their universal and stellar evolutionary origins:

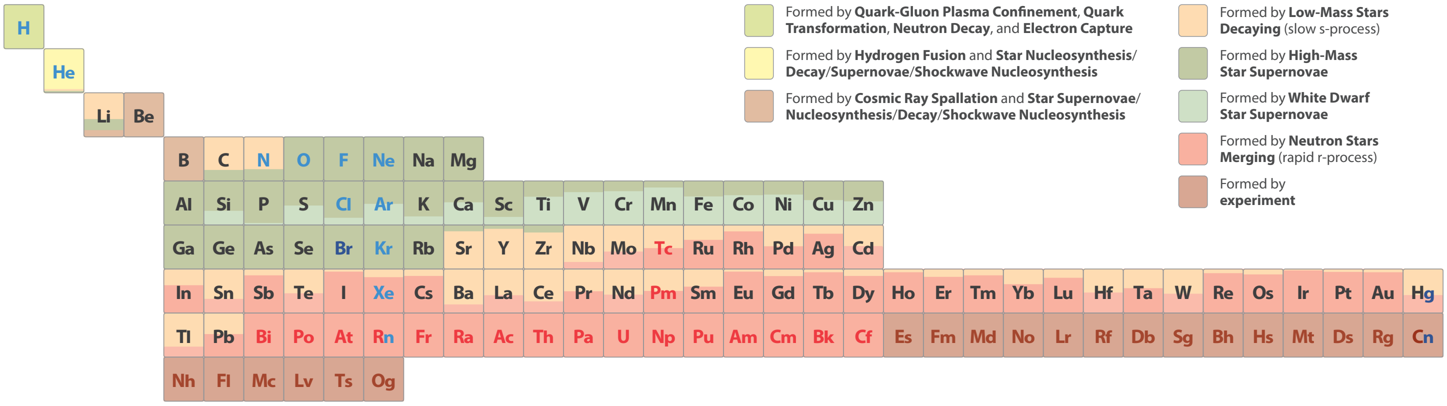


Figure 24: The universal origins of elements in the Right Step Periodic Table (RSPT-36) can be situated thanks to the back-and-forth gradual and punctuated paradigm shifting efforts of theorists and observational researchers.

Which further allows the RSPT to reflect the elemental proportions of the Eddington Number (for the observable universe) alongside the order of the non-metals and metals per Astronomy and Cosmology:

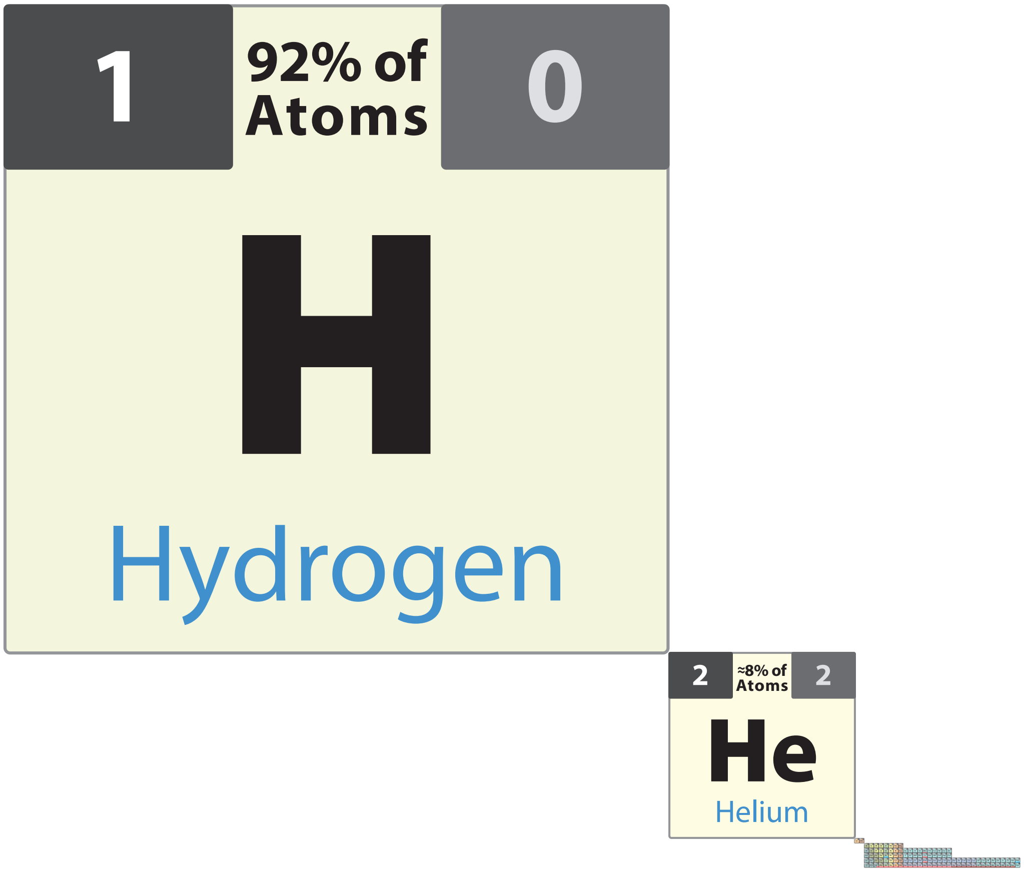


Figure 25a: The RSPT's natural form allows it to reflect the elemental proportions of the Eddington Number (for the observable universe) alongside the order of the non-metals and metals (per Astronomy and Cosmology).

