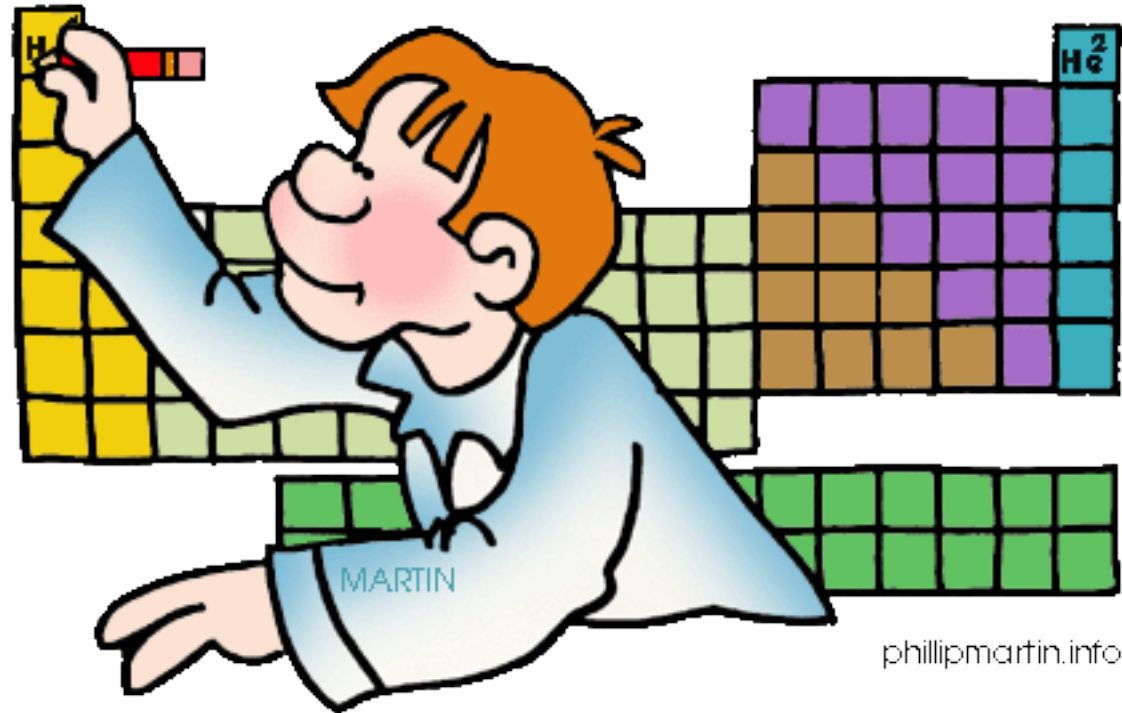


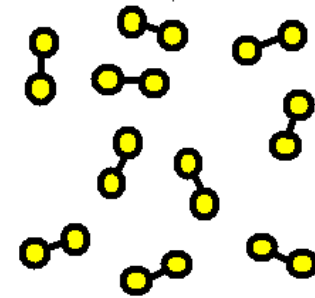
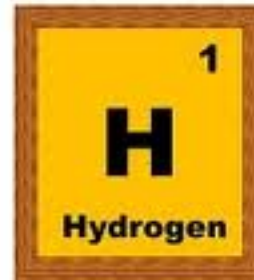
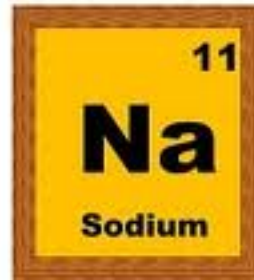
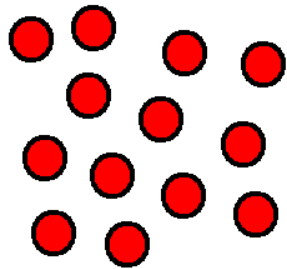
The Elements and the Periodic Table



