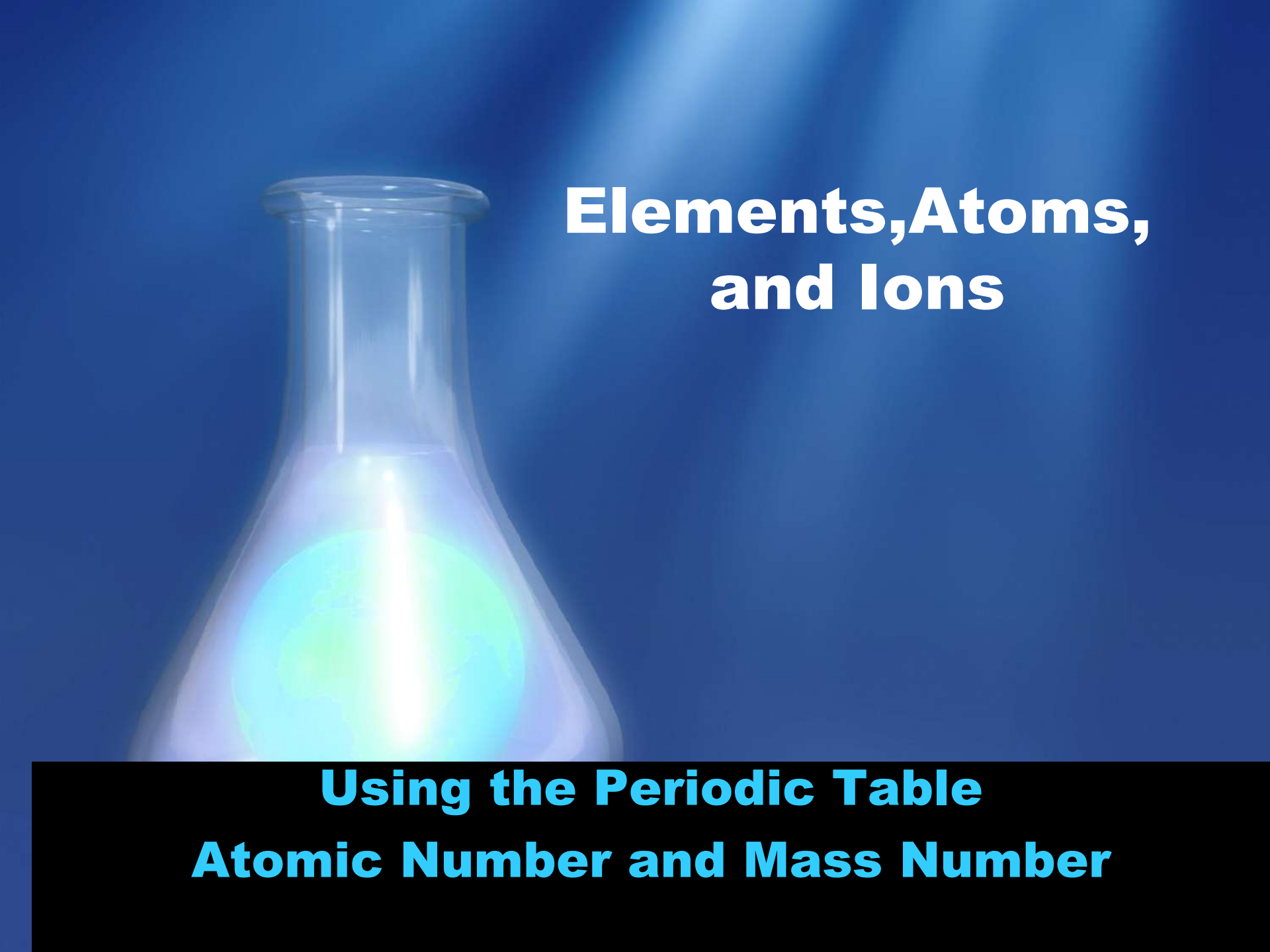


Elements,Atoms, and Ions

Using the Periodic Table

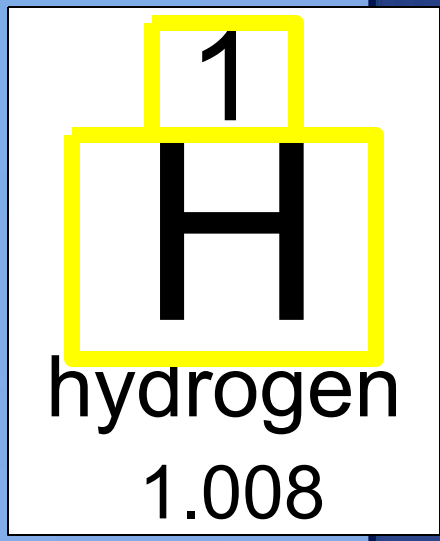
Atomic Number and Mass Number

Introduction to the Periodic Table

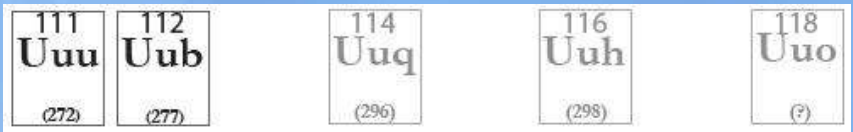
- **Periodic table** → a chart showing all the elements arranged in columns in such a way that all the elements in a given column exhibit similar chemical properties.

Introduction to the Periodic Table

- The periodic table shows all of the known elements and gives a good deal of information about each one.
  - –Number above each symbol is the atomic number (# protons and also # electrons).
  - –Letters are the element symbol.



Introduction to the Periodic Table



- –Elements 112 through 118 used to have unusual 3-letter designations beginning with U that are standing in place until the elements are named by the scientific community.(update 2018 all have been named)
- –

- Elements are listed on the periodic table in order of increasing atomic number.

Introduction to the Periodic Table

