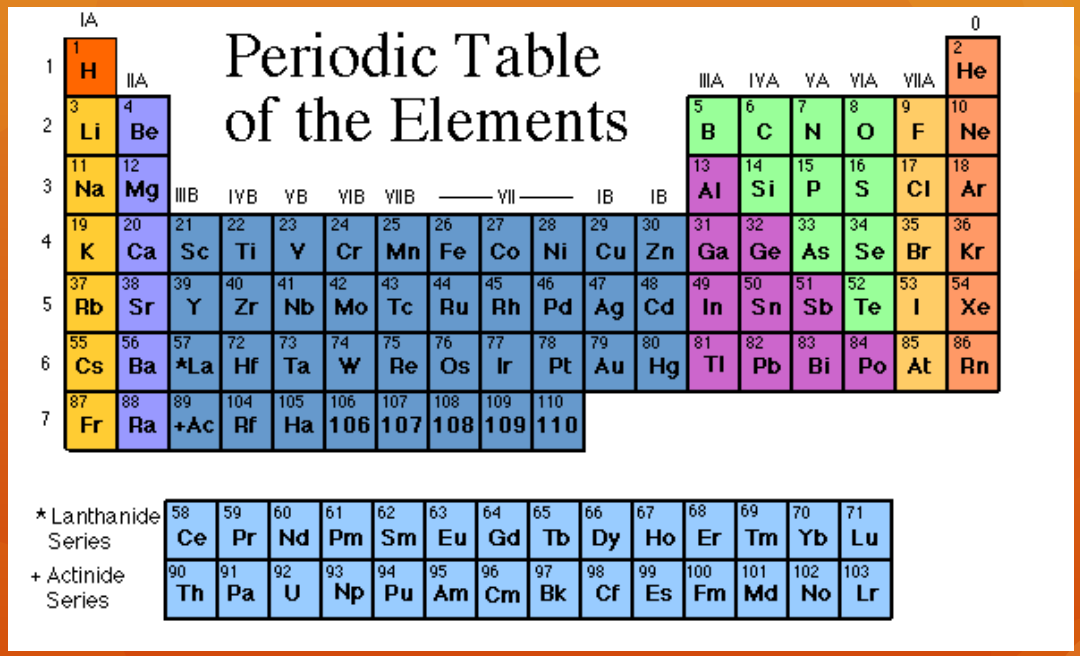
Chapter 5 – The Periodic Table



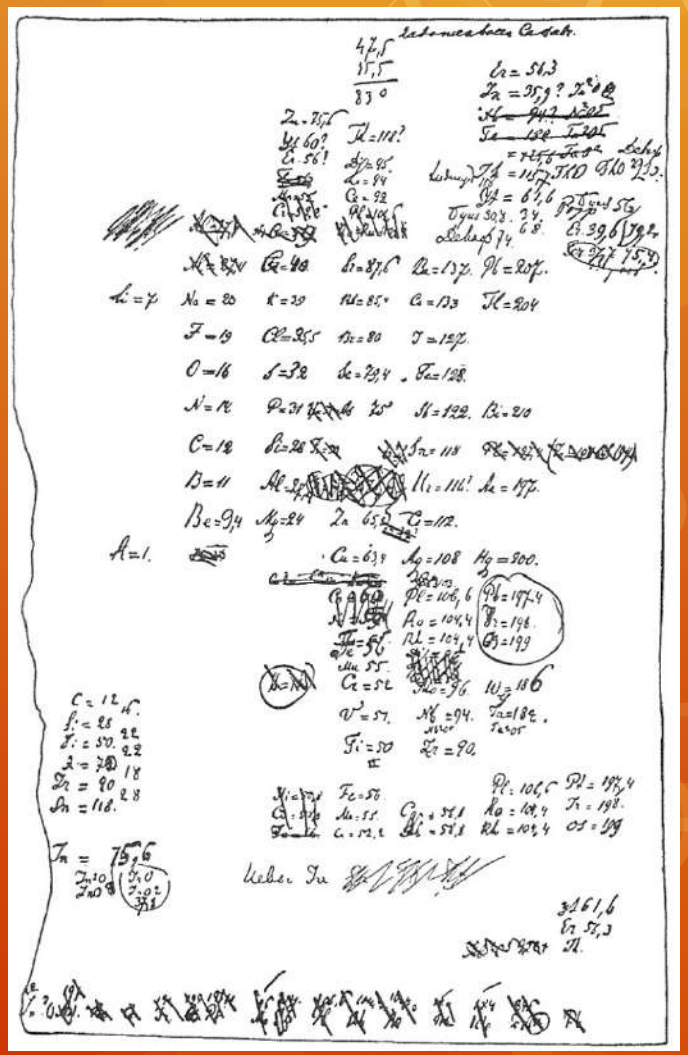
Jennie L. Borders

Warm-Up Mar. 4

1. Who created the first useful periodic table?
2. What is a column on the periodic table called?
3. What is a valence electron?