As well as for the total mass-energy of the known universe:

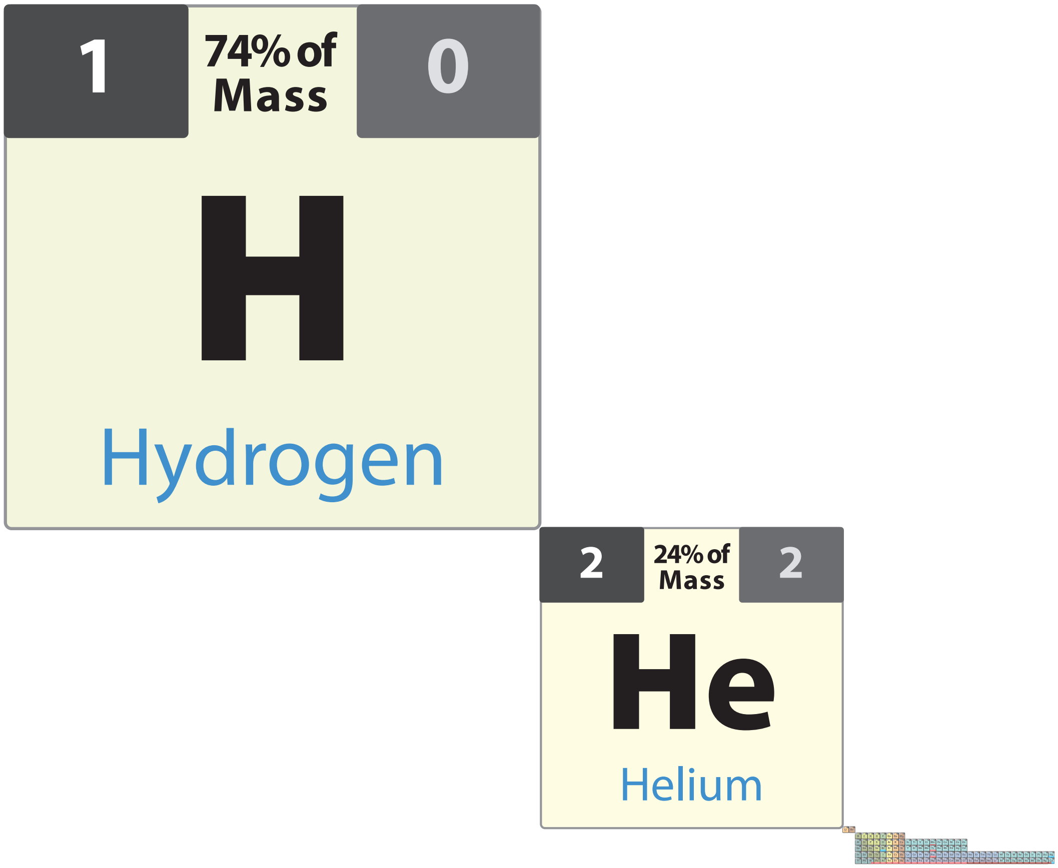


Figure 25b: The Right Step Periodic Table enables a natural mirroring of the universe's total mass-energy alongside the non-metal and metal ordering conventions of Astronomy and Cosmology.

The RSPT also appears to offer clearer insights into general periodic trends:

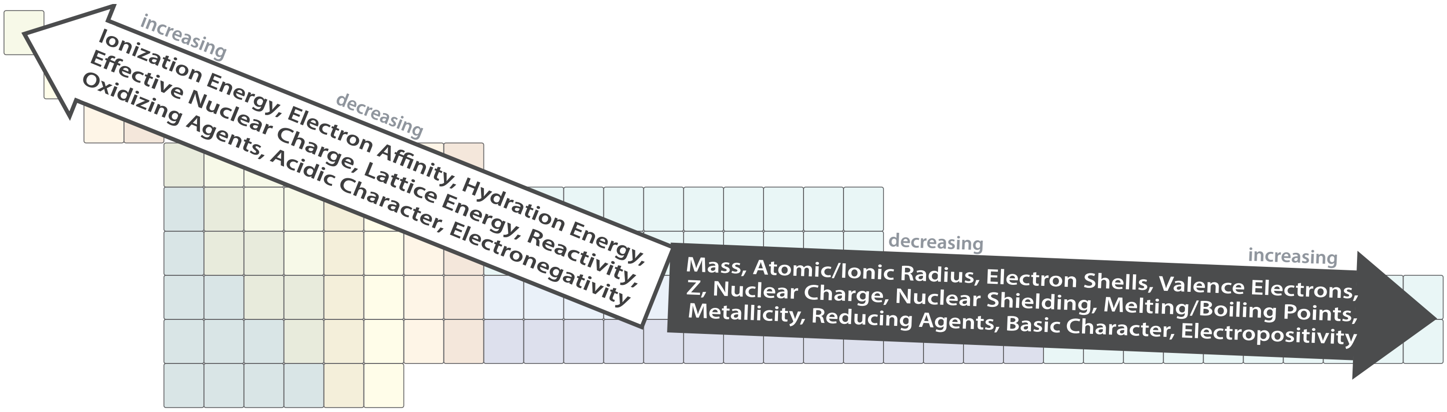


Figure 26a: The Right Step Periodic Table (RSPT-36) offers clearer insights into general periodic trends.

As well as clarifying Madelung's Rule usage, specifically that it can be relied on for s/p-period filling but not for d/f-periods:

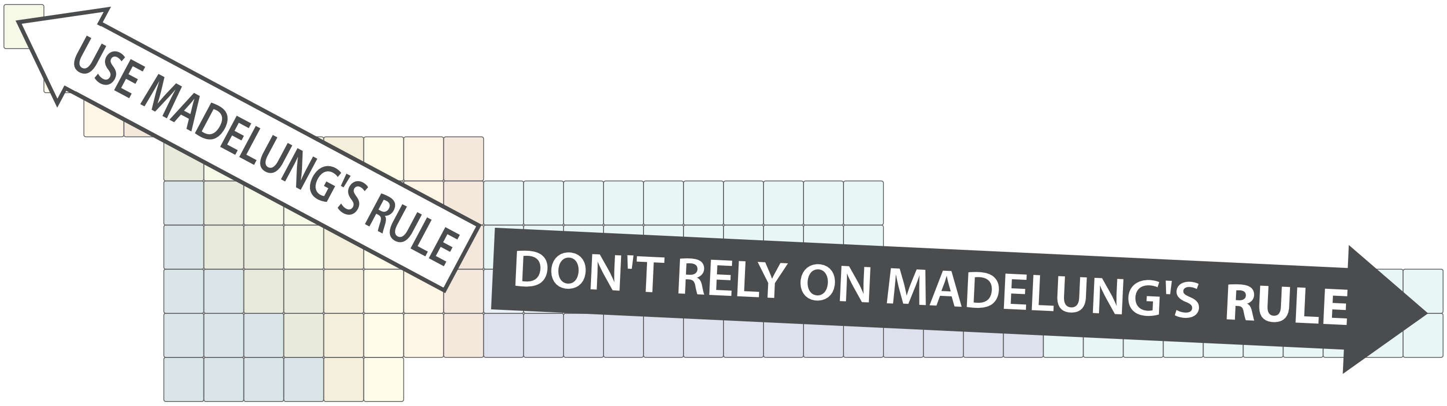
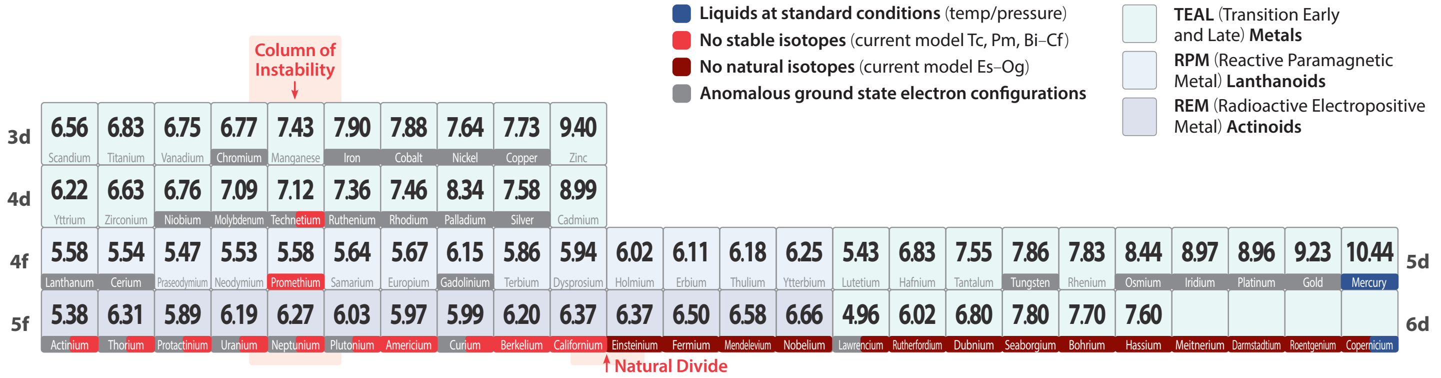


