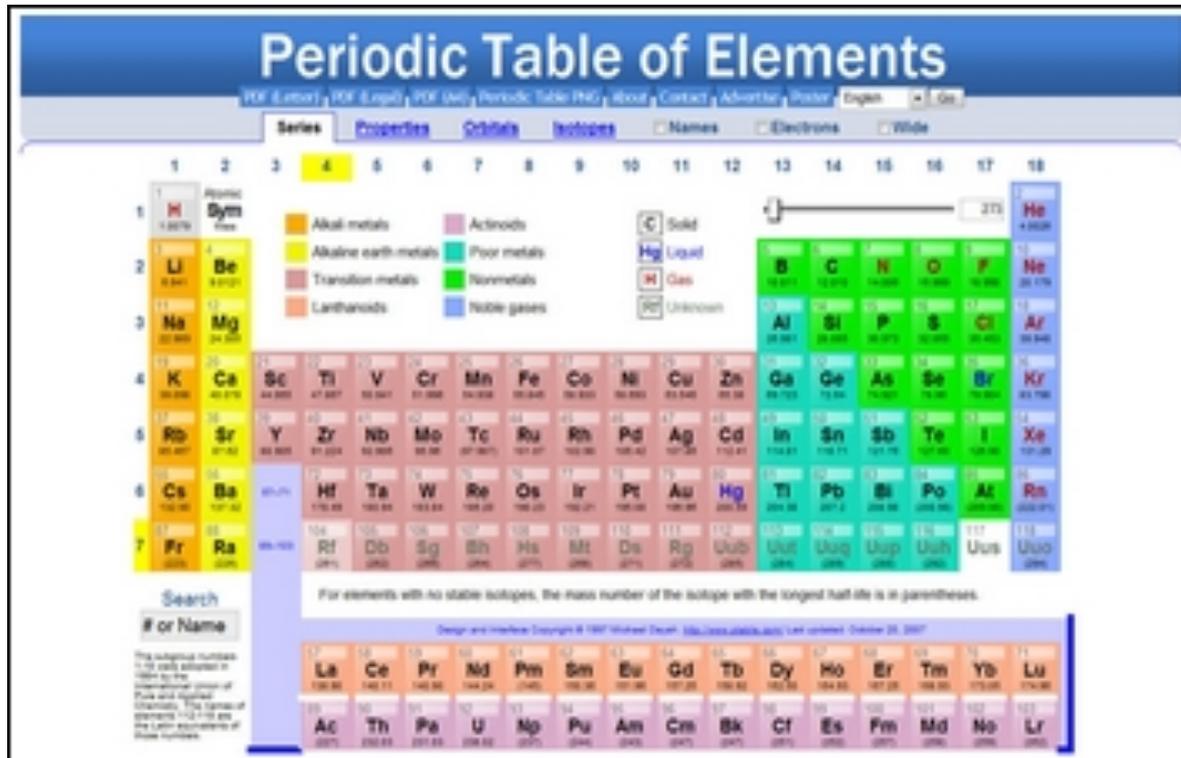


Do Now:

What is the Periodic Table?

# The Periodic Table



# History - Dmitri Mendeleev

Reihen	Gruppe I. — R <sup>0</sup>	Gruppe II. — R <sup>0</sup>	Gruppe III. — R <sup>0</sup> <sup>3</sup>	Gruppe IV. RH <sup>4</sup> R <sup>0</sup> <sup>4</sup>	Gruppe V. RH <sup>5</sup> R <sup>0</sup> <sup>5</sup>	Gruppe VI. RH <sup>6</sup> R <sup>0</sup> <sup>6</sup>	Gruppe VII. RH R <sup>0</sup> <sup>7</sup>	Gruppe VIII. — R <sup>0</sup> <sup>8</sup>
1	II=1							
2	Li=7	Be=9,4	B=11	C=12	N=14	O=16	F=19	
3	Na=23	Mg=24	Al=27,3	Si=28	P=31	S=32	Cl=35,5	
4	K=39	Ca=40	—=44	Ti=48	V=51	Cr=52	Mn=55	Fe=56, Co=59, Ni=59, Cu=63.
5	(Cu=63)	Zn=65	—=68	—=72	As=75	Se=78	Br=80	
6	Rb=85	Sr=87	?Yt=88	Zr=90	Nb=94	Mo=96	—=100	Ru=104, Rh=104, Pd=106, Ag=108.
7	(Ag=108)	Cd=112	In=113	Sn=118	Sb=122	Te=125	J=127	
8	Cs=133	Ba=137	?Di=138	?Ce=140	—	—	—	— — — —
9	(—)	—	—	—	—	—	—	
10	—	—	?Er=178	?La=180	Ta=182	W=184	—	Os=195, Ir=197, Pt=198, Au=199.
11	(Au=199)	Hg=200	Tl=204	Pb=207	Bi=208	—	—	
12	—	—	—	Th=231	—	U=240	—	— — — —

## Mendeleev's Proposal

Arranged the elements into rows in order of increasing mass and placed elements with similar properties into the same columns.

