Unplugged Lesson

Lesson Title:	**Element Characteristics**
Grade Level:	**High School**
Subject:	**Chemistry**
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Engagement:

- Students will sort shapes that are different colors. They can sort how they like based on categories that they come up with (size, angles, color, number of sides).
- Once sorting is done, teacher will ask what things in science can be sorted using different categories?
- Have you ever heard of the periodic table? It was made using different characteristics of elements.
- Students will ask themselves: How was the periodic table made? What characteristics were used to sort elements?

Exploration:

- Students will be given cards with various elements and a few characteristics about each element. They will come up with their own categories and sort the elements into their categories.

What are some ways that you could sort these elements based on their characteristics?

Students can use the categories they have sorted to try to come up with their own idea of how the elements may fit together to make the periodic table.

Explanation:

- Students share out how they sorted the elements, as well as how they would set up the periodic table based upon how they sorted the elements.
- How do you think the different categories you came up with could be used to make the periodic table? Would your system be able to be used for new elements being added?
- Why does your system work? How could you argue that some characteristics of an element may be more important than others?

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Elaboration:

- Write down your process for sorting. Try to make it applicable if I were to give you more element cards. Write instructions so that one of your classmates/me/someone else could come in and use your system to sort more elements
- Share the story of how Mendeleev established the periodic table:
    - Dimitri Mendeleev was a Russian chemist in the 1800s
    - Wanted to organize the elements
    - Made element cards just like played solitaire and us.
    - Everywhere he went he took cards and tried reorganizing them.
    - The story goes: on a day he was supposed to catch a train, he took out the cards and got to work. He missed his train and stayed up for 3 days and nights, just arranging and rearranging the cards. Exhausted, he went to sleep, and this (see below) table came to him in a dream.
    - He even left space for some undiscovered elements, that were discovered in the next few years (Gallium, germanium, and scandium)
- Discuss with students how the different periodic tables are arranged and the importance as to why they are arranged (i.e. ionization energy trend, electron affinity trend, atomic radius/size, non-metals/metals/transition metals, etc)
- Discuss the similarities and differences between their own sorting of the elements/their own organization of the periodic table, Mendeleev's periodic table, and the current periodic table.
- Discuss the importance of having any type of information arranged instead of it just being random (does it make our lives easier?)

Evaluation:

- Using their sorted periodic tables and the actual periodic table, students will show the trends of ionization energy and electronegativity on the table.
    - Give copy of periodic table and have students use colored pencils to draw arrows showing the trend of decrease/increase for ionization energy, electronegativity, and atomic radius
    - Students will color code the periodic table based on metal/nonmetal/transition metal etc

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- Students will demonstrate understanding of how/why the periodic table is set up the way it is using characteristics of elements that make it up

Na 496 kJ/mol 0.93 227 pm Alkali metal	Ag 731 kJ/mol 1.93 172 pm Transition metal	O 141 kJ/mol 3.44 152 pm nonmetal
F 328 kJ/mol 3.98 147 pm nonmetal	Cr 653 kJ/mol 1.66 125 pm Transition metal	Sr 549 kJ/mol 0.95 215 pm metal

