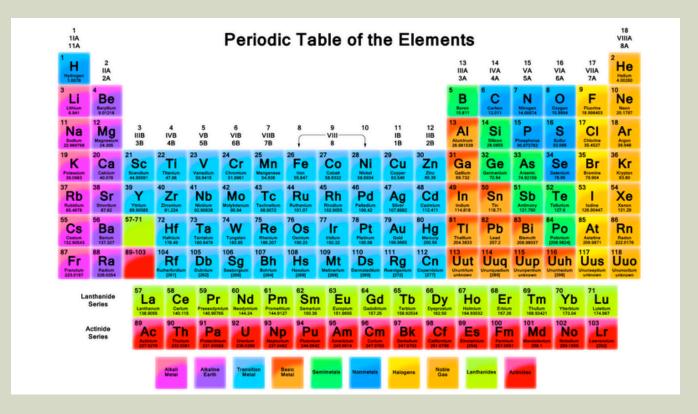


THE PERIODIC TABLE

Is an arrangement of elements in which the elements are separated into groups based on a set of repeating properties



EXPANSION OF THE ELEMENTS

- French scientist Lavoisier complied a list of all the known elements
 - Contained 33 elements organized into four categories
- The advent of electricity and the Industrial revolution played a large role in the discovery of new elements.
- By 1870, there were approximately 70 known elements.

Table of the Elements (33) Antimony Oxygen Arsenic Azote Bismuth Hydrogen Cobalt Sulphur Copper Phosphorus Gold Lime Charcoal Iron Magnesia Muriatic radical Lead Barytes Manganese Fluoric radical Argill Mercury Boracic radical Silex Molybdena Nickel Argill (alum=potassium aluminum sulfate) Platina Silver Silex (silicon dioxide = quartz Tin Magnesia (Epsom salts=magnesium sulfate) Tungstein Zinc Lime = calcium oxide