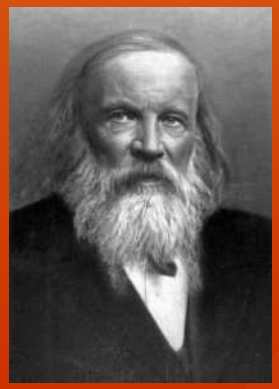
Section 5.1 – Organizing the Elements

- A periodic table is an arrangement of elements in columns, based on a set of properties that repeat from row to row.
- Dmitri Mendeleev is credited with creating the first useful periodic table.
- Mendeleev arranged the elements into rows in order of increasing mass so that elements with similar properties were in the same column.



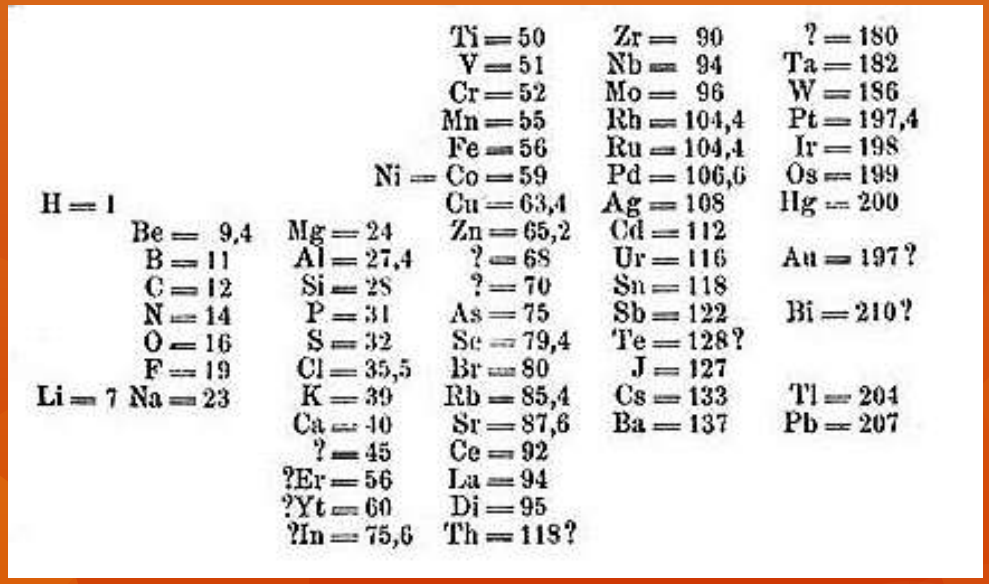
Mendeleev's Periodic Table

- Mendeleev could not make a complete periodic table of the elements because many elements had not yet been discovered.
- He had to leave spaces in his table for those elements.
- He used the properties of elements located near the blank spaces in his table to predict properties for undiscovered elements.



Mendeleev's Periodic Table

- The close matches between Mendeleev's predictions and the actual properties of new elements showed how useful his periodic table could be.