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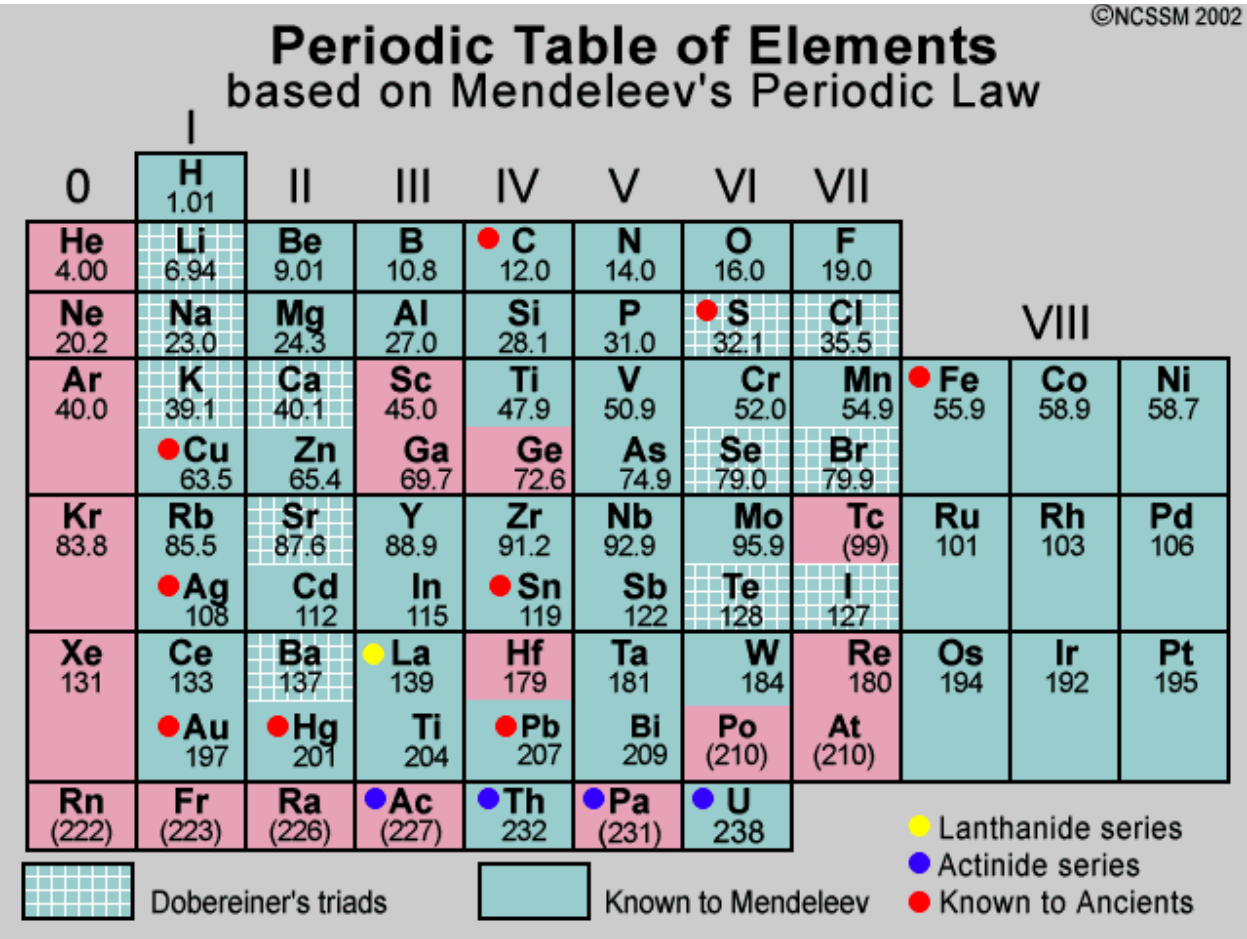