# Mendeleev's prediction

During Mendeleev's time, there were only 63 known elements. He used the properties of these existing elements to predict that other elements would be discovered.

# Evidence supporting Mendeleev's table.

Scientists used Mendeleev's predictions to fill in the holes for the missing elements. These new elements helped support Mendeleev's table.

The modern periodic table is a close match to Mendeleev's.

# Closure:

- How did Mendeleev arrange his periodic table?

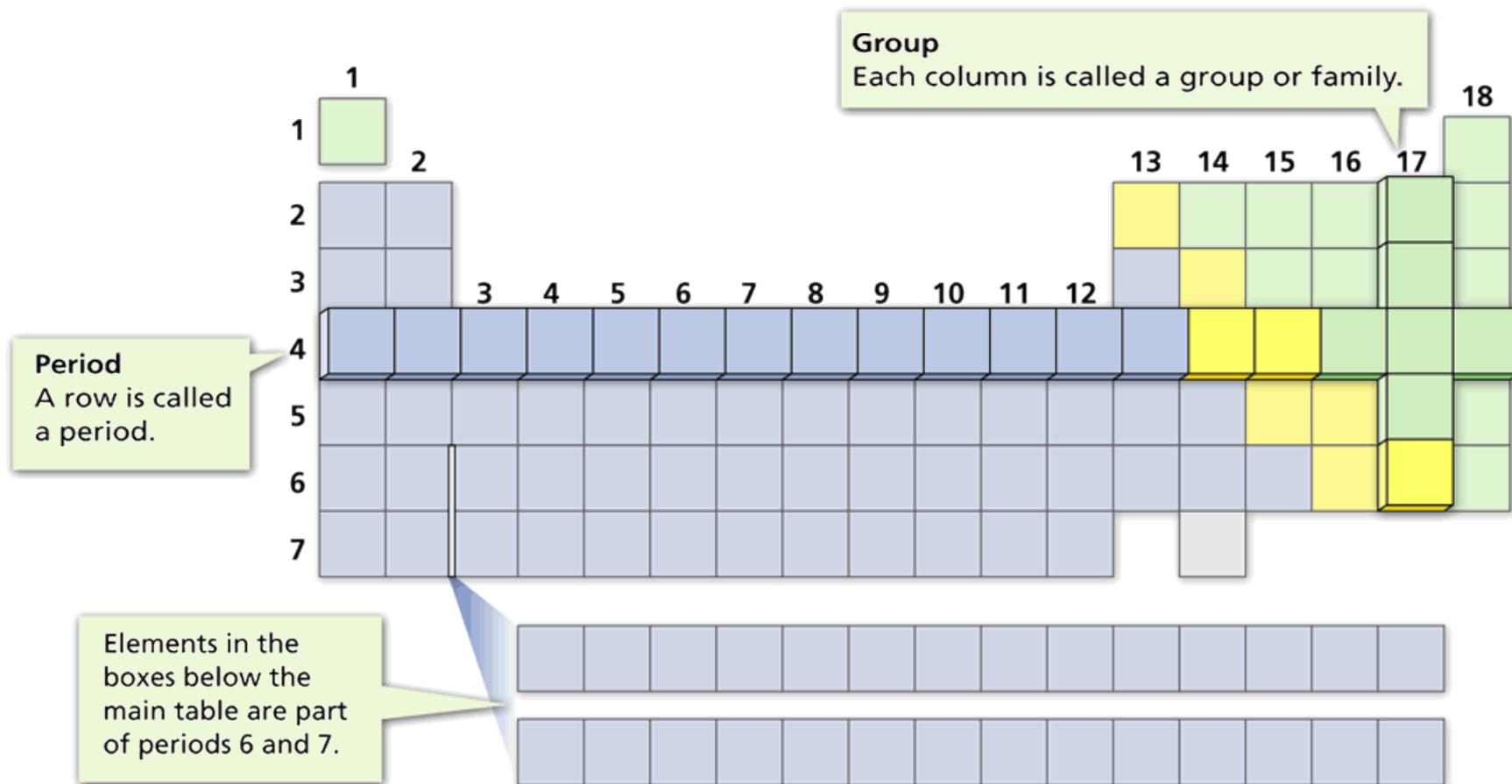
## Do Now:

How is the Modern Periodic Table arranged?