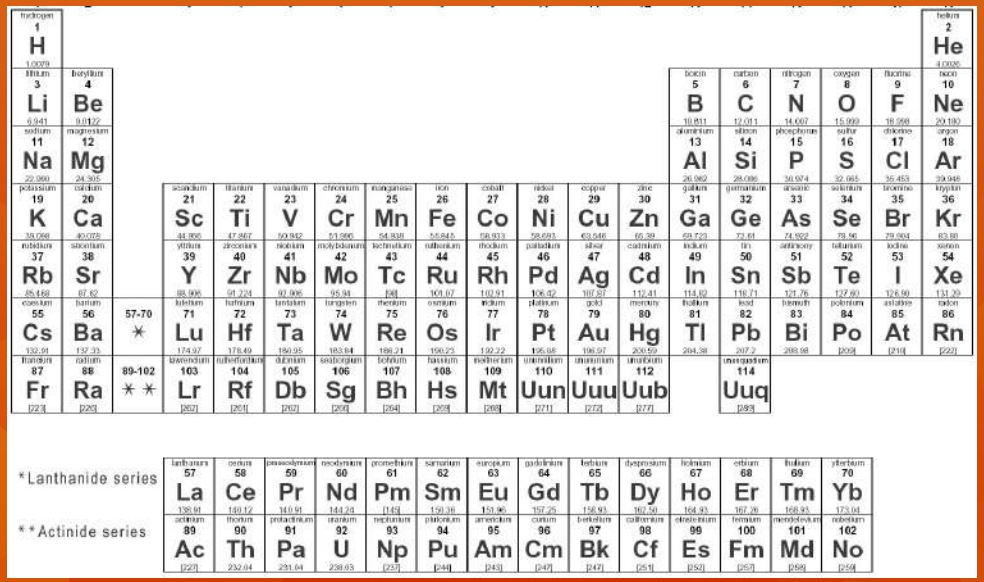
			Ti = 50	Zr = 90	? = 180	
			V = 51	Nb = 94	Ta = 182	
			Cr = 52	Mo = 96	W = 186	
			Mn = 55	Rh = 104,4	Pt = 197,4	
			Fe = 56	Ru = 104,4	Ir = 198	
			Ni = Co = 59	Pd = 106,6	Os = 199	
H = 1			Cu = 63,4	Ag = 108	Hg = 200	
	Be = 9,4	Mg = 24	Zn = 65,2	Cd = 112		
	B = 11	Al = 27,4	? = 68	Ur = 116	Au = 197?	
	C = 12	Si = 28	? = 70	Sn = 118		
	N = 14	P = 31	As = 75	Sb = 122	Bi = 210?	
	O = 16	S = 32	Se = 79,4	Te = 128?		
	F = 19	Cl = 35,5	Br = 80	J = 127		
Li = 7	Na = 23	K = 39	Rb = 85,4	Cs = 133	Tl = 204	
		Ca = 40	Sr = 87,6	Ba = 137	Pb = 207	
		? = 45	Ce = 92			
		?Er = 56	La = 94			
		?Yt = 60	Di = 95			
		?In = 75,6	Th = 118?			

Section 5.1 Assessment

1. Describe how Mendeleev organized the elements into rows and columns in his periodic table.
2. How did the discovery of new elements such as gallium demonstrate the usefulness of Mendeleev's table?
3. Why did Mendeleev leave spaces in his table?
4. How was Mendeleev able to predict the properties of elements that had not yet been discovered?

Section 5.2 – The Modern Periodic Table

- Mendeleev developed his periodic table before the discovery of protons.
- In the modern periodic table, elements are arranged by increasing atomic number (number of protons).



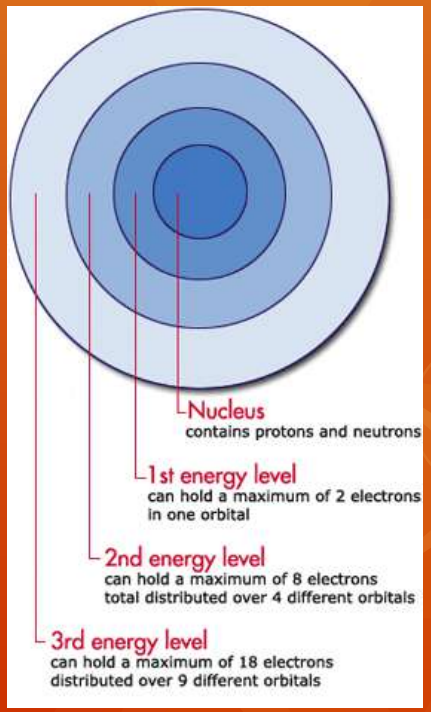
Periods

- Each row in the table of elements is a period.
- The number of elements per period varies because the maximum number of electrons increases from energy level to energy level.