Source: https://corrosion-doctors.org/Periodic/Periodic-Mendeleev.htm

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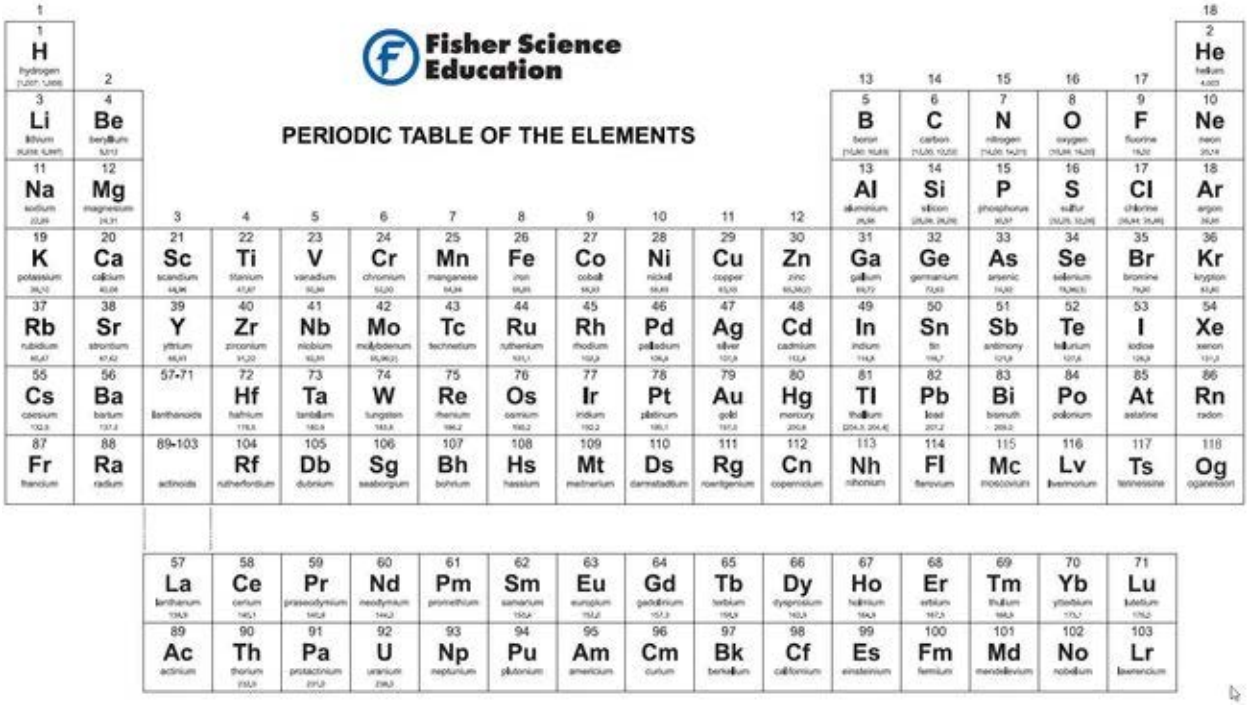
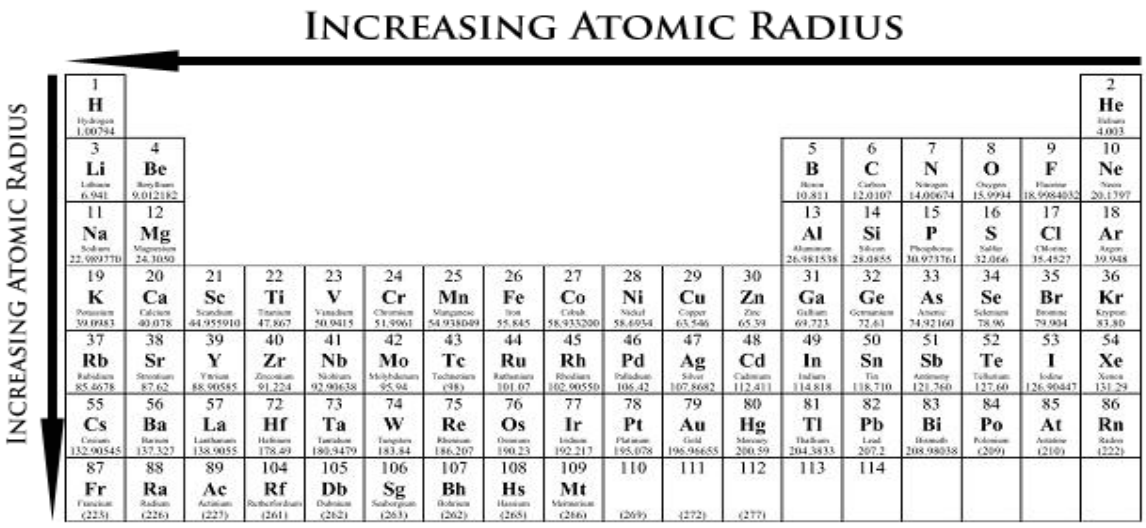


