

Chapter 5: The Periodic Law

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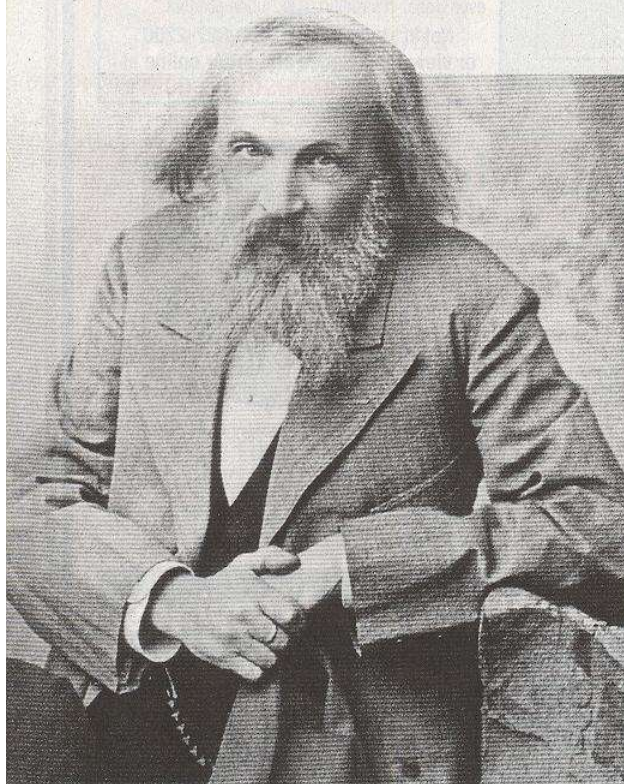
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Online Resources: <https://bit.ly/33T7qua>

20 THINGS YOU DIDN'T KNOW ABOUT THE PERIODIC TABLE

By Rebecca Coffey



Mendeleev is above. Rebecca Coffey's blog, *The Excuses I'm Going With*, is at rebeccacoffey.blogspot.com

1. You may remember the Periodic Table of the Elements as a dreary chart on your classroom wall. If so, you never guessed its real purpose: It's a giant cheat sheet. **2.** The table has served chemistry students since 1869, when it was created by Dmitry Mendeleev, a cranky professor at the University of St. Petersburg. **3.** With a publisher's deadline looming, Mendeleev didn't have time to describe all 63 then-known elements. So he turned to a data set of atomic weights meticulously gathered by others. **4.** To determine those weights, scientists had passed currents through various solutions to break them up into their constituent atoms. Responding to a battery's polarity, the atoms of one element would go this-away, the atoms of another thataway. The atoms were collected in separate containers and then weighed. **5.** From this process, chemists determined relative weights—which were all Mendeleev needed to establish a useful ranking. **6.** Fond of card games, he wrote the weight for each element on a separate index card and sorted them as in solitaire. Elements with similar properties formed a "suit" that he placed in columns ordered by ascending atomic weight. **7.** Now he had a new Periodic Law ("Elements arranged according to the value of their atomic weights present a clear periodicity of properties") that described one pattern for all 63 elements. **8.** Where Mendeleev's table had blank spaces, he correctly predicted the weights and chemical behaviors of some missing elements—gallium, scandium, and germanium. **9.** But when argon was discovered in 1894, it didn't fit into any of Mendeleev's columns, so he denied its existence—as he did for helium, neon, krypton, xenon, and radon. **10.** In 1902 he acknowledged he had not anticipated the existence of these overlooked, incredibly unreactive elements—the noble gases—which now constitute the entire eighth group of the table. **11.** Now we sort elements by

their number of protons, or "atomic number," which determines an atom's configuration of oppositely charged electrons and hence its chemical properties. **12.** Noble gases (far right on the periodic table) have closed shells of electrons, which is why they are nearly inert. **13.** Atomic love: Take a modern periodic table, cut out the complicated middle columns, and fold it once along the middle of the Group 4 elements. The groups that kiss have complementary electron structures and will combine with each other. **14.** Sodium touches chlorine—table salt! You can predict other common compounds like potassium chloride, used in very large doses as part of a lethal injection. **15.** The Group 4 elements in the middle bond readily with each other and with themselves. Silicon + silicon + silicon ad infinitum links up into crystalline lattices, used to make semiconductors for computers. **16.** Carbon atoms—also Group 4—bond in long chains, and voilà: sugars. The chemical flexibility of carbon is what makes it the key molecule of life. **17.** Mendeleev wrongly assumed that all elements are unchanging. But radioactive atoms have unstable nuclei, meaning they can move around the chart. For example, uranium (element 92) gradually decays into a whole series of lighter elements, ending with lead (element 82). **18.** Beyond the edge: Atoms with atomic numbers higher than 92 do not exist naturally, but they can be created by bombarding elements with other elements or pieces of them. **19.** The two newest members of the periodic table, still-unnamed elements 114 and 116, were officially recognized last June. Number 116 decays and disappears in milliseconds. **20.** Physicist Richard Feynman once predicted that number 137 defines the table's outer limit; adding any more protons would produce an energy that could be quantified only by an imaginary number, rendering element 138 and higher impossible. Maybe. **D**

For a printable periodic table visit: discovermagazine.com/web/periodictable

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