# The Modern Periodic Table

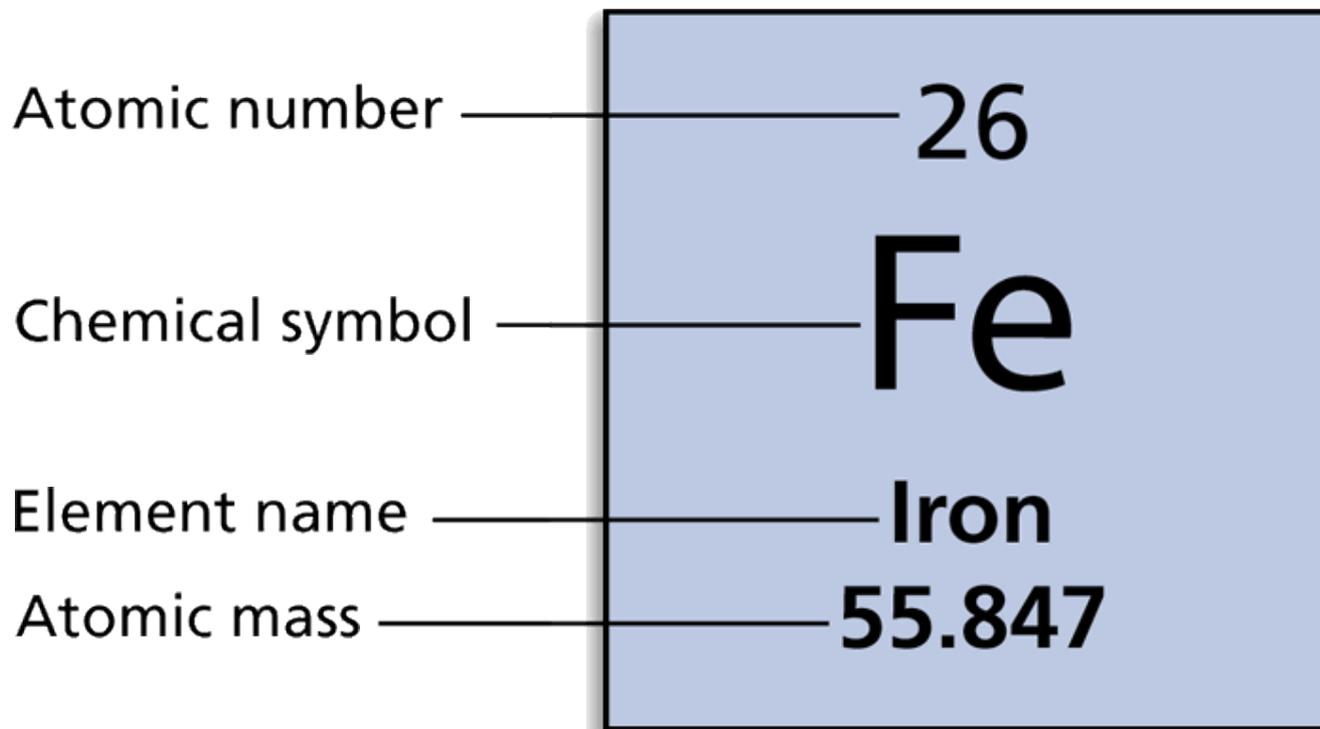
Elements are arranged by increasing atomic number.

This arrangement of atoms in columns with repeating properties from row to row is called the PERIODIC TABLE.



# Finding Data on Elements

Each square of the periodic table includes an element's atomic number, chemical symbol, name, and atomic mass.