Source: https://www.fishersci.com/shop/products/giant-periodic-table-8x4/s71879



Source: https://www.quora.com/How-does-atomic-size-increase-from-top-to-bottom-in-a-group-when-the-number-of-orbits-increase-with-the-force-of-attraction-of-nucleus-and-electrons

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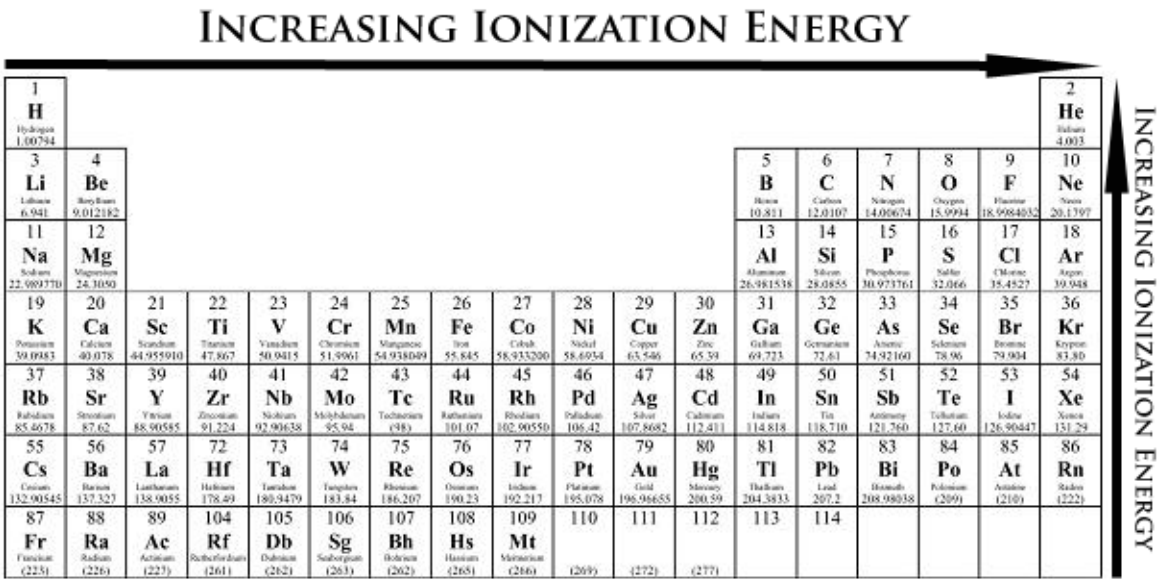

1 H Hydrogen 1.00794																	2 He Helium 4.003
3 Li Lithium 6.941	4 Be Beryllium 9.012182											5 B Boron 10.811	6 C Carbon 12.0107	7 N Nitrogen 14.00674	8 O Oxygen 15.9994	9 F Fluorine 18.9984032	10 Ne Neon 20.1797
11 Na Sodium 22.989770	12 Mg Magnesium 24.3050											13 Al Aluminum 26.981538	14 Si Silicon 28.0855	15 P Phosphorus 30.973761	16 S Sulfur 32.066	17 Cl Chlorine 35.4527	18 Ar Argon 39.948
19 K Potassium 39.0983	20 Ca Calcium 40.078	21 Sc Scandium 44.955910	22 Ti Titanium 47.867	23 V Vanadium 50.9415	24 Cr Chromium 51.9961	25 Mn Manganese 54.938049	26 Fe Iron 55.845	27 Co Cobalt 58.933200	28 Ni Nickel 58.6934	29 Cu Copper 63.546	30 Zn Zinc 65.39	31 Ga Gallium 69.723	32 Ge Germanium 72.61	33 As Arsenic 74.92160	34 Se Selenium 78.96	35 Br Bromine 79.904	36 Kr Krypton 83.80
37 Rb Rubidium 85.4678	38 Sr Strontium 87.62	39 Y Yttrium 88.90585	40 Zr Zirconium 91.224	41 Nb Niobium 92.90638	42 Mo Molybdenum 95.94	43 Tc Technetium (98)	44 Ru Ruthenium 101.07	45 Rh Rhodium 102.90550	46 Pd Palladium 106.42	47 Ag Silver 107.8682	48 Cd Cadmium 112.411	49 In Indium 114.818	50 Sn Tin 118.710	51 Sb Antimony 121.760	52 Te Tellurium 127.60	53 I Iodine 126.90447	54 Xe Xenon 131.29
55 Cs Cesium 132.90545	56 Ba Barium 137.327	57 La Lanthanum 138.9055	72 Hf Hafnium 178.49	73 Ta Tantalum 180.9479	74 W Tungsten 183.84	75 Re Rhenium 186.207	76 Os Osmium 190.23	77 Ir Iridium 192.217	78 Pt Platinum 195.078	79 Au Gold 196.96655	80 Hg Mercury 200.59	81 Tl Thallium 204.3833	82 Pb Lead 207.2	83 Bi Bismuth 208.98038	84 Po Polonium (209)	85 At Astatine (210)	86 Rn Radon (222)
87 Fr Francium (223)	88 Ra Radium (226)	89 Ac Actinium (227)	104 Rf Rutherfordium (261)	105 Db Dubnium (262)	106 Sg Seaborgium (263)	107 Bh Bohrium (262)	108 Hs Hassium (265)	109 Mt Meitnerium (266)	110 (269)	111 (272)	112 (277)	113	114				