Figure 26b: The Right Step Periodic Table (RSPT-36) clarifies Madelung's Rule reliance and usage.

The RSPT also highlights the ionization energy decreases at the beginning of each s/p-orbital period (and when a d-period follows an f-period), and how the issues with expected electron ground state configurations correlate to problems with the expected ordered increase in ionization energy:



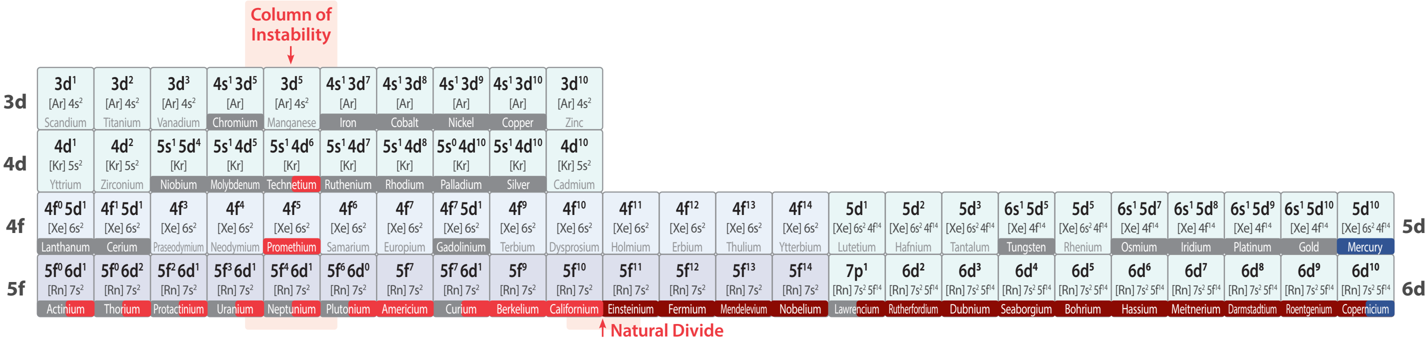
🟦 **Liquids at standard conditions** (temp/pressure)
🟥 **No stable isotopes** (current model Tc, Pm, Bi–Cf)
🟥 **No natural isotopes** (current model Es–Og)
⬛ **Anomalous ground state electron configurations**

TEAL (Transition Early and Late) **Metals**
RPM (Reactive Paramagnetic Metal) **Lanthanoids**
REM (Radioactive Electropositive Metal) **Actinoids**

3d	6.56 Scandium	6.83 Titanium	6.75 Vanadium	6.77 Chromium	7.43 Manganese	7.90 Iron	7.88 Cobalt	7.64 Nickel	7.73 Copper	9.40 Zinc															
4d	6.22 Yttrium	6.63 Zirconium	6.76 Niobium	7.09 Molybdenum	7.12 Technetium	7.36 Ruthenium	7.46 Rhodium	8.34 Palladium	7.58 Silver	8.99 Cadmium															
4f	5.58 Lanthanum	5.54 Cerium	5.47 Praseodymium	5.53 Neodymium	5.58 Promethium	5.64 Samarium	5.67 Europium	6.15 Gadolinium	5.86 Terbium	5.94 Dysprosium	6.02 Holmium	6.11 Erbium	6.18 Thulium	6.25 Ytterbium	5.43 Lutetium	6.83 Hafnium	7.55 Tantalum	7.86 Tungsten	7.83 Rhenium	8.44 Osmium	8.97 Iridium	8.96 Platinum	9.23 Gold	10.44 Mercury	5d
5f	5.38 Actinium	6.31 Thorium	5.89 Protactinium	6.19 Uranium	6.27 Neptunium	6.03 Plutonium	5.97 Americium	5.99 Curium	6.20 Berkelium	6.37 Californium	6.37 Einsteinium	6.50 Fermium	6.58 Mendelevium	6.66 Nobelium	4.96 Lawrencium	6.02 Rutherfordium	6.80 Dubnium	7.80 Seaborgium	7.70 Bohrium	7.60 Hassium	Meitnerium	Darmstadtium	Roentgenium	Copernicium	6d