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Elements

- Made up of one type of atom
- Found on the Periodic Table



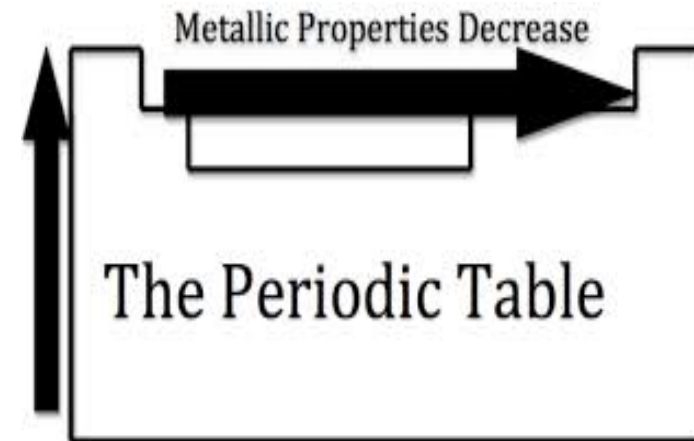
Classes of Elements

Elements are grouped on the periodic table into 3 major categories: **metals**, **non-metals**, and **metalloids** based on their **metallic** properties

The periodic table is color-coded as follows:

- Metals (Yellow):** Includes all elements on the left side of the table, the transition metals in the middle, and the lanthanide and actinide series at the bottom.
- Nonmetals (Green):** Includes elements on the right side of the table, specifically the halogens and noble gases.
- Metalloids (Pink):** Includes elements along the diagonal line separating metals and nonmetals, such as Boron, Silicon, Germanium, Arsenic, Antimony, and Tellurium.

- Metals
- Nonmetals
- Metalloids



Properties of Metals

- Physical Properties

- **Conductors** of heat and electricity.
- Shiny
- **Ductile** and **malleable**
- Most are **solid** at room temp.

- Chemical Properties

- Water causes **corrosion**
- Tend to **lose** electrons in reactions

What metal is not a solid @ room temperature?

- Found on the **left side** of the periodic table (exception Hydrogen)

The periodic table is shown with three regions highlighted: Metal (blue), Metalloid (green), and Nonmetal (tan). The Lanthanide and Actinide series are shown below the main table.

79
Au
196.967



11
Na
22.990

Properties of Non-Metals

1																	18
H																	He
3	4											13	14	15	16	17	18
Li	Be											B	C	N	O	F	Ne
11	12											13	14	15	16	17	18
Na	Mg											Al	Si	P	S	Cl	Ar
19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36
K	Ca	Sc	Ti	V	Cr	Mn	Fe	Co	Ni	Cu	Zn	Ga	Ge	As	Se	Br	Kr
37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54
Rb	Sr	Y	Zr	Nb	Mo	Tc	Ru	Rh	Pd	Ag	Cd	In	Sn	Sb	Te	I	Xe
55	56	57-71	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86
Cs	Ba		Hf	Ta	W	Re	Os	Ir	Pt	Au	Hg	Tl	Pb	Bi	Po	At	Rn
87	88	89-103	104	105	106	107	108	109	110	111	112	113	114	115	116	117	118
Fr	Ra		Rf	Db	Sg	Bh	Hs	Mt	Ds	Rg	Cn	Nh	Fl	Mc	Lv	Ts	Og
57	58	59	60	61	62	63	64	65	66	67	68	69	70	71			
La	Ce	Pr	Nd	Pm	Sm	Eu	Gd	Tb	Dy	Ho	Er	Tm	Yb	Lu			
89	90	91	92	93	94	95	96	97	98	99	100	101	102	103			
Ac	Th	Pa	U	Np	Pu	Am	Cm	Bk	Cf	Es	Fm	Md	No	Lr			

- Physical Properties
 - **Poor conductors** of heat and electricity.
 - Solids are **brittle** and **dull**
 - Many are **gases**.
- Chemical Properties
 - Tend to **gain** electrons in reactions
- Found on the **right** side of the periodic table