LONG FORM OF PERIODIC TABLE

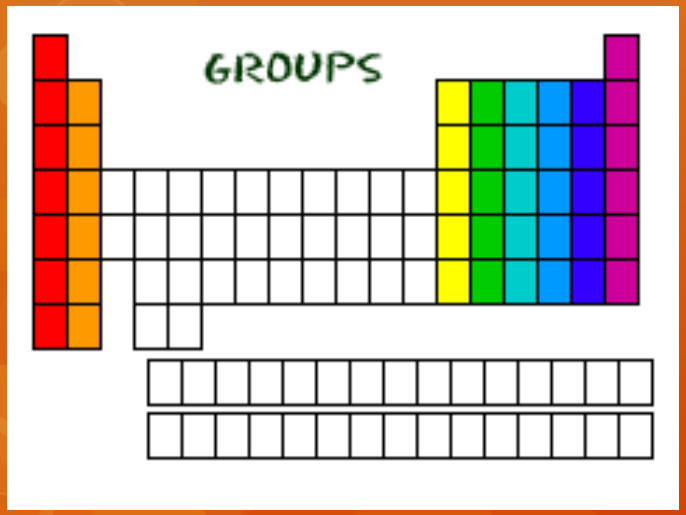
	Light Metals IA		Heavy Metals (Transition Metals)										Non-Metals IIIA	IVA	VA	VIA	VIIA	VIIA or 0
Period 1	1 H	IIA																2 He
Period 2	3 Li	4 Be											5 B	6 C	7 N	8 O	9 F	10 Ne
Period 3	11 Na	12 Mg	IIIB	IVB	VB	VIB	VIIB	VIIB	VIIB	IB	IIB		13 Al	14 Si	15 P	16 S	17 Cl	18 Ar
Period 4	19 K	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
Period 5	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
Period 6	55 Cs	56 Ba	57 to 71	72 Hf	73 Ta	74 W	75 Re	76 Os	77 Ir	78 Pt	79 Au	80 Hg	81 Ti	82 Pb	83 Bi	84 Po	85 At	86 Rn
Period 7	87 Fr	88 Ra	89 to 103	104 Rf	105 Ha	106 Sg	107 Ns	108 Hs	109 Mt									

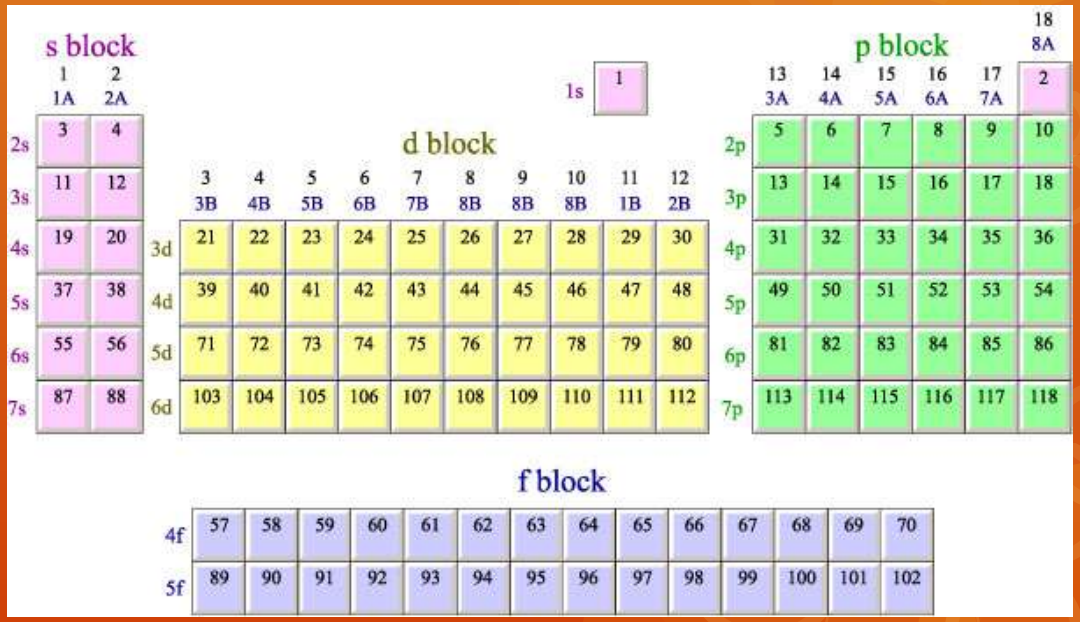
Lanthanide series →	57 La	58 Ce	59 Pr	60 Nd	61 Pm	62 Sm	63 Eu	64 Gd	65 Tb	66 Dy	67 Ho	68 Er	69 Tm	70 Yb	71 Lu
Actinide series →	89 Ac	90 Th	91 Pa	92 U	93 Np	94 Pu	95 Am	96 Cm	97 Bk	98 Cf	99 Es	100 Fm	101 Md	102 No	103 Lr