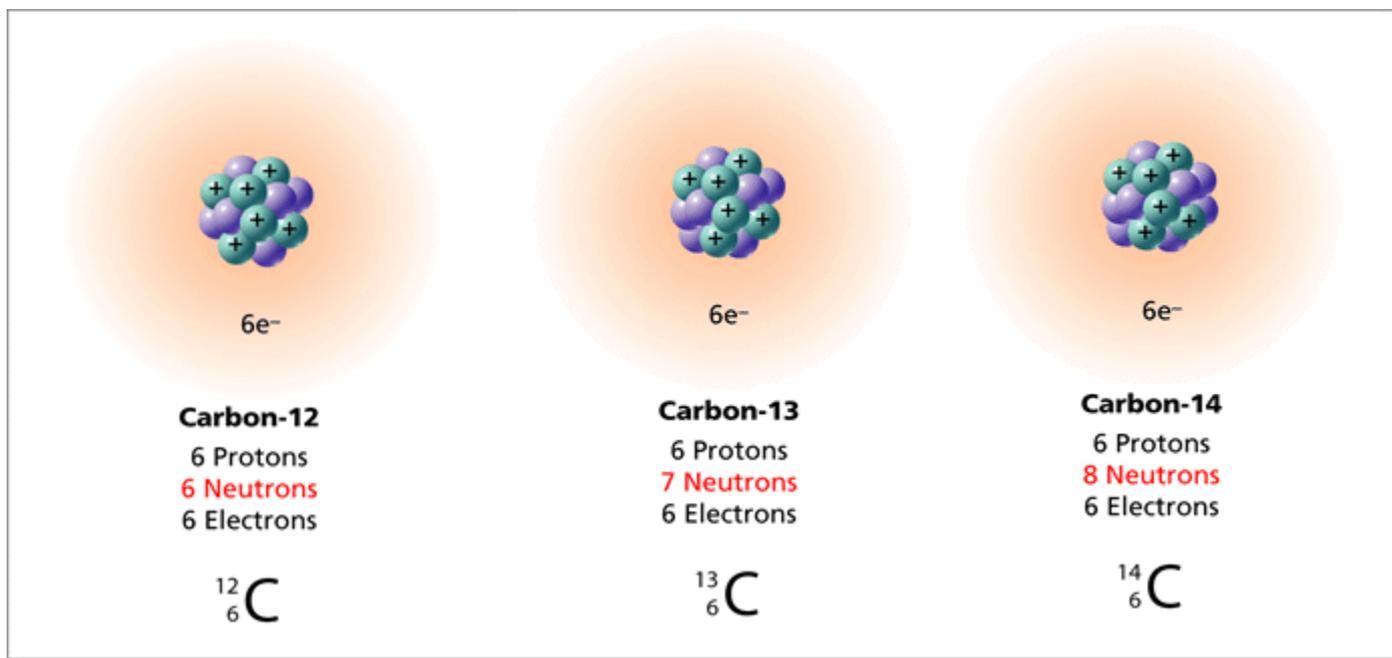
# Atomic Mass

Is equal to the **average weight** of all of the **isotopes** of that element found in nature, and expressed as atomic mass units. (amu' s)

What is an ISOTOPE: Isotopes of an element are atoms of the same element that have **equal number of protons** BUT **a different number of neutrons.**

SO..... **Their atomic number is the same but their atomic mass is different.**

# Why does Carbon have an atomic mass of 12.011amu and not just 12.0?



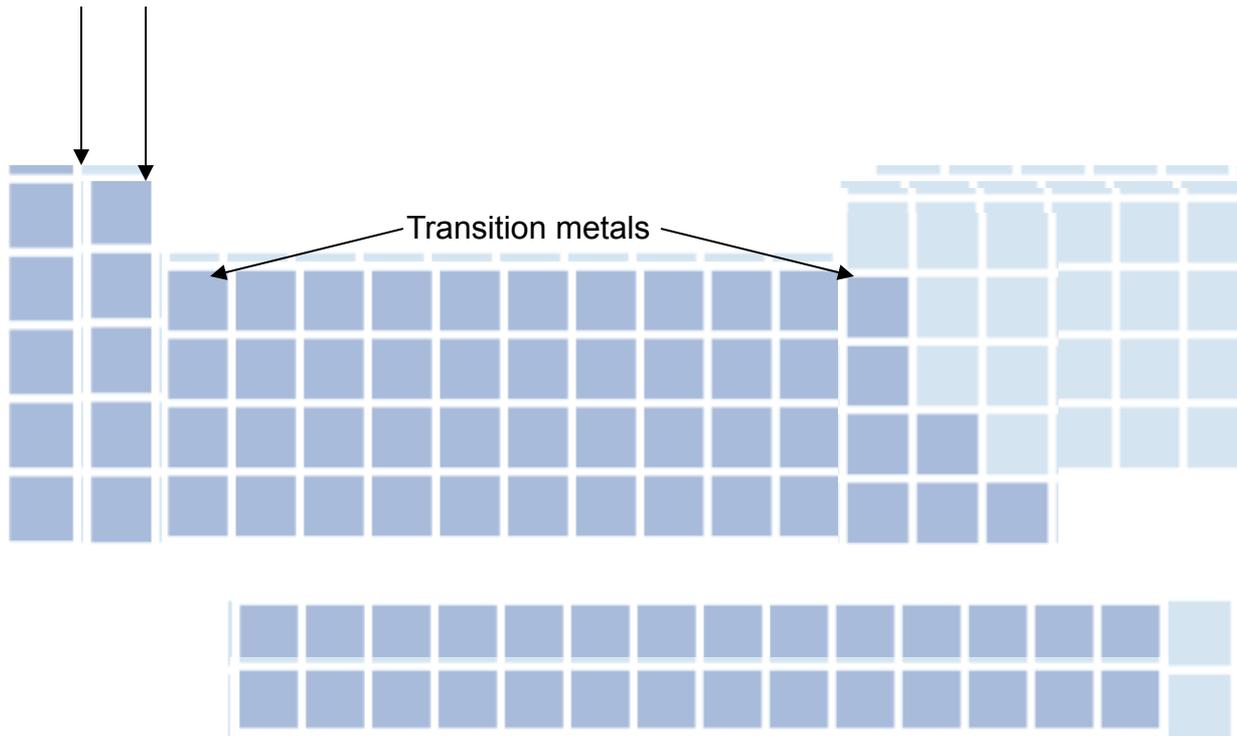
# Classes of Elements

Elements are classified into three major categories:

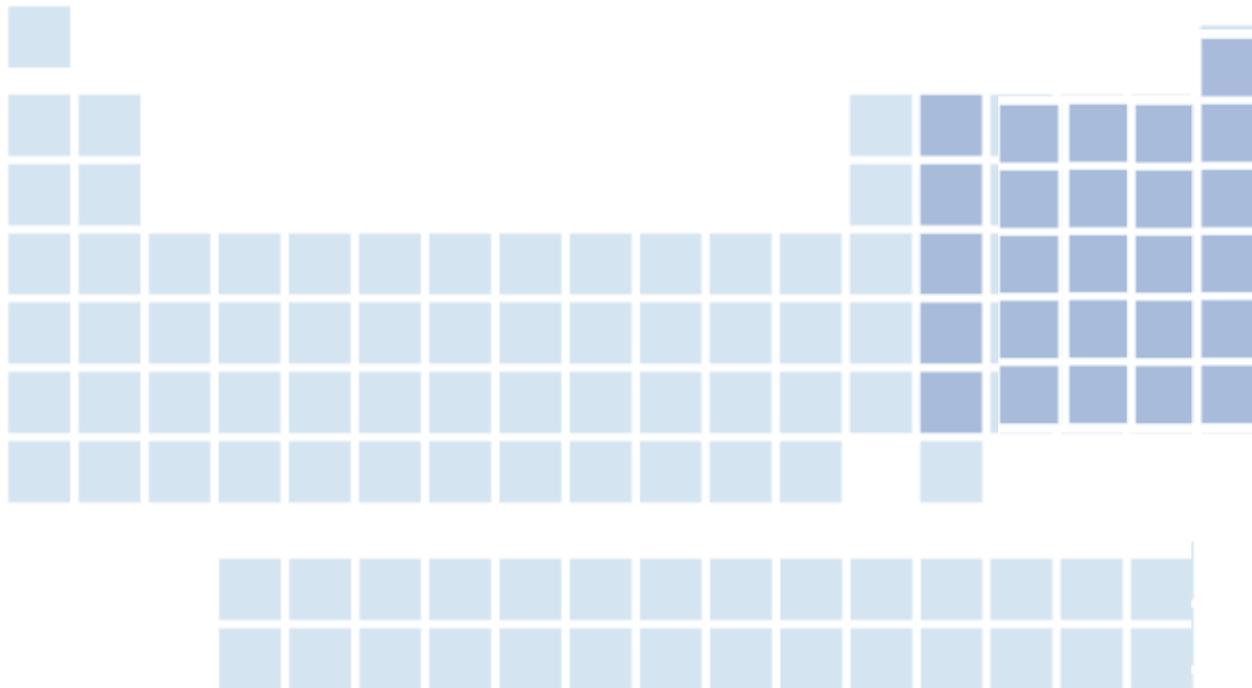
- 1) **METALS**- located on the left side of the periodic table.
- 2) **NONMETALS**- located on the right side of the periodic table.
- 3) **METALLOIDS**- located on a “staircase” between metals and nonmetals.

# Location of Metals

Alkali Metals



# Location of Nonmetals





# Closure:

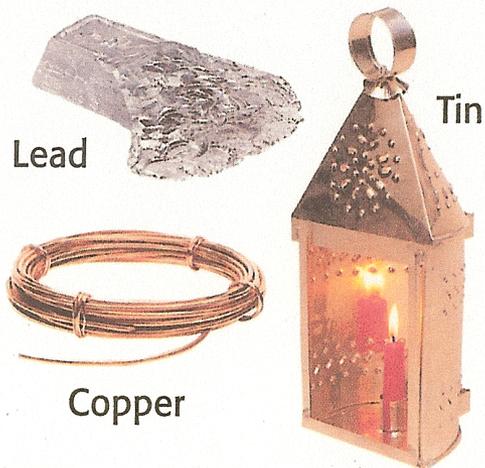
What class of elements has the greatest number of spots on the periodic table?

## Do Now:

What are the 3 major categories of elements and where are they located on the Periodic Table?

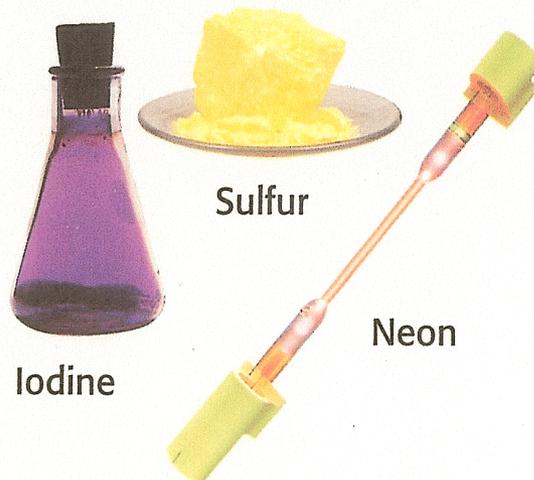
# The Three Major Categories of Elements

## Metals



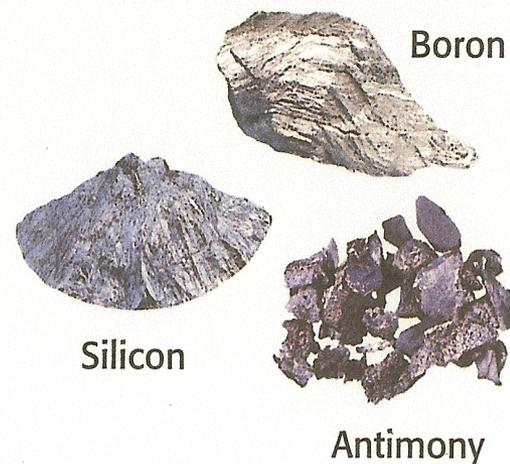
**Metals** are elements that are shiny and are good conductors of heat and electric current. They are *malleable*. (They can be hammered into thin sheets.) They are also *ductile*. (They can be drawn into thin wires.)