16
S
32.066



Sulfur

6
C
12.001



Carbon

Properties of Metalloids

1																	18
H																	He
3	4											5	6	7	8	9	10
Li	Be											B	C	N	O	F	Ne
11	12											13	14	15	16	17	18
Na	Mg											Al	Si	P	S	Cl	Ar
19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36
K	Ca	Sc	Ti	V	Cr	Mn	Fe	Co	Ni	Cu	Zn	Ga	Ge	As	Se	Br	Kr
37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54
Rb	Sr	Y	Zr	Nb	Mo	Tc	Ru	Rh	Pd	Ag	Cd	In	Sn	Sb	Te	I	Xe
55	56	57-71	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86
Cs	Ba		Hf	Ta	W	Re	Os	Ir	Pt	Au	Hg	Tl	Pb	Bi	Po	At	Rn
87	88	89-103	104	105	106	107	108	109	110	111	112	113	114	115	116	117	118
Fr	Ra		Rf	Db	Sg	Bh	Hs	Mt	Ds	Rg	Cn	Nh	Fl	Mc	Lv	Ts	Og
57	58	59	60	61	62	63	64	65	66	67	68	69	70	71			
La	Ce	Pr	Nd	Pm	Sm	Eu	Gd	Tb	Dy	Ho	Er	Tm	Yb	Lu			
89	90	91	92	93	94	95	96	97	98	99	100	101	102	103			
Ac	Th	Pa	U	Np	Pu	Am	Cm	Bk	Cf	Es	Fm	Md	No	Lr			



Germanium

Silicon



- Physical Properties
 - Properties of both **metals** and **non-metals**
 - **Semi-conductors**: conduct heat and electricity better than non-metals but not as well as metals
 - **Ductile** and **malleable**
- Chemical Properties
 - Can **lose, gain, or share** electrons
 - Found along the **“staircase”** of the periodic table

What are semiconductors used in?



Elements are further arranged vertically on the periodic table into families/groups based on their properties

3	Li
11	Na
19	K
37	Rb
55	Cs
87	Fr

Periodic Table of Elements

	1 IA		2 IIA														13 IIIA	14 IVA	15 VA	16 VIA	17 VIIA	18 VIIIA
1	H																B	C	N	O	F	Ne
2	Li	Be																				
3	Na	Mg	Al	Si	P	S	Cl	Ar														
4	K	Ca	Sc	Ti	V	Cr	Mn	Fe	Co	Ni	Cu	Zn	Ga	Ge	As	Se	Br	Kr				
5	Rb	Sr	Y	Zr	Nb	Mo	Tc	Ru	Rh	Pd	Ag	Cd	In	Sn	Sb	Te	I	Xe				
6	Cs	Ba	La	Hf	Ta	W	Re	Os	Ir	Pt	Au	Hg	Tl	Pb	Bi	Po	At	Rn				
7	Fr	Ra	Ac	Rf	Db	Sg	Bh	Hs	Mt	Uun	Uuu	Uub										

2	He
10	Ne
18	Ar
36	Kr
54	Xe
86	Rn

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

Hydrogen Group

- Has **one** electron
- Very **flammable** gas



Facts:

- *The Hindenburg blimp exploded because it was filled with hydrogen*
- *Hydrogen is the most abundant element in the universe, because it makes up stars*

Periodic Table Elements

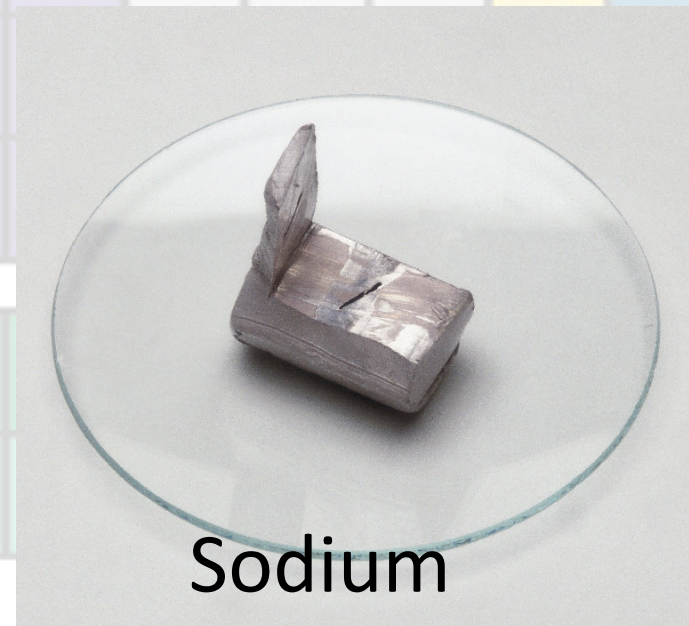
Group 1:

Alkali Metals

- Soft, silvery metals
- Loses 1 electron
- Very reactive (especially with water)



1829 - Johann Döbereiner looked at the reactions of lithium, sodium, and potassium when they were placed in water.