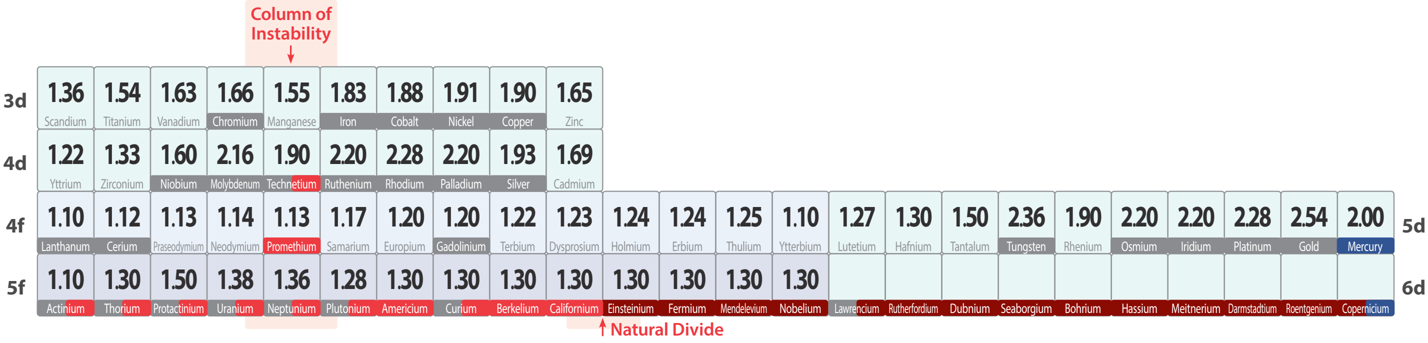
Figure 27: Ionization energy order issues and the correlated anomalous electron ground state configurations.

With the added benefit of simplifying atomic orbital charts after one-to-one directly mapping them onto the RSPT form — visually rationalizing exceptions to Madelung's Rule and the related periodicity of the ground state electron orbital shell configuration anomalies:



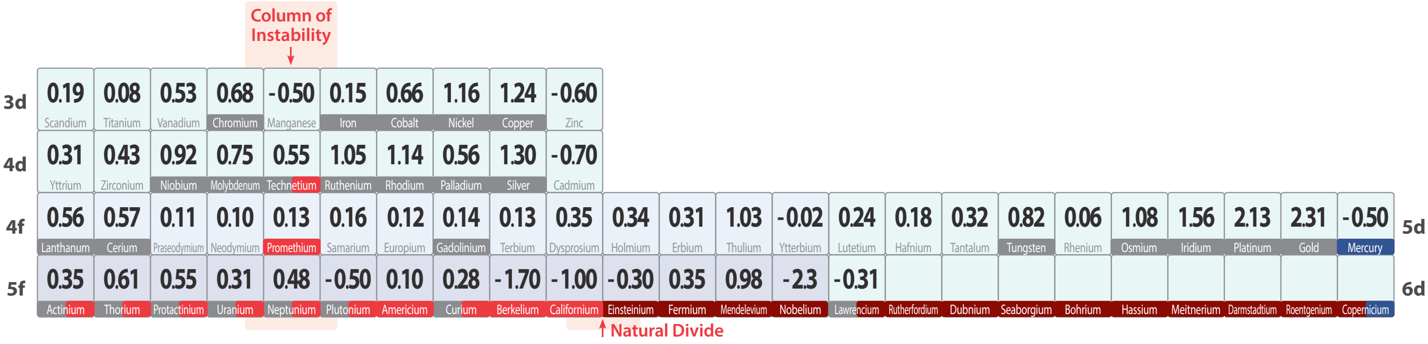
3d	$3d^1$ [Ar] $4s^2$ Scandium	$3d^2$ [Ar] $4s^2$ Titanium	$3d^3$ [Ar] $4s^2$ Vanadium	$4s^1 3d^5$ [Ar] Chromium	$3d^5$ [Ar] $4s^2$ Manganese	$4s^1 3d^7$ [Ar] Iron	$4s^1 3d^8$ [Ar] Cobalt	$4s^1 3d^9$ [Ar] Nickel	$4s^1 3d^{10}$ [Ar] Copper	$3d^{10}$ [Ar] $4s^2$ Zinc															
4d	$4d^1$ [Kr] $5s^2$ Yttrium	$4d^2$ [Kr] $5s^2$ Zirconium	$5s^1 5d^4$ [Kr] Niobium	$5s^1 4d^5$ [Kr] Molybdenum	$5s^1 4d^6$ [Kr] Technetium	$5s^1 4d^7$ [Kr] Ruthenium	$5s^1 4d^8$ [Kr] Rhodium	$5s^0 4d^{10}$ [Kr] Palladium	$5s^1 4d^{10}$ [Kr] Silver	$4d^{10}$ [Kr] $5s^2$ Cadmium															
4f	$4f^0 5d^1$ [Xe] $6s^2$ Lanthanum	$4f^1 5d^1$ [Xe] $6s^2$ Cerium	$4f^3$ [Xe] $6s^2$ Praseodymium	$4f^4$ [Xe] $6s^2$ Neodymium	$4f^5$ [Xe] $6s^2$ Promethium	$4f^6$ [Xe] $6s^2$ Samarium	$4f^7$ [Xe] $6s^2$ Europium	$4f^7 5d^1$ [Xe] $6s^2$ Gadolinium	$4f^9$ [Xe] $6s^2$ Terbium	$4f^{10}$ [Xe] $6s^2$ Dysprosium	$4f^{11}$ [Xe] $6s^2$ Holmium	$4f^{12}$ [Xe] $6s^2$ Erbium	$4f^{13}$ [Xe] $6s^2$ Thulium	$4f^{14}$ [Xe] $6s^2$ Ytterbium	$5d^1$ [Xe] $6s^2 4f^{14}$ Lutetium	$5d^2$ [Xe] $6s^2 4f^{14}$ Hafnium	$5d^3$ [Xe] $6s^2 4f^{14}$ Tantalum	$6s^1 5d^5$ [Xe] $4f^{14}$ Tungsten	$5d^5$ [Xe] $6s^2 4f^{14}$ Rhenium	$6s^1 5d^7$ [Xe] $4f^{14}$ Osmium	$6s^1 5d^8$ [Xe] $4f^{14}$ Iridium	$6s^1 5d^9$ [Xe] $4f^{14}$ Platinum	$6s^1 5d^{10}$ [Xe] $4f^{14}$ Gold	$5d^{10}$ [Xe] $6s^2 4f^{14}$ Mercury	5d
5f	$5f^0 6d^1$ [Rn] $7s^2$ Actinium	$5f^0 6d^2$ [Rn] $7s^2$ Thorium	$5f^2 6d^1$ [Rn] $7s^2$ Protactinium	$5f^3 6d^1$ [Rn] $7s^2$ Uranium	$5f^4 6d^1$ [Rn] $7s^2$ Neptunium	$5f^6 6d^0$ [Rn] $7s^2$ Plutonium	$5f^7$ [Rn] $7s^2$ Americium	$5f^7 6d^1$ [Rn] $7s^2$ Curium	$5f^9$ [Rn] $7s^2$ Berkelium	$5f^{10}$ [Rn] $7s^2$ Californium	$5f^{11}$ [Rn] $7s^2$ Einsteinium	$5f^{12}$ [Rn] $7s^2$ Fermium	$5f^{13}$ [Rn] $7s^2$ Mendelevium	$5f^{14}$ [Rn] $7s^2$ Nobelium	$7p^1$ [Rn] $7s^2 5f^{14}$ Lawrencium	$6d^2$ [Rn] $7s^2 5f^{14}$ Rutherfordium	$6d^3$ [Rn] $7s^2 5f^{14}$ Dubnium	$6d^4$ [Rn] $7s^2 5f^{14}$ Seaborgium	$6d^5$ [Rn] $7s^2 5f^{14}$ Bohrium	$6d^6$ [Rn] $7s^2 5f^{14}$ Hassium	$6d^7$ [Rn] $7s^2 5f^{14}$ Meitnerium	$6d^8$ [Rn] $7s^2 5f^{14}$ Darmstadtium	$6d^9$ [Rn] $7s^2 5f^{14}$ Roentgenium	$6d^{10}$ [Rn] $7s^2 5f^{14}$ Copernicium	6d