Groups

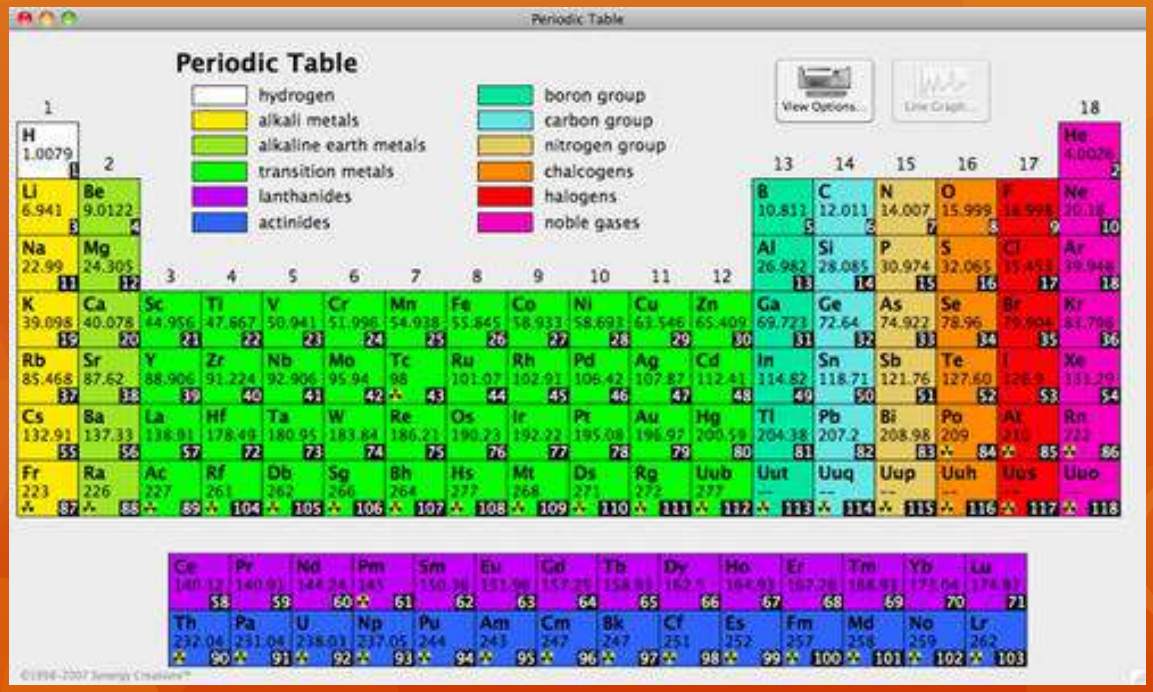
- Each column on the periodic table is called a group.
- The elements within a group have similar properties.