## Nonmetals



**Nonmetals** are elements that are dull (not shiny) and that are poor conductors of heat and electric current. Solids tend to be brittle and unmalleable. Few familiar objects are made of only nonmetals.

## Metalloids

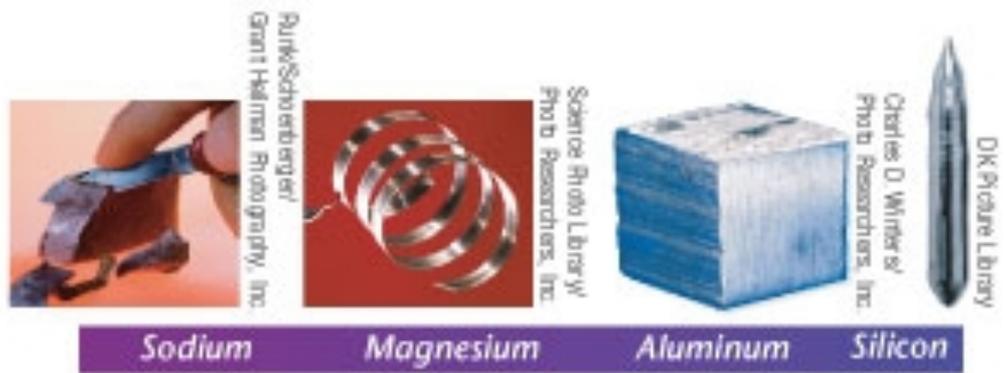


**Metalloids** are also called semi-conductors. They have properties of both metals and nonmetals. Some metalloids are shiny. Some are dull. Metalloids are somewhat malleable and ductile. Some metalloids conduct heat and electric current as well.

# Variations across a period (row)

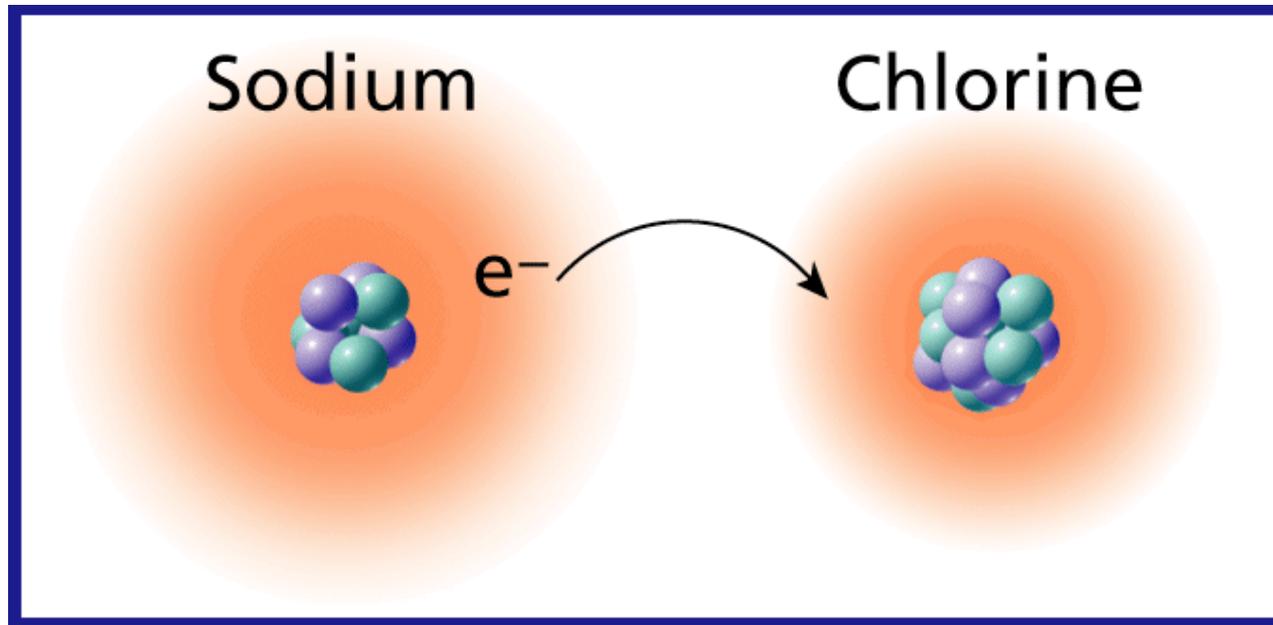
Period 3 elements:

From left to right in a row (period), materials become less metallic.



# Group A Elements

It's all about the Valence Electrons! (they occupy the highest energy level of an atom and are readily available for chemical reactions. Their numbers increase as you move from left to right on the periodic table).



# Determining the Number of Valence Electrons

P51

Atoms of elements in **Groups 1 and 2** have the same number of valence electrons as their group number.