Figure 28: Exceptions to Madelung's Rule and the related periodicity of the ground state electron configuration anomalies.



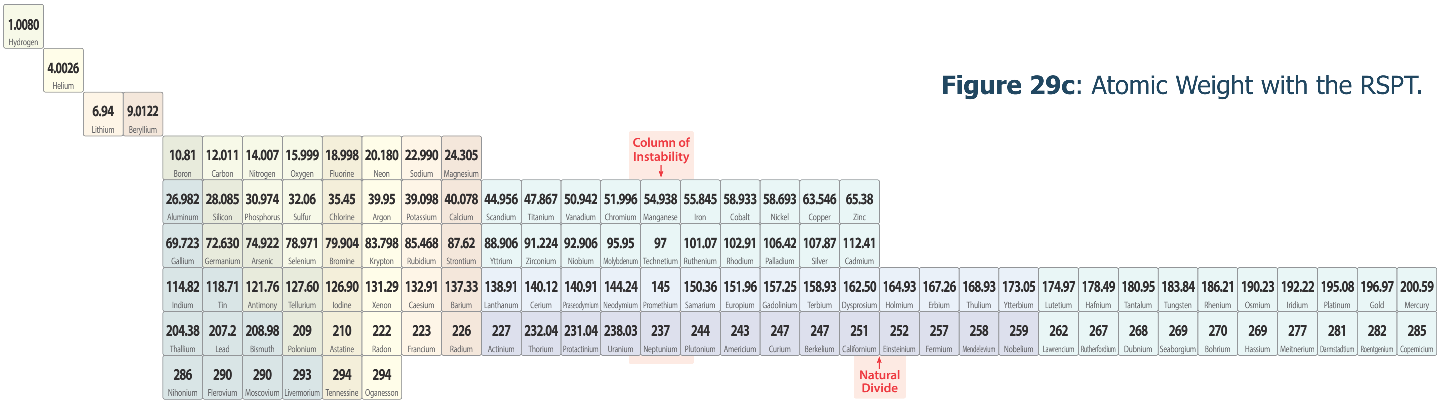
3d	1.36 Scandium	1.54 Titanium	1.63 Vanadium	1.66 Chromium	1.55 Manganese	1.83 Iron	1.88 Cobalt	1.91 Nickel	1.90 Copper	1.65 Zinc															
4d	1.22 Yttrium	1.33 Zirconium	1.60 Niobium	2.16 Molybdenum	1.90 Technetium	2.20 Ruthenium	2.28 Rhodium	2.20 Palladium	1.93 Silver	1.69 Cadmium															
4f	1.10 Lanthanum	1.12 Cerium	1.13 Praseodymium	1.14 Neodymium	1.13 Promethium	1.17 Samarium	1.20 Europium	1.20 Gadolinium	1.22 Terbium	1.23 Dysprosium	1.24 Holmium	1.24 Erbium	1.25 Thulium	1.10 Ytterbium	1.27 Lutetium	1.30 Hafnium	1.50 Tantalum	2.36 Tungsten	1.90 Rhenium	2.20 Osmium	2.20 Iridium	2.28 Platinum	2.54 Gold	2.00 Mercury	5d
5f	1.10 Actinium	1.30 Thorium	1.50 Protactinium	1.38 Uranium	1.36 Neptunium	1.28 Plutonium	1.30 Americium	1.30 Curium	1.30 Berkelium	1.30 Californium	1.30 Einsteinium	1.30 Fermium	1.30 Mendelevium	1.30 Nobelium	Lawrencium	Rutherfordium	Dubnium	Seaborgium	Bohrium	Hassium	Meitnerium	Darmstadtium	Roentgenium	Copernicium	6d

Figure 29a: Electronegativity trends in the d- and f-periods with the RSPT.



3d	0.19 Scandium	0.08 Titanium	0.53 Vanadium	0.68 Chromium	-0.50 Manganese	0.15 Iron	0.66 Cobalt	1.16 Nickel	1.24 Copper	-0.60 Zinc															
4d	0.31 Yttrium	0.43 Zirconium	0.92 Niobium	0.75 Molybdenum	0.55 Technetium	1.05 Ruthenium	1.14 Rhodium	0.56 Palladium	1.30 Silver	-0.70 Cadmium															
4f	0.56 Lanthanum	0.57 Cerium	0.11 Praseodymium	0.10 Neodymium	0.13 Promethium	0.16 Samarium	0.12 Europium	0.14 Gadolinium	0.13 Terbium	0.35 Dysprosium	0.34 Holmium	0.31 Erbium	1.03 Thulium	-0.02 Ytterbium	0.24 Lutetium	0.18 Hafnium	0.32 Tantalum	0.82 Tungsten	0.06 Rhenium	1.08 Osmium	1.56 Iridium	2.13 Platinum	2.31 Gold	-0.50 Mercury	5d
5f	0.35 Actinium	0.61 Thorium	0.55 Protactinium	0.31 Uranium	0.48 Neptunium	-0.50 Plutonium	0.10 Americium	0.28 Curium	-1.70 Berkelium	-1.00 Californium	-0.30 Einsteinium	0.35 Fermium	0.98 Mendelevium	-2.3 Nobelium	-0.31 Lawrencium	Rutherfordium	Dubnium	Seaborgium	Bohrium	Hassium	Meitnerium	Darmstadtium	Roentgenium	Copernicium	6d

Figure 29b: Electron Affinity trends in the d- and f-periods with the RSPT.



