



# FICTIONAL ELEMENT

Can a made-up element featured in the movie **Black Panther** help explain how the periodic table is organized?



**ESSENTIAL QUESTION:** How are elements arranged on the periodic table?

The hero of the hit blockbuster *Black Panther* has more than superhuman strength. He also has a high-tech suit powered by a fictional element called vibranium. Just a thin layer of the rare metal in Black Panther's suit can stop bullets. It can even absorb the force of blows and explosions and then reemit that energy to knock out villains. The element also looks cool: In its pure form, it glows a mysterious purple.

Vibranium may be fictional, but many of its chemical and physical properties mimic those of real-life elements. Like many metals, it is hard, shiny, and able to conduct electricity. And like some radioactive elements, it can emit energy and glow in the dark.

The similarities between vibranium and actual elements recently got Sibrina Collins thinking. She's the executive director of the Marburger STEM Center at Lawrence Technological University in Michigan. "What if vibranium were real?" she wondered. "Where would it fit in on the periodic table?"

Collins asked a chemistry professor at the university to pose the question to her students for bonus points on an exam. "There was no right or wrong answer," says Collins. "It was just to get them thinking about why the periodic table is arranged the way it is." The students had a wide range of responses. But we won't tell you what they thought. Instead, use the information in the article and diagram below to come up with your own answer. ✨

—Jacob Batchelor

📍 WHERE DOES IT FIT?



Vb

Use the information below to decide where you would put vibranium on the periodic table.

# HOW THE PERIODIC TABLE IS ORGANIZED

The periodic table contains all known elements—118 of them! They're arranged so their properties typically change in a predictable way.

**ATOMIC NUMBER:** Elements appear on the table in order of their atomic number—the number of positively charged protons in an atom's nucleus. In general, elements become heavier as the atomic number increases. Hydrogen (H) appears first and is also the lightest.

**GROUPS:** Elements are also arranged based on their electrons. These negatively charged particles orbit an atom's nucleus in shells, or energy levels. Elements in each group, or column, have the same number of electrons in their outer shells. That gives them similar properties. For example, the noble gases in Group 18 are inert—they don't react with other elements.

**METALS AND NONMETALS:** Most elements are metals. Metals lose electrons easily, making them good conductors of heat and electricity. They're usually solid and malleable, or easy to shape. Most other elements are nonmetals, which gain electrons easily. They exist as solids, liquids, or gases.