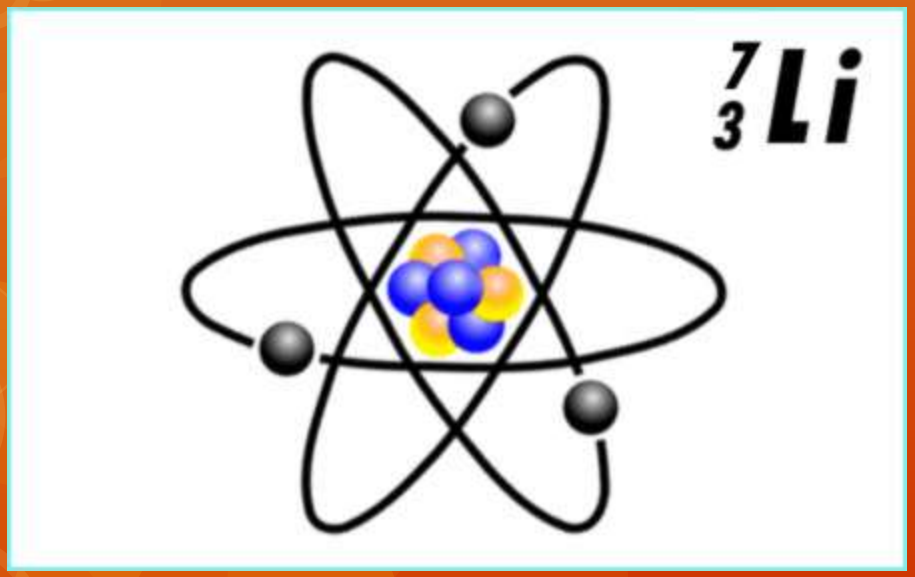
Periodic Law

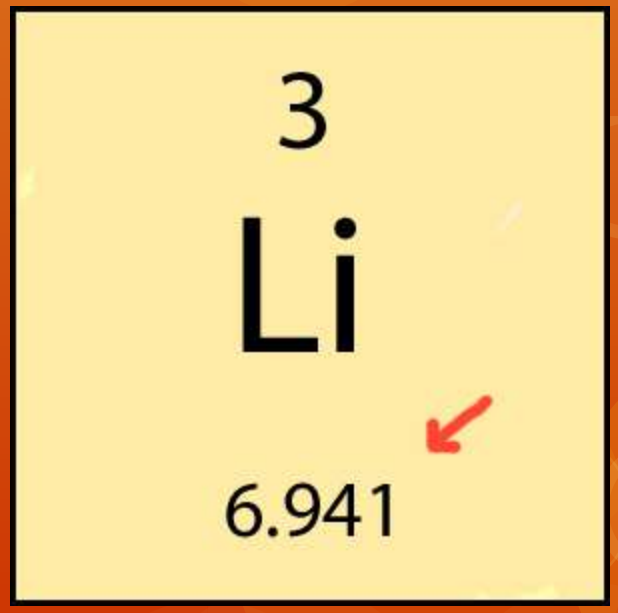
- The pattern of repeating properties across a period when the elements are arranged in order of increasing atomic number is called the periodic law.



Mass Number vs. Atomic Mass

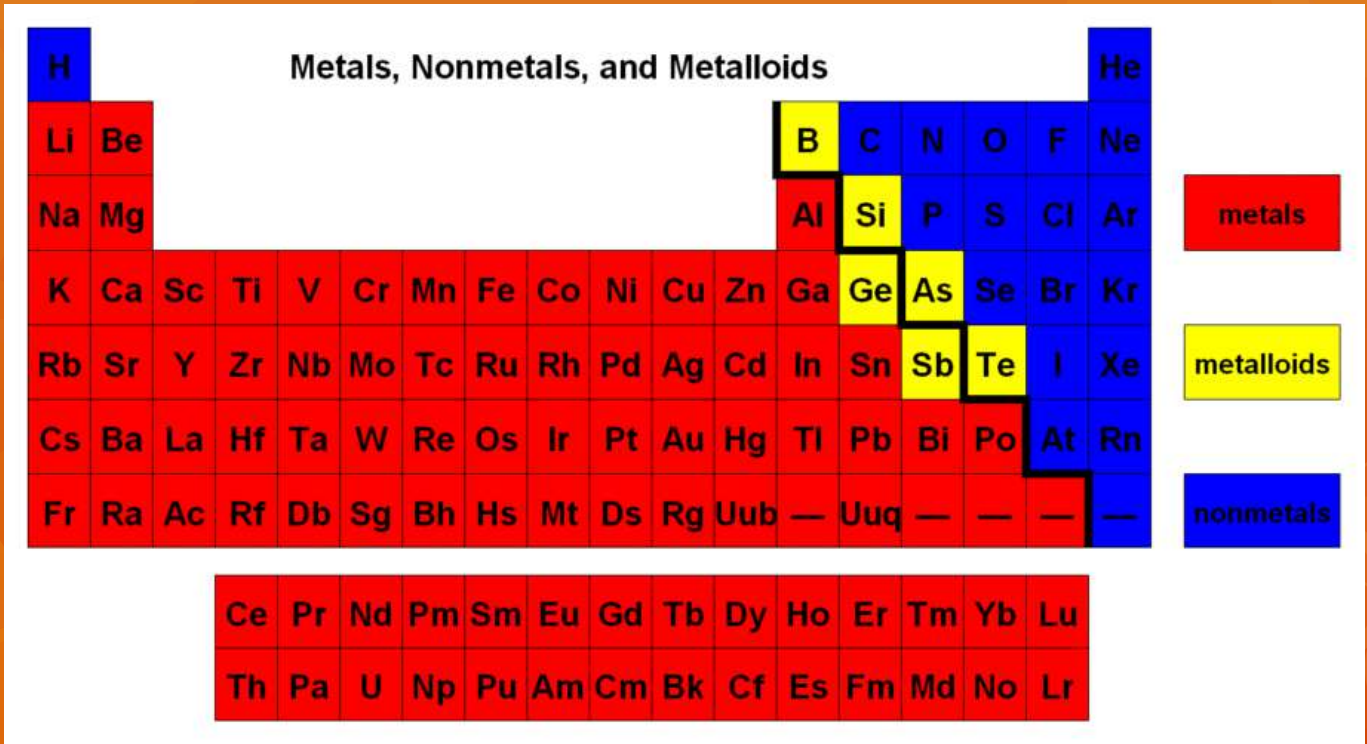
- Mass number is the number of protons and neutrons in the nucleus of an atom.
- Atomic mass is a value that depends on the distribution of an element's isotopes in nature and the masses of those isotopes.





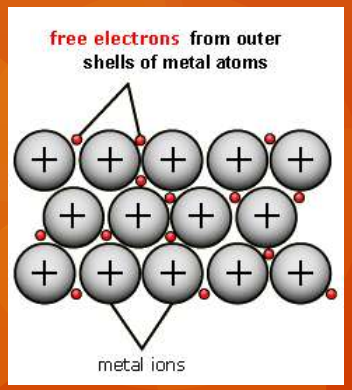
Classes of Elements

- Elements are classified as metals, nonmetals, and metalloids.