H	
1	2
Li	Be
Na	Mg
K	Ca
Rb	Sr
Cs	Ba
Fr	Ra

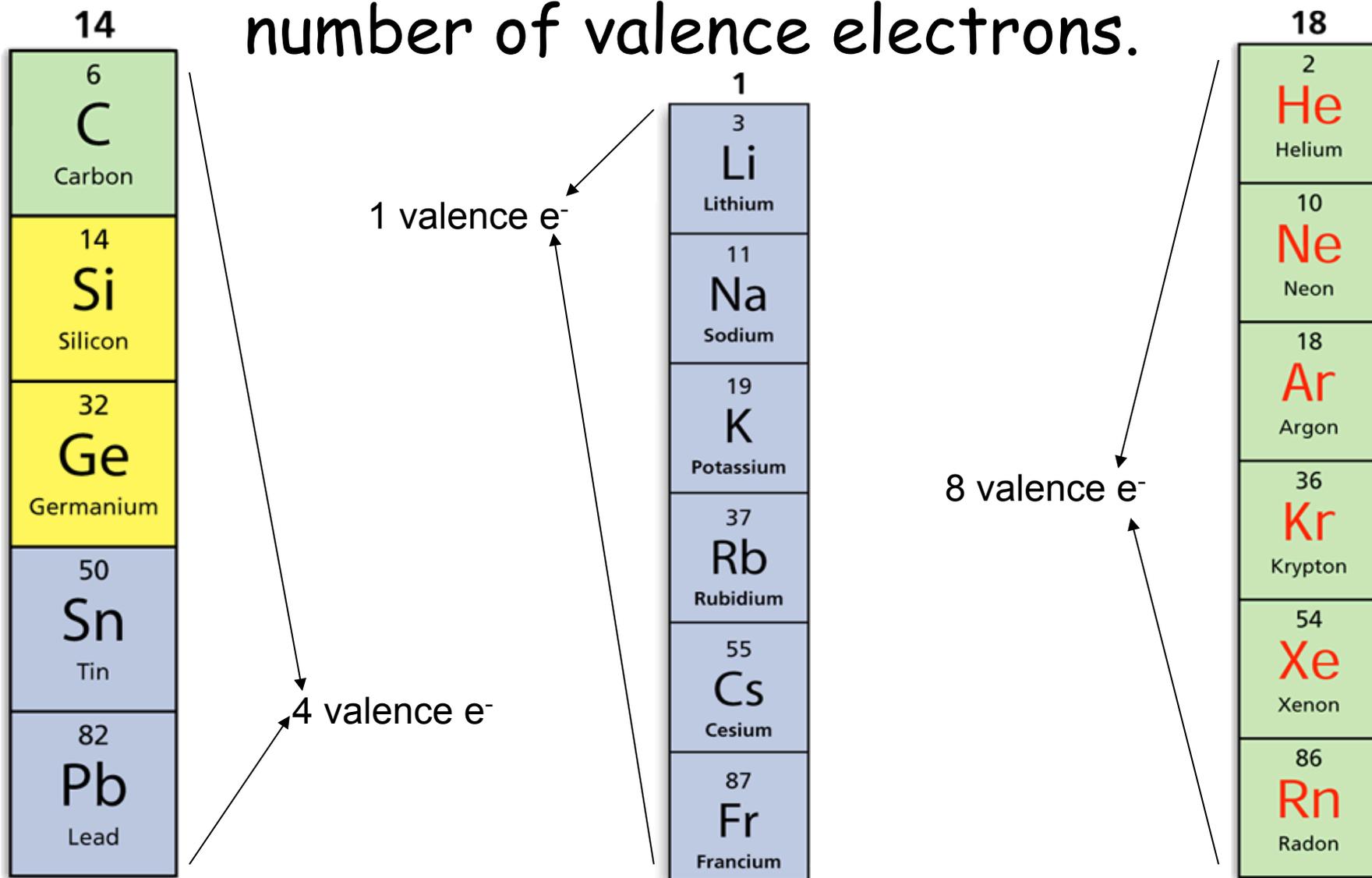
Atoms of elements in **Groups 3–12** do not have a rule relating their valence electrons to their group number.

**WE WILL NOT  
FOCUS ON  
THESE  
TRANSITION  
ELEMENTS.**

Atoms of elements in **Groups 13–18** have 10 fewer valence electrons than their group number. However, helium atoms have only 2 valence electrons.

					18
					He
13	14	15	16	17	Ne
B	C	N	O	F	Ne
Al	Si	P	S	Cl	Ar
Ga	Ge	As	Se	Br	Kr
In	Sn	Sb	Te	I	Xe
Tl	Pb	Bi	Po	At	Rn
	Uuq				

Elements in a group exhibit similar properties because they have the same number of valence electrons.



# Closure:

How can you quickly tell how many valence electrons any element has simply by looking at the periodic table?