1.0080 Hydrogen																																			
	4.0026 Helium																																		
		6.94 Lithium	9.0122 Beryllium																																
				10.81 Boron	12.011 Carbon	14.007 Nitrogen	15.999 Oxygen	18.998 Fluorine	20.180 Neon	22.990 Sodium	24.305 Magnesium																								
				26.982 Aluminum	28.085 Silicon	30.974 Phosphorus	32.06 Sulfur	35.45 Chlorine	39.95 Argon	39.098 Potassium	40.078 Calcium	44.956 Scandium	47.867 Titanium	50.942 Vanadium	51.996 Chromium	54.938 Manganese	55.845 Iron	58.933 Cobalt	58.693 Nickel	63.546 Copper	65.38 Zinc														
				69.723 Gallium	72.630 Germanium	74.922 Arsenic	78.971 Selenium	79.904 Bromine	83.798 Krypton	85.468 Rubidium	87.62 Strontium	88.906 Yttrium	91.224 Zirconium	92.906 Niobium	95.95 Molybdenum	97 Technetium	101.07 Ruthenium	102.91 Rhodium	106.42 Palladium	107.87 Silver	112.41 Cadmium														
				114.82 Indium	118.71 Tin	121.76 Antimony	127.60 Tellurium	126.90 Iodine	131.29 Xenon	132.91 Caesium	137.33 Barium	138.91 Lanthanum	140.12 Cerium	140.91 Praseodymium	144.24 Neodymium	145 Promethium	150.36 Samarium	151.96 Europium	157.25 Gadolinium	158.93 Terbium	162.50 Dysprosium	164.93 Holmium	167.26 Erbium	168.93 Thulium	173.05 Ytterbium	174.97 Lutetium	178.49 Hafnium	180.95 Tantalum	183.84 Tungsten	186.21 Rhenium	190.23 Osmium	192.22 Iridium	195.08 Platinum	196.97 Gold	200.59 Mercury
				204.38 Thallium	207.2 Lead	208.98 Bismuth	209 Polonium	210 Astatine	222 Radon	223 Francium	226 Radium	227 Actinium	232.04 Thorium	231.04 Protactinium	238.03 Uranium	237 Neptunium	244 Plutonium	243 Americium	247 Curium	247 Berkelium	251 Californium	252 Einsteinium	257 Fermium	258 Mendelevium	259 Nobelium	262 Lawrencium	267 Rutherfordium	268 Dubnium	269 Seaborgium	270 Bohrium	269 Hassium	277 Meitnerium	281 Darmstadtium	282 Roentgenium	285 Copernicium
				286 Nihonium	290 Flerovium	290 Moscovium	293 Livermorium	294 Tennessine	294 Oganesson																										

Figure 29c: Atomic Weight with the RSPT.

See Mark Leach’s encyclopedic Internet Database of Periodic Tables for the thousands of creative and often visually stunning attempts at solving any one of the above issues. This paper’s author learned of Leach’s exhaustive labour-of-love resource during due-diligence research, and, utterly disheartened by the sheer volume, opened every single page fully expecting to find the Right-Step form had already been discovered.

While two came close (Beylkin for Tc–Pm and the ground state issues versus Gutiérrez-Samanez and Mendoza for the shape), they did not completely address the disputes over H — though Mendoza came uncomfortably close — as well as He and Li–Be, the periodicity of Cf/Es, gases, liquids, and ground anomalies, as well as commonality trends, accurate orbital filling, and the cosmic-stellar evolution of the elements.

The name of the RSPT was inspired by the Janet Left Step Periodic Table, and features a built-in parody of the Otis Redding-Aretha Franklin classic (Respect).

Bonus Easter Egg: SPOCH BONSe, pronounced Spock Bones, is a mnemonic device to help remember the updated elements considered most essential for human life (replacing CHNOPS). Also considered POSCH SeNOB and SNOBS ePOCH. And yes, two Oxygens were snuck in there, but it’s justified by the importance of O_2 (while conveniently ignoring the other diatomics).

Concluding Remarks

Just as properly configuring the relationships between the d- and f-periods to resolve the Group 3 Forever War and declare one side victorious could not satisfy everyone involved (especially as the charge came from an entirely unexpected and unwelcome direction), properly configuring the H, He, and Li–Be elements and their natural relationships into a more optimum periodic table will not satisfy everyone (or more probably anyone).

As it must reflect the asymmetric evolution of the elements and the universe, any truly objective periodic table must also necessarily overcome hundreds of thousands of years of innate ocularcentric desires surrounding genetic and epigenetic worthiness inseparably attached to symmetrical attractiveness.

Coupled with answering to the byproducts of print technologies and their width-conscious format imperatives — along with the change management energy requirements of engaging sunk-cost fallacies, alleviating cognitive dissonances, and mitigating individual and institutional inertiae — promoting the abandonment of all emotional and intellectual capital previously and currently invested into the instantly recognized, world-beloved, and ubiquitously accepted standard (though unofficial for good reason) icon will not be an easy ask.

When minor tweaks that surprisingly perfected (yet maintained) the current table were hoped and looked for (instead of a complete overhaul), one can only trust that the questions raised and the potentials locked within the new form will be addressed (even if towards a more optimal build) and not just kicked down the road for the future to deal with, perpetually delayed under the injunction of requiring more information and time to consider, or most powerfully neutralized through lack of engagement.