Sodium

1 IA	2 IIA											13 IIIA	14 IVA	15 VA	16 VIA	17 VIIA	18 VIIIA
1 H												5 B	6 C	7 N	8 O	9 F	10 Ne
3 Li	4 Be											13 Al	14 Si	15 P	16 S	17 Cl	18 Ar
11 Na	12 Mg	3 IIIB	4 IVB	5 VB	6 VIB	7 VIIB	8 VIIIB	9 VIIIB	10 VIIIB	11 IB	12 IIB	13 Al	14 Si	15 P	16 S	17 Cl	18 Ar
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
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
55 Cs	56 Ba	57 La	72 Hf	73 Ta	74 W	75 Re	76 Os	77 Ir	78 Pt	79 Au							86 Rn
87 Fr	88 Ra	89 Ac	104 Rf	105 Db	106 Sg	107 Bh	108 Hs	109 Mt	110 Uuu	111 Uuu							

Lanthanides

Actinides

Periodic Table of Elements

Group 2:

Alkaline Earth Metals



- Silvery-White Metals
- Loses 2 electrons
- Reactive



Calcium

Facts:

- Found in rocks in the earth's crust
- Used in fireworks and flares

1 IA	2 IIA	3 IIIB	4 IVB	5 VB	6 VIB	7 VIIB	8 VIII	9 VIII	10 VIII	11 IB	12 IIB	13 IIIA	14 IVA	15 VA	16 VIA	17 VIIA	18 VIIIA
1 H	2 He																
3 Li	4 Be																10 Ne
11 Na	12 Mg																18 Ar
19 K	20 Ca																36 Kr
37 Rb	38 Sr																54 Xe
55 Cs	56 Ba																86 Rn
87 Fr	88 Ra																

Lanthanides

Actinides

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
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

Periodic Table of Elements

Group 3-12:

Transition Metals

1 IA	2 IIA	3 IIIB	4 IVB	5 VB	6 VIB	7 VIIB	8 VIII	9 VIII	10 VIII	11 IB	12 IIB	13 IIIA	14 IVA	15 VA	16 VIA	17 VIIA	18 VIIIA		
1 H																		2 He	
3 Li	4 Be																	9 F	10 Ne
11 Na	12 Mg																	17 Cl	18 Ar
19 K	20 Ca	21 Sc	22 Ti	23 V	24 Cr	25 Mn	26 Fe	27 Co	28 Ni	29 Cu	30 Zn							35 Br	36 Kr
37 Rb	38 Sr	39 Y	40 Zr	41 Nb	42 Mo	43 Tc	44 Ru	45 Rh	46 Pd	47 Ag	48 Cd							53 I	54 Xe
55 Cs	56 Ba	57 La	72 Hf		74 Ta	75 W	76 Re	77 Os	78 Ir	79 Pt	80 Au							85 At	86 Rn
87 Fr	88 Ra	89 Ac	104 Rf		106 Db	107 Sg	108 Bh	109 Hs	110 Mt	111 Uun	112 Uub								



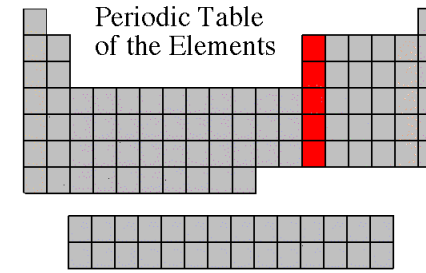
Copper



Iron

- **Conductors** of heat and electricity
- **Malleable** and **ductile**
- **Electrons vary (N/A)**

Group 13: Boron Family



- **Loses 3** electrons

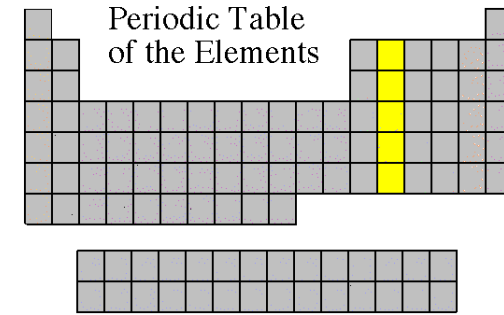
- *Fun Facts:*

- Aluminum is the most abundant metal in Earth's crust.
- *Aluminum is used for foil wrap, pop cans, cooking pans, and siding on houses.*
- *Aluminum was once seen as more precious than gold*