Metals

- The majority of the elements on the periodic table are classified as metals.
- Metals are elements that are good conductors of electric current and heat.
- Most metals are solid at room temperature except mercury.
- Most metals are malleable and ductile (they can be drawn into wires).



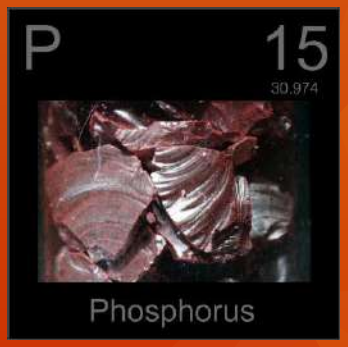
Transition Metals

- Metals in groups 3 through 12 are called transition metals.
- Transition metals are elements that form a bridge between the elements on the left and right sides of the periodic table.
- One property of transition metals is their ability to form compounds with distinctive colors.

Nonmetals

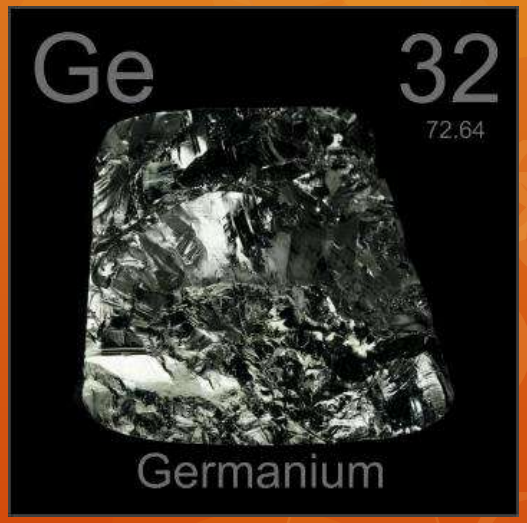
- Nonmetals are elements that are poor conductors of heat and electric current.
- Because nonmetals have low boiling points, many nonmetals are gases at room temperature.

- The nonmetals that are solids at room temperature tend to be brittle.
- Nonmetals vary in their chemical and physical properties.



Metalloids

- Metalloids are elements with properties that fall between those of metals and nonmetals.



Variation Across a Period

- Across a period from left to right, the elements become less metallic and more nonmetallic in their properties.

Section 5.2 Assessment

1. What determines the order of the elements in the modern periodic table?
2. Describe the periodic law.
3. What two factors determine the atomic mass of an element?
4. Name three categories that are used to classify the elements in the periodic table.

Section 5.2 Assessment

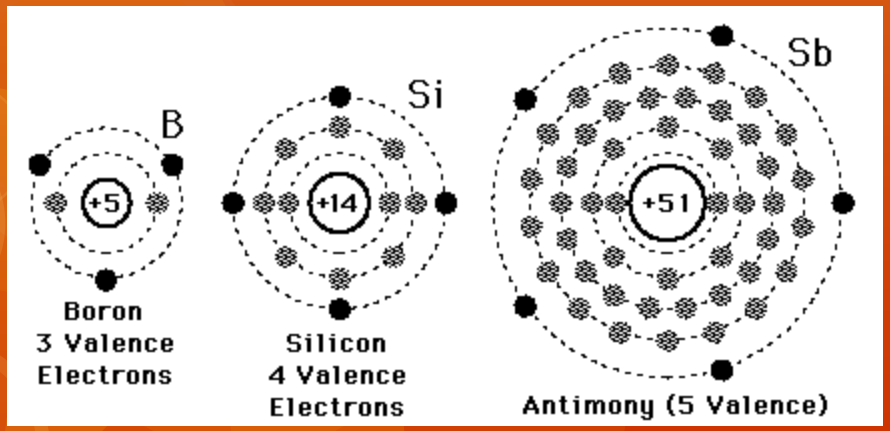
5. What major change occurs as you move from left to right across the periodic table?
6. The atomic mass of iodine (I) is less than the atomic mass of tellurium (Te). But an iodine atom has one more proton than a tellurium atom. Explain how this situation is possible.
7. Explain how you know that no new element with an atomic number of less than 100 will be discovered.