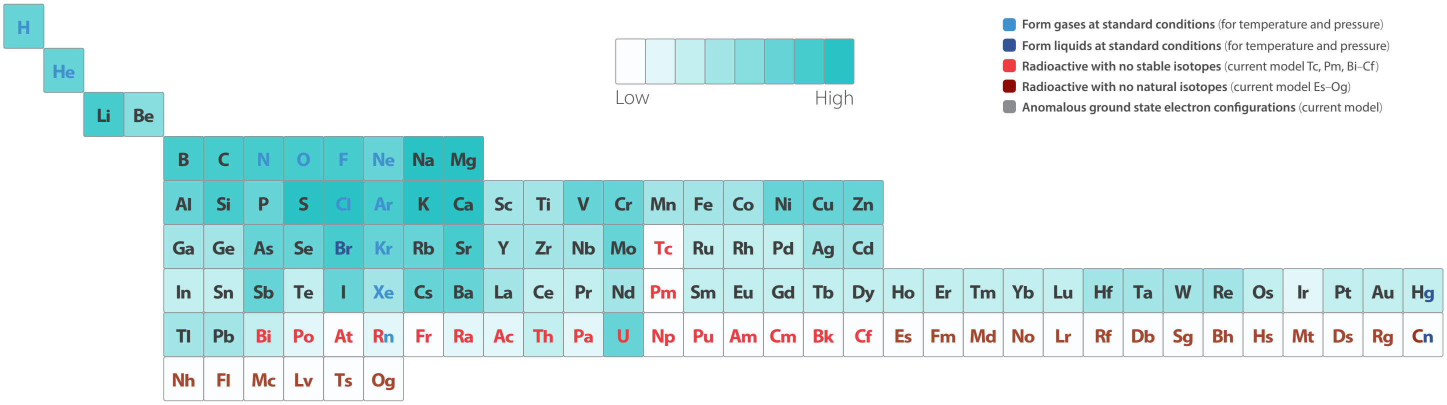


Figure 30: The Right Step Periodic Table (RSPT-36) displaying the relative abundance of elements found in the ocean thanks to Kenneth and Holly Johnson and the Monterey Bay Aquarium Research Institute (MBARI).

SECTION 4. **Further Questions**

The mutually reinforcing feedback loops of the incremental gradualist experimental precursors (discovering issues with and weakening current scientific paradigms after pushing them to their limits) lead to punctuated realizations (finally abandoning experimentally disproven theories and searching for more fundamental scientific paradigms), resulting in ever deeper understandings in Biology, Chemistry, Physics, and Information.

While the paradigm shifters generally garner most of the credited glory (often earning surname mononyms), such breakthroughs would not be possible without the continuing back-and-forth between the often thankless monotonous brute force, inspired tactical, and other hard-won insights of observers, researchers, and theorists interspersed before, during, and after the current and previous paradigm shifts.

If not for the untold millennia of unnamed and unremembered discoverers and re-discoverers slowly beginning to understand and build upon handed-down pre-chymistry knowledge of the earliest known natural substances and mixtures, succeeded by the proto-scientific first steps towards unlocking and entering the doors of discovery past which lay the basic compounds and their veiled properties, Mendeleev's achievement in correctly organizing the elements based on known characteristics (after and due to the many near misses of precursors and contemporaries), followed by 150 years of painstaking and often unfruitful, uncredited, or unacknowledged labour and art (along with those occasional moments of pure eureka joy) uncovering ever more fundamental properties, eventually resulting in the breakthrough discoveries of the radioactive elements Tc and Pm and the unexpectedly related theories behind potential Islands of Stability, the Right-Step Periodic Table would never have been discovered.

Knowing that we are always standing on the shoulders of the giants whose lives and efforts made possible the knowledge taken for granted should always fill us with gratitude, humility, and a debt of honour. As with even a minor breakthrough as this potentially optimum periodic table — which even if not the one, might at least inspire or reignite efforts towards eventually finding the one — not only answers existing questions (either directly or by bypassing) but necessarily leads to new ones:

1. Should Mass 2 and 3 be considered pre- or proto-roadblocks — as ^{2}H represents only .01% of all Hydrogen atoms, and ^{3}H only .0002% of all Helium atoms (the why and not the how this occurs);

2. Is the **duplet rule** actually a rule if it appears to be synthetically designed to match the **octet rule** in order to conflate the s-element duplet He with the p-element Ne-Ar-Kr-Xe-Rn-Og octet gases — or is it merely a justification for keeping them all together in the artificial Group 18;

3. If the **18-electron** only tends to (but not always) be obeyed by the Transition Metal molecules, is it actually a rule. Again, if the rule is similarly manufactured to fit in with the **duplet** and **octet rules**, would the relationships not be better served by a much broader or conversely much more specific set of separate and openly unrelated valency shell rules (full period rules or full orbital rules);

4. Are the often significant connections between the 8th orbital positions in periods and connected periods (the s^2p^6 octet gases and the d^8 and f^8 anomalous column) mere numerology or something more fundamental than stability — and are there related reasons for the 10th position connections;

5. Similarly, are the now transparently significant connections between the 5th orbital positions in periods and connected periods (the p^5 Halogens as a unified Group, the d^5 and f^5 and potential g^5 Column of Instability) also mere numerology or something more fundamental than instability — and if not, what is the why (and not just the how) beneath stability and instability;

6. Can we uncover underlying mechanisms to build categorization type consensus for every p-block element. The vertically grouped p^5 Halogens category currently appears uncontroversial. The s^2p^6 Octet Gases vertical group similarly seems consensual and only controversial as far as including the duplet 2s-elements (Li and Be). But we might ask ourselves why the p^1, p^2, p^3, and p^4 element groups are so inconsistent when it comes to shared properties and so varied when it comes to their

dissimilar characteristics. Why should so closely linked elements contain such a random mix of Reactive Nonmetals, Metalloids, and Other/Poor/Pre-Transition (excluding Al) Metals — and can we find a definite answer for which elements should be classified to each type. And what are we to make of yet again forcing elements into categorizations through judiciously chosen properties where the most common Aluminum is included as a Post-Transition Metal even though it comes before the Transition Metals;

7. Relatedly, why are Thallium (Th) and Lead (Fe) not as fundamentally unstable as Bismuth (Bi). Is it as simple as p^3 Bismuth carrying the known instabilities associated with unevenly Z-numbered elements. Or is it for related reasons where the similarly columned though differently categorized and much less complex p^3 Nitrogen (N) is also a gas at standard conditions;

8. Should Sc and Y be lumped in with the 4f-period elements (beyond La and C that they share as a column Group) because of judiciously chosen chemical property similarities while ignoring differing electrical and magnetic properties. Is this yet another case of artificially connecting elements like He and the octet gases. And, as we fix the table, the groups, the categorizations, the types, and the keys, should we not as well fix the REE (Rare Earth Elements) misnomer as they aren't actually rare; and