MENDELEEV'S TABLE

- Russian chemist, Dmitri Mendeleev, demonstrated a connection between atomic mass and elemental properties
- When elements were ordered by increasing atomic mass, there was a periodic pattern in their properties
- Mendeleev arranged the elements in order of increasing atomic mass into columns
 - Similar properties appeared at regular intervals
- Noting the similar properties and trends, he was able to predict the properties of the yet-to-be-discovered elements scandium, gallium, and germanium

```
? = 180
                              Ti = 50
                                          Zr = 90
                                                      Ta = 182
                              V = 51
                                         Nb = 94
                                         Mo = 96
                              Cr = 52
                                                       W = 186
                                                       Pt = 197.4
                             Mn = 55
                                         Rh = 104.4
                              Fe - 56
                                         Ru = 104,4
                                                       Ir = 198
                                                       0s = 199
                        Ni = Co = 59
                                         Pd = 106.6
H = 1
                             Cu = 63.4
                                         Ag = 108
                                                      Hg == 200
                              Zn = 65,2
                                         Cd = 112
       Be = 9.4
                  Mg = 24
                                                      Au = 197?
                              ? = 68
                                         Ur = 116
                  Al = 27.4
       B = 11
                              ? = 70
                   Si = 2S
       C = 12
                                          Sn = 118
                                                      Bi = 210?
                   P = 31
                              As = 75
                                        Sb = 122
       N = 14
                                         Te = 128?
       0 = 16
                   S = 32
                              Se = 79.4
                                           J = 127
                  Cl = 35,5
                              Br ..... 80
       F = 19
Li = 7 \text{ Na} = 23
                             Rb = 85.4 Cs = 133
                                                       T1 = 204
                   K = 39
                  Ca == 40
                              Sr = 87.6
                                         Ba = 137
                                                      Pb = 207
                    ? = 45
                              Ce = 92
                  2 \text{Er} = 56
                              La = 94
                  ?Yt = 60
                             Di = 95
                             Th = 118?
                  2 \ln = 75.6
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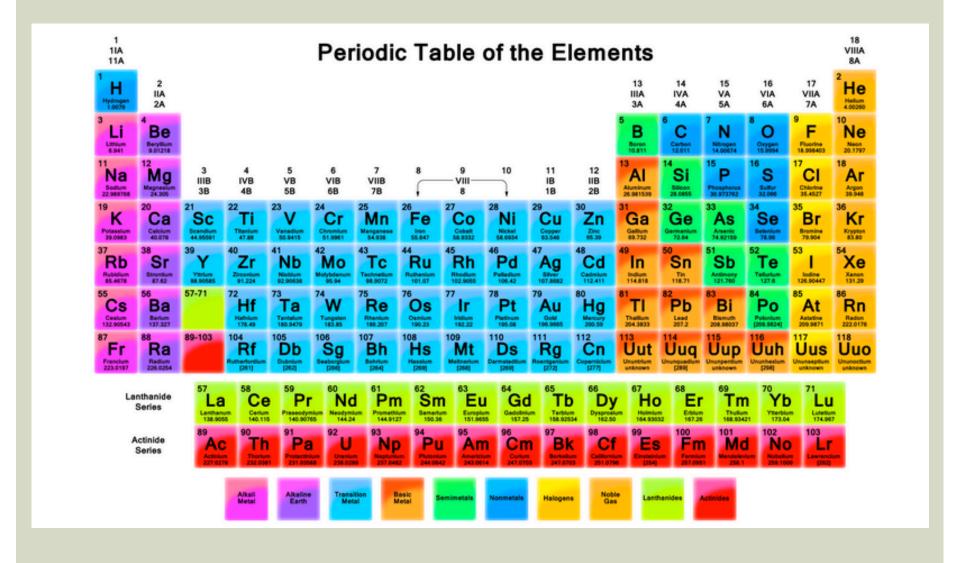
MOSELEY'S CORRECTIONS

- Mendeleev's table wasn't completely correct
 - Arranging elements by mass resulted in several elements being placed in groups of elements with different properties
- Moseley 1913:
 - Arranged the elements according to:
 - 1. Increasing atomic number
 - 2. Elements with similar properties were put in the same column



PERIODIC LAW

- After 1913 scientists were able to organize the table based on atomic number (# of protons)
- Periodic Law:
 - When elements are arranged in order of increasing atomic number,
 there is a periodic repetition of their physical and chemical properties
- This law produced the modern periodic table.





PERIODIC TABLE MAP

- The table is a map to ANY element
- You can find an element if you know:
 - 1. Atomic number
 - 2. Period and group number
 - Period: horizontal rows (left to right)
 - Group: vertical columns (top to bottom)
 - Also called "Families"
- Beginning with hydrogen in period 1, there are a total of 7 periods
 - During electron configuration we called the periods the "principle energy level"!
- Each group is numbered 1 18
 - Elements in groups 1, 2, and 13-18 possess a wide range of chemical and physical properties
 - These are known as the "main group" or "representative" elements
 - Elements in groups 3 12 are referred to as transition elements
 - Classified as metals, non-metals, and metalloids

PERIODS AND GROUPS

Periods:

- Beginning with hydrogen in period 1, there are a total of 7 periods
- Properties of the elements within a period change as you move across a period from left to right

Groups:

- Each group is numbered 1 18
- Elements in groups 1, 2, and 13-18 possess a wide range of chemical and physical properties
 - These are known as the "main group" or "representative" elements
- Elements in groups 3 12 are referred to as transition elements
 - Classified as metals, non-metals, and metalloids

PROPERTIES OF METALS

- Generally shiny when smooth and clean
- Solid at room temperature
- Good conductors of heat and electricity
- Most are malleable and ductile
- ~80% of the periodic table is metallic

Alkali Metals:

- Except for hydrogen, Group 1 elements
- Highly reactive and usually exist as compounds with other elements

Alkaline Earth Metals:

- Group 2
- Highly reactive

NONMETALS AND METALLOIDS

- Nonmetals:
 - Poor conductors of heat and electric current
 - Most are gaseous at room temperature
- Metalloids:
 - Properties exist between metal and nonmetal
 - Highly dependent on conditions of the environment
 - i.e. temperature, state of matter, etc.

1 1A 1A	2 IIA 2A		М	etals		Metall	oids		Nonm	netals		13 IIIB 3A	14 IVB 4A	15 VB SA	16 IVB 6A	17 VIB 7A	18 VIIB 8A 2 He
3 Li	Be	3 IIIA	4 IVA	5 VA	6 VIA	7 VIIA	8	9 VIIIA	10	11 18	12 IIB	5 B	6 C	7 N	8 0	9 F 17	10 Ne
Na	Mg	3B	4B	5B	68	7B		8B		18	2B	Al	Si	15 P	16 S	ĊΪ	Ar
19 K	Ca	Sc 21	Ti	23 V	Cr	Mn 25	Fe Fe	Co	28 Ni	²⁹ Cu	30 Zn	31 Ga	Ge 32	As	34 Se	35 Br	36 Kr
Rb	38 Sr	39 Y	Zr	Nb	Mo	TC 43	Ru	Rh	Pd	Ag	48 Cd	⁴⁹ In	Sn Sn	Sb	Te	53 	Xe
Cs S	56 Ba	71 Lu	Hf	Ta	74 W	75 Re	76 Os	77 r	78 Pt	79 Au	80 Hg	81 TI	Pb	Bi	Po	85 At	86 Rn
87 Fr	Ra	lo3 Lr	Rf	105 Db	Sg	Bh	108 Hs	Mt	110 Ds	Rg	Uub		Uuq				
		1	57	58	59	60	61	62	63	64	65	66	67	68	69	70	
			La	Če	Pr	Nd	Pm	Sm	Eu	Gd	Tb	Dy	Ho	Er	Tm	Yb	
			89 Ac	90 Th	91 Pa	92 U	93 Np	94 Pu	95 Am	96 Cm	97 Bk	98 Cf	99 Es	Fm	Md	102 No	

- What trends do you see?
- Are there any exceptions to the trends?
- What divides metals from nonmetals?

GROUP NAMES

- Recall that columns are called "groups" or "families"
- Common names have been assigned to these groups as well
- Group 1:
 - Alkali Metals
 - Reactive with water (Li, Na, K, Rb, Cs, Fr)
- Group 2:
 - Alkaline Earth Metals
 - Abundant in Earth's crust (Be, Mg, Ca, Sr, Ba, Ra)

GROUP NAMES CONTINUED

- Groups 3 12
 - Transition metals
 - They transition from metals to nonmetals
- There is a special class within the transition metals called Inner transition metals
 - Include Lanthanides and Actinides
 - Sometimes called the rare earth elements
 - Located on the bottom of the periodic table

MORE GROUP NAMES

- There are two special group names in the nonmetal section of the table
 - Halogens
 - Group 17
 - Include F, Cl, Br, I, At
 - Most reactive nonmetals
 - Nobel Gases
 - Group 18
 - Include He, Ne, Ar, Kr, Xe, Rn
 - Uniquely unreactive ("inert")
- Groups 1, 2, 13 17 are called the representative elements because they show a wide range of chemical and physical properties

HOW DOES ELEMENT LOCATION HELP DETERMINE ATOMIC STRUCTURE?

- Element location tells us about how the atom is structured
- Group number tells us the number of valence electrons
 - Outermost electrons in the atom
- Period tells us the number of energy levels in the atom
 - Refers to the size of the atom and how many electrons can be accommodated