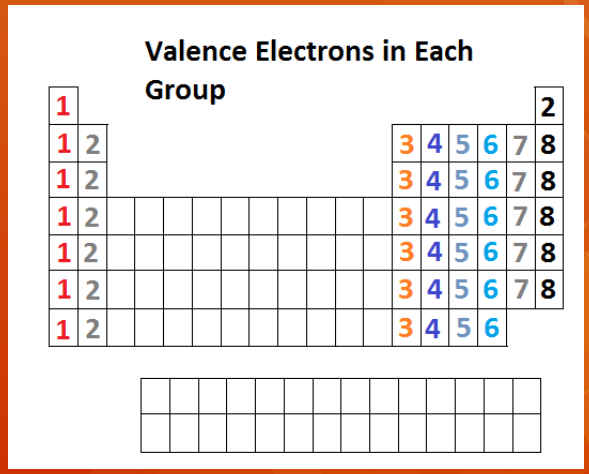
Warm-Up Mar. 5

1. How did Mendeleev arrange his periodic table?
2. Name one element that would have properties similar to chlorine (Cl).
3. What does the periodic law state?

Section 5.3 – Representative Groups

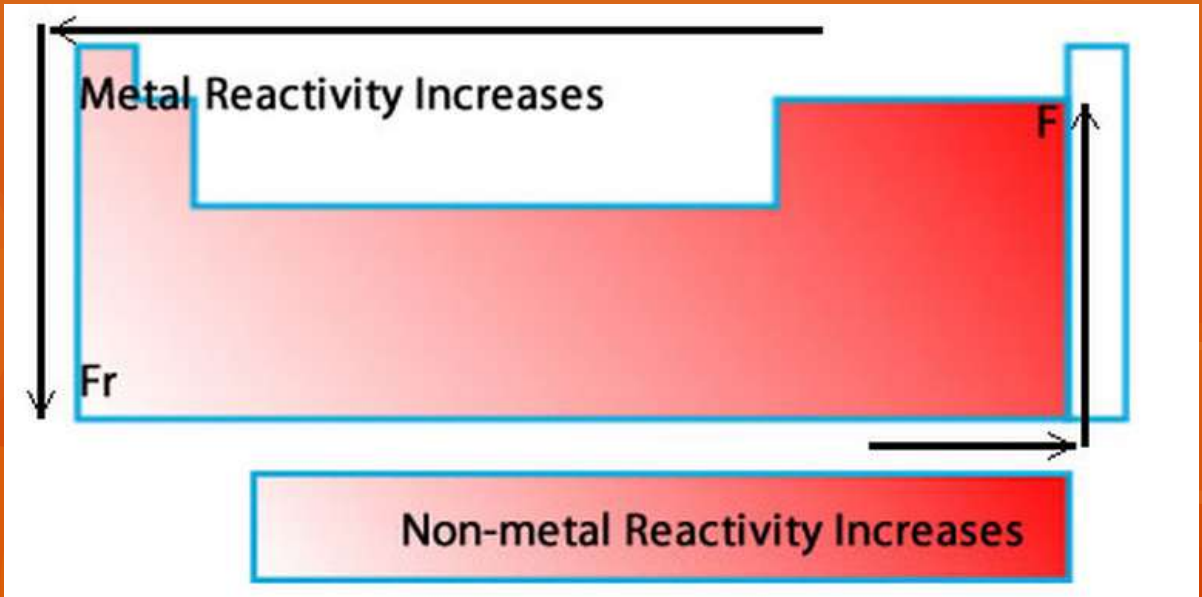
- A valence electron is an electron that is in the highest occupied energy level of an atom. These electrons play a key role in chemical reactions.
- Elements in a group have similar properties because they have the same number of valence electrons.





Reactivity and the Periodic Table

- Reactivity increases to the left in a row across the metals and increases down in a group of the metals.
- Reactivity increases to the right in a row across the nonmetals (except the noble gases are unreactive) and decreases down a group in the nonmetals.



Section 5.3 Assessment

1. Explain why elements in a group have similar properties.
2. What is the most reactive metal in group 2?
3. What is the most reactive nonmetal in period 3?


Alkali Metal
Alkaline earth metal
Lanthanide
Actinide
Transition Metal
Other Metals
Metalloids
Non Metals
Halogen
Noble Gas
1 IA
2 IIA
3 IIIB
4 IVB
5 VB
6 VIB
7 VIIB
8
9
10
VIIIB
11 IB
12 IIB
13 IIIA
14 IVA
15 VA
16 VIA
17 VIIA
18 VIIIA
H
He
Li
Be
B
C
N
O
F
Ne
Na
Mg
Al
Si
P
S
Cl
Ar
K
Ca
Sc
Ti
V
Cr
Mn
Fe
Co
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Cu
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