Group 1	Group 2	Group 3	Group 4	Group 5	Group 6	Group 7	Group 8	Group 9	Group 10	Group 11	Group 12	Group 13	Group 14	Group 15	Group 16	Group 17	Group 18	
1 H Hydrogen (1.007, 1.009)	4 Be Beryllium 9.012	21 Sc Scandium 44.96	22 Ti Titanium 47.87	23 V Vanadium 50.94	24 Cr Chromium 52.00	25 Mn Manganese 54.94	26 Fe Iron 55.85	27 Co Cobalt 58.93	28 Ni Nickel 58.69	29 Cu Copper 63.55	30 Zn Zinc 65.38	31 Al Aluminum 26.98	32 Ge Germanium 72.63	33 As Arsenic 74.92	34 Se Selenium 78.97	35 Br Bromine (79.90, 79.91)	36 Kr Krypton 83.80	37 Rb Rubidium 85.47
2 He Helium 4.003	10 Ne Neon 20.18	39 Y Yttrium 88.91	40 Zr Zirconium 91.22	41 Nb Niobium 92.91	42 Mo Molybdenum 95.96	43 Tc Technetium (98)	44 Ru Ruthenium 101.1	45 Rh Rhodium 102.9	46 Pd Palladium 106.4	47 Ag Silver 107.9	48 Cd Cadmium 112.4	49 In Indium 114.8	50 Sn Tin 118.7	51 Sb Antimony 121.8	52 Te Tellurium 127.6	53 I Iodine 126.9	54 Xe Xenon 131.3	
3 Li Lithium (6.94, 6.937)	12 Mg Magnesium (24.30, 24.31)	39-40 57-71 89-103	40 Zr Zirconium 91.22	41 Nb Niobium 92.91	42 Mo Molybdenum 95.96	43 Tc Technetium (98)	44 Ru Ruthenium 101.1	45 Rh Rhodium 102.9	46 Pd Palladium 106.4	47 Ag Silver 107.9	48 Cd Cadmium 112.4	49 In Indium 114.8	50 Sn Tin 118.7	51 Sb Antimony 121.8	52 Te Tellurium 127.6	53 I Iodine 126.9	54 Xe Xenon 131.3	
4 K Potassium 39.10	20 Ca Calcium 40.08	57-71 89-103	72 Hf Hafnium 178.5	73 Ta Tantalum 180.9	74 W Tungsten 183.8	75 Re Rhenium 186.2	76 Os Osmium 190.2	77 Ir Iridium 192.2	78 Pt Platinum 195.1	79 Au Gold 197.0	80 Hg Mercury 200.6	81 Tl Thallium (204.3, 204.4)	82 Pb Lead 207.2	83 Bi Bismuth 209.0	84 Po Polonium (209)	85 At Astatine (210)	86 Rn Radon (222)	
5 Rb Rubidium 85.47	38 Sr Strontium 87.62	57-71 89-103	72 Hf Hafnium 178.5	73 Ta Tantalum 180.9	74 W Tungsten 183.8	75 Re Rhenium 186.2	76 Os Osmium 190.2	77 Ir Iridium 192.2	78 Pt Platinum 195.1	79 Au Gold 197.0	80 Hg Mercury 200.6	81 Tl Thallium (204.3, 204.4)	82 Pb Lead 207.2	83 Bi Bismuth 209.0	84 Po Polonium (209)	85 At Astatine (210)	86 Rn Radon (222)	
6 Cs Cesium 132.9	56 Ba Barium 137.3	57-71 89-103	104 Rf Rutherfordium (261)	105 Db Dubnium (268)	106 Sg Seaborgium (271)	107 Bh Bohrium (270)	108 Hs Hassium (277)	109 Mt Meitnerium (276)	110 Ds Darmstadtium (281)	111 Rg Roentgenium (280)	112 Cn Copernicium (285)	113 Nh Nihonium (284)	114 Fl Flerovium (289)	115 Mc Moscovium (288)	116 Lv Livermorium (293)	117 Ts Tennessine (294)	118 Og Oganesson (294)	
7 Fr Francium (223)	88 Ra Radium (226)	57-71 89-103	104 Rf Rutherfordium (261)	105 Db Dubnium (268)	106 Sg Seaborgium (271)	107 Bh Bohrium (270)	108 Hs Hassium (277)	109 Mt Meitnerium (276)	110 Ds Darmstadtium (281)	111 Rg Roentgenium (280)	112 Cn Copernicium (285)	113 Nh Nihonium (284)	114 Fl Flerovium (289)	115 Mc Moscovium (288)	116 Lv Livermorium (293)	117 Ts Tennessine (294)	118 Og Oganesson (294)	
Period 1	Period 2	Period 3	Period 4	Period 5	Period 6	Period 7	Period 8	Period 9	Period 10	Period 11	Period 12	Period 13	Period 14	Period 15	Period 16	Period 17	Period 18	
1	2	8	18	18	32	32	32	32	32	32	32	32	32	32	32	32	32	

**Legend:**

- C** Solid
- Br** Liquid
- Ho** Gas
- Tc** Synthetic

**Color Key:**

- Hydrogen (Red)
- Alkali metals (Purple)
- Alkaline earth metals (Pink)
- Transition metals (Yellow)
- Other metals (Green)
- Noble gases (Blue)
- Nonmetals (Light Blue)
- Inner transition metals (Orange)
- Unknown properties (Grey)

**PERIODS:** In general, elements on the left side of a period, or row, more easily give up electrons when bonding with other elements. Elements on the right (excluding the noble gases) tend to more easily accept electrons. That means these elements are more reactive, or able to undergo a chemical reaction.

**INNER TRANSITION METALS:** These two rows of elements belong in Group 3. Because they don't fit neatly on the table, they're placed underneath. Those in the top row are soft, silvery white metals. Those in the bottom row are radioactive.

**SYNTHETIC ELEMENTS:** Some elements are unstable and don't exist in nature. Scientists make them in a lab. Science World's periodic table depicts them using orange symbols.