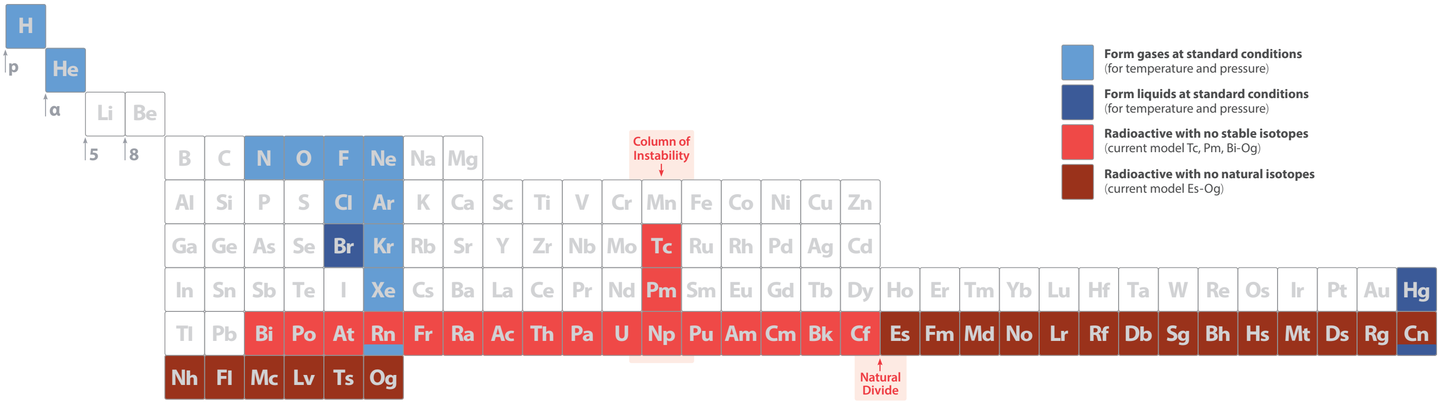
9. Speaking of historical misnomers, should the Main Group also be redefined as the octet ruled p-block and 3s–7s-periods are no longer fundamentally connected in the same ways to the duplet H, He, Li, and Be elements.

While we must accept nature constantly usurping our desires (including bilateral symmetry as a deciding factor), we should be less accepting of nature not eventually providing more descriptive answers after the continued refinement and shedding of our normatively assumed questions.

Correcting the Periodic Table based on evolution indicates a new physics may be necessary for understanding the periodic characteristics of the element Groups (columns). Just as electrons have the electron shell model, nucleons have their own nuclear shell model where protons and neutrons (separate from each other) fill orbital energy shells in pairs with opposite angular momenta — instead of opposite quantum spin as with electrons — with most interactions and reactivity also carried by the outer unpaired valence nucleons.

Similar to electrons, adding or removing nucleons changes binding energy and alters atomic stability, resulting in semi-magic, magic, and doubly magic nuclei (protons and neutrons) — and suggests this may also create anomalous nucleon ground state proton and neutron configurations.

With the shared chemical characteristics down columned groups often not as expected within the current models, all of this might mean that the much more massive nucleons may also contribute to the periodicity of elements, beyond radioactivity. This includes the related possibility that the periodic characteristics additionally result from interactions between nucleons and each other and with electrons — including nuclear, relativistic, and particularly the electromagnetic effects between the negatively charged electrons and the positively charged protons.



🟦 **Form gases at standard conditions** (for temperature and pressure)

🟦 **Form liquids at standard conditions** (for temperature and pressure)

🟥 **Radioactive with no stable isotopes** (current model Tc, Pm, Bi-Og)

🟫 **Radioactive with no natural isotopes** (current model Es-Og)

Figure 31: The Right-Step visually reinforces the trends of the gas, liquid, and radioactive divergent element types (Rule 13).

SECTION 5. **RESEARCH APPENDICES** — currently in progress

APPENDIX A: **Putting the Pre- and Proto-Elements in Their Place**

Referencing the Free Neutron, Free Electron, Free Proton, Alpha Particle, and the Mass 5- and 8-Roadblocks.

APPENDIX B: **Putting Hydrogen in Its Place**

Referencing the main research behind why $1s^1$ Hydrogen (H) does not fit in any Group.

APPENDIX C: **Putting Helium in Its Place**

Referencing the main research behind why $1s^2$ Helium (He) does not fit in any Group.

APPENDIX D: **Putting Lithium in Its Place**

Referencing research for why $2s^1$ Lithium (Li) does not fit with the $3s^1$–$7s^1$ Group 1 Alkali Metals.

APPENDIX E: **Putting Beryllium in Its Place**

Referencing research for why $2s^2$ Beryllium (Be) does not fit with the $3s^2$–$7s^2$ Group 2 Alkaline Earth Metals.

APPENDIX F: **Putting the D- and F-Blocks in Their Places**

Overview referencing the research behind correcting the current standard artificially stacked d-block.

F1: **Putting Sc-Y-La-Ac in Their Place**: Referencing the reasons for reordering the d- and f-periods;

F2: **Putting Ti-Zr-Ce-Th in Their Place**: Referencing the reasons for reordering the d- and f-periods;

F3: **Putting V-Nb-Pr-Pa in Their Place**: Referencing the reasons for reordering the d- and f-periods;

F4: **Putting Cr-Mo-Nd-U in Their Place**: Referencing the reasons for reordering the d- and f-periods;

F5: **Putting Mn-Tc-Pm-Np in Their Place**: Referencing the reasons why fixing the Group to Mn-Tc-Pm-Np (the Column of Instability) supports orienting the d- and f-periods into their natural places;

F6: **Putting Fe-Ru-Sm-Pu in Their Place**: Referencing the reasons for reordering the d- and f-periods;

F7: **Putting Co-Rh-Eu-Am in Their Place**: Referencing the reasons for reordering the d- and f-periods;

F8: **Putting Ni-Pd-Gd-Cm in Their Place**: Referencing the reasons for reordering the d- and f-periods;

F9: **Putting Cu-Ag-Tb-Bk in Their Place**: Referencing the reasons for reordering the d- and f-periods; and

F10: **Putting Zn-Cd-Dy-Cf in Their Place**: Referencing the reasons for reordering the d- and f-periods.

APPENDIX G: **All-Inclusive Last Resort**

Developing and expanding Rule 16 as well as describing how the Right-Step Periodic Table (RSPT) was accidentally discovered while working on the Emergent Universe model with its natural elemental evolution from and through Information --> Physics --> Chemistry --> Biology.