Aluminum



Group 14: Carbon Family



- Shares 4 electrons

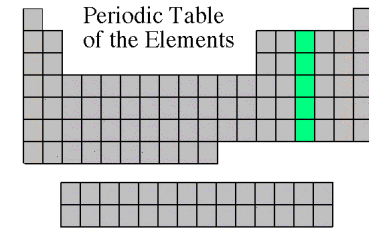
- *Facts:*

- *Named after first element in the family.*
- The element carbon is called the “basis of life”
- *There is an entire branch of chemistry devoted to carbon compounds called organic chemistry.*
- *Silicon is 2nd only to oxygen in abundance in Earth’s crust.*



Silicon

Group 15: Nitrogen Family

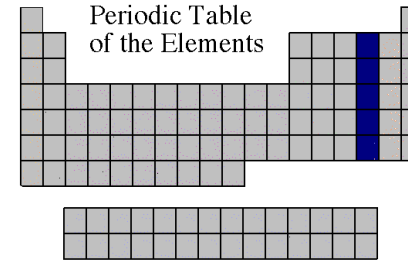


- Shares 3 electrons
- *Facts:*
 - Nitrogen makes up 78% of our atmosphere.
 - *Phosphorus is used for many things such as water softeners, match heads, and fine china.*
 - *Antimony and bismuth are added to other metals to lower their melting point. Bismuth is used on fire-sprinkler heads.*

Phosphorus



Group 16: Oxygen Family



- Gains 2 electrons or shares
- *Facts:*
 - Oxygen is the most abundant element in the earth's crust
 - *Sulfur is a non-metal that combines with metals to form sulfides with distinct colors that are used in paints.*
 - *Selenium is needed in trace amounts in your diet. It is also used in photocopiers.*

Sulfur



Periodic Table of Elements

Group 17: Halogens

1 IA	2 IIA	3	4	5	6	7	8	9	10	11 IB	12 IIB	13 IIIA	14 IVA	15 VA	16 VIA	17 VIIA	18 VIII A
1 H																	2 He
3 Li	4 Be											5 B	6 C	7 N	8 O	9 F	10 Ne
11 Na	12 Mg											13 Al	14 Si	15 P	16 S	17 Cl	18 Ar
19 K	20 Ca				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
37 Rb	38 Sr											49 In	50 Sn	51 Sb	52 Te	53 I	54 Xe
55 Cs	56 Ba											81 Tl	82 Pb	83 Bi	84 Po	85 At	86 Rn
87 Fr	88 Ra																

- Most are **poisonous**
- **Gains 1** electron or **shares**
- Very **reactive**
- React with **alkali metals** to form **salts**
- *Facts:*

- *Fluorine is the most reactive element*
- *Chlorine is used in pools and cleaning products*
- *Bromine is used in dyes in cosmetics*
- *Iodine is essential in diets*



Periodic Table of Elements

Group 18:

Noble Gases



- Non-reactive (inert)
- Does not gain or lose electrons
- Colorless gases



1 IA	2 IIA											13 IIIA	14 IVA	15 VA	16 VIA	17 VIIA	18 VIIIA
1 H																	2 He
3 Li	4 Be											5 B	6 C	7 N	8 O	9 F	10 Ne
11 Na	12 Mg	3 IIIB	4 IVB	5 VB	6 VIB	7 VIIB	8 VIII	9 VIII	10 VIII	11 IB	12 IIB	13 Al	14 Si	15 P	16 S	17 Cl	18 Ar
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
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
55 Cs	56 Ba	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	86 Rn
87 Fr	88 Ra	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	

Rare Earth Metals

- At the **bottom** of the Periodic Table
- Composed of **two series**

1) Lanthanide Series

2) Actinide Series

- Top row (#s 57-71)
- Very reactive
- Typically silver in color

- Bottom Row (#s 89-103)
- All are radioactive

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