# Group 1A (1) - Alkali Metals

1 3 Li Lithium
11 Na Sodium
19 K Potassium
37 Rb Rubidium
55 Cs Cesium
87 Fr Francium

The metals in Group 1, from lithium to francium, are called the *alkali metals*. Alkali metals react with atoms of other elements by losing one electron. **How many valence e<sup>-</sup> do these elements have?**

Alkali metals are so highly reactive, they only exist as compounds. Sodium and Potassium are very important to life. **Can you name 1 compound that includes an alkali metal?**

Reactivity increases as you move down the group. **What is less reactive than Cesium but more reactive than Lithium?** (Lithium is found in batteries and medicine)

# Group 2A (2) - Alkaline Earth Metals

2
4 Be Beryllium
12 Mg Magnesium
20 Ca Calcium
38 Sr Strontium
56 Ba Barium
88 Ra Radium

Group 2 of the periodic table contains the *alkaline earth metals*. These elements are not as reactive as the metals in Group 1, but they are more reactive than most other metals. They are also harder than group 1 metals and have higher melting points. **How many valence e<sup>-</sup> do they have?**

Differences in their reactivity is how they react with water. They are good conductors of electricity.

Mg can be as hard as steel when mixed with other metals but is extremely light. **How could that be important?**

Calcium is important for bones and muscles. **Where have you heard of Calcium sulfate?**

# Group 3A (13) - Boron Family

**B**

Group 3 contains a metalloid, boron, and 4 metals. **All have 3 valence e<sup>-</sup>.**

**Al**

Aluminum is the most abundant metal in the Earth's crust. It is found in a mineral called bauxite.

**Ga**

**In**

Most of our laboratory glassware contains boron, which helps prevent it from shattering when heated.

**Tl**

# Group 4A (14) - The Carbon Family

14
6 C Carbon
14 Si Silicon
32 Ge Germanium
50 Sn Tin
82 Pb Lead

Each element in the carbon family has atoms that can gain, lose, or **share four electrons** when reacting with atoms of other elements.

Most of the compounds in your body, except water, contain carbon. Carbon controls most of the reactions in your body. It also exists in long chains in coal and oil.

Silicon is the 2<sup>nd</sup> most abundant element in the Earth's crust, existing as silicon dioxide. It is found in quartz, sand, and glass. When combined with carbon, it can be extremely hard and is used for saw blades.

# Group 5A (15) - The Nitrogen Family

15
7 N Nitrogen
15 P Phosphorus
33 As Arsenic
51 Sb Antimony
83 Bi Bismuth

Group 5A, the nitrogen family, contains two nonmetals: nitrogen and phosphorus. **These elements have 5 valence e<sup>-</sup>.**

Many fertilizers contain nitrogen and phosphorous and our bodies need both of these elements to help release energy from the food we eat.

White phosphorous is so reactive with oxygen that it bursts into flame when it comes in contact with it. Red phosphorous, which is less reactive, is used in matches.

# Group 6A (16) - The Oxygen Family

16
8 <b>O</b> Oxygen
16 <b>S</b> Sulfur
34 <b>Se</b> Selenium
52 <b>Te</b> Tellurium
84 <b>Po</b> Polonium

Group 6A, the oxygen family, contains three nonmetals: oxygen, sulfur, and selenium. **These elements have 6 valence e<sup>-</sup>.**

Oxygen is the most abundant element in Earth's crust and is part of the gases that make up the air we breathe. Ozone is a form of oxygen in the atmosphere and protects us from harmful solar radiation.

Sulfur was one of the first elements to be discovered because it occurs in large deposits in the Earth. It is used to make rubber and sulfuric acid.

# Group 7A (17) - The Halogens

17
9 F Fluorine
17 Cl Chlorine
35 Br Bromine
53 I Iodine
85 At Astatine

The Group 7A elements are the most reactive nonmetals. Atoms of these elements easily form compounds by sharing or gaining one electron when reacting with atoms of other elements. **They have 7 valence e<sup>-</sup>.**

Fluorine is found in toothpaste and chlorine in bleach and swimming pool water. Both help to kill bacteria. **Reactivity decreases as you go down the group. (F is the most reactive halogen and At is the least)**

Iodine is important in the workings of the thyroid gland.

# Group 8A (18) - The Noble Gases

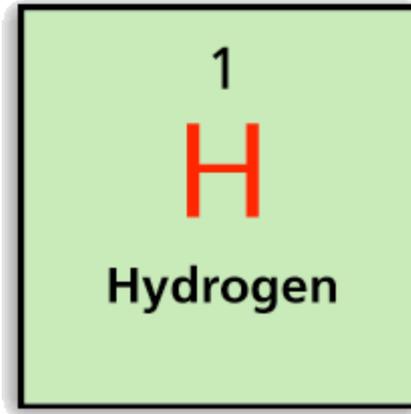
18
2 He Helium
10 Ne Neon
18 Ar Argon
36 Kr Krypton
54 Xe Xenon
86 Rn Radon

The elements in Group 8A are known as the *noble gases*. They do not ordinarily form compounds because atoms of noble gases do not usually gain, lose, or share electrons. They have 8 valence  $e^-$ , except helium which only has 2. They are odorless and colorless.

Remember from a previous discussion, the noble gases are used in neon lights.

Highly reactive elements can be stored in Argon to prevent them from reacting with other elements.

# Hydrogen



Because the chemical properties of hydrogen differ very much from those of the other elements, it really cannot be grouped into a family. **Because it has only 1  $e^-$ , its location on the periodic table is due to the electron configuration not to its properties.**