Source:
https://chem.libretexts.org/Bookshelves/Inorganic_Chemistry/Supplemental_Modules_(Inorganic_Chemistry)/Descriptive_Chemistry/Periodic_Trends_of_Elemental_Properties/Periodic_Tre

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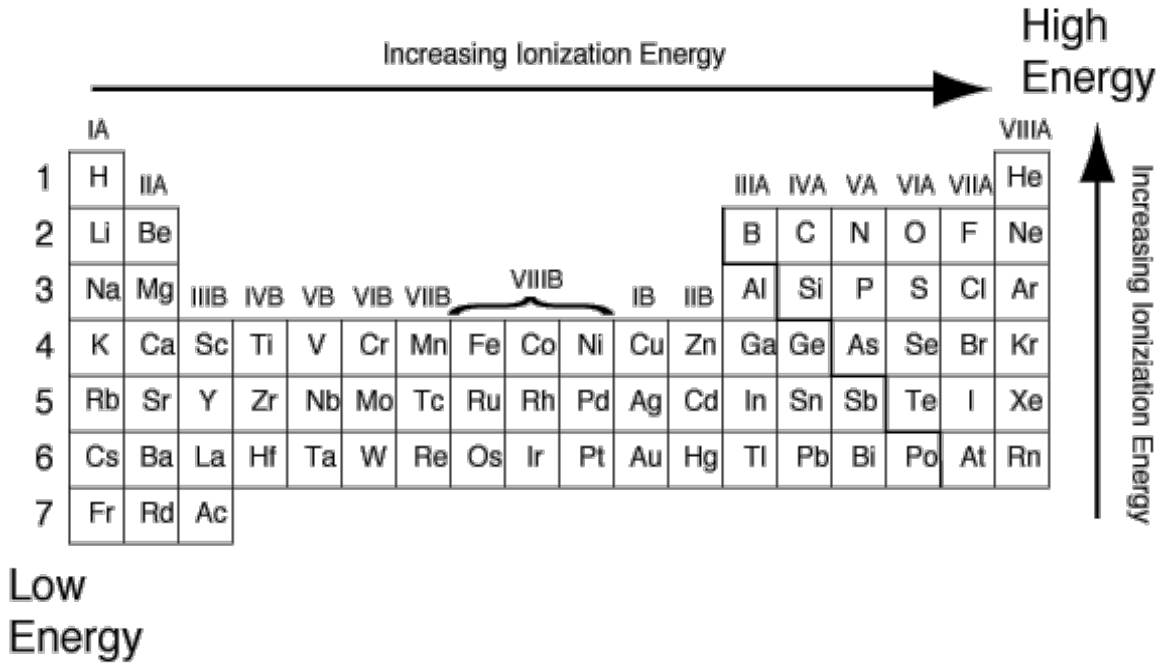

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