- The elements are arranged in specific horizontal rows and vertical columns.
- Elements were first arranged in 1869 by Dmitri Mendeleev.
  - –Arranged by similarities in the chemical properties of the “families” of elements.

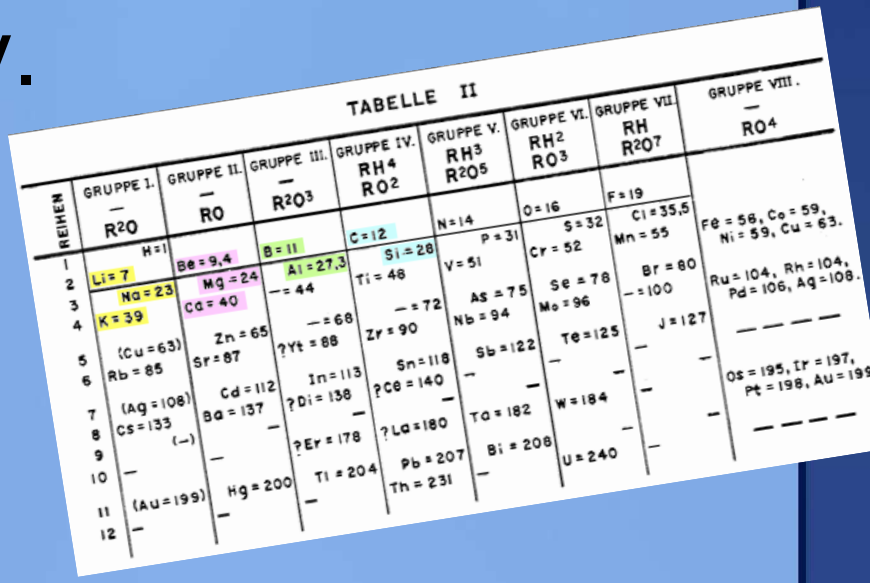


TABELLE II

REIHEN	GRUPPE I. — R^2O	GRUPPE II. — RO	GRUPPE III. — R^2O^3	GRUPPE IV. RH^4 RO^2	GRUPPE V. RH^3 R^2O^5	GRUPPE VI. RH^2 RO^3	GRUPPE VII. RH R^2O^7	GRUPPE VIII. — RO^4
1	H=1					O=16	F=19	
2	Li=7	Be=9,4	B=11	C=12	N=14			
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	Zr=90	As=75	Se=78	Br=80	
6	Rb=85	Sr=87	?Yt=88	—=72	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	—	

Introduction to the Periodic Table

- The name *periodic table* comes from the fact that as we increase the atomic numbers, every so often an element occurs with properties similar to those of an earlier element.
  - –The elements listed vertically all show similar chemical behavior.

F and **Cl** are reactive gases that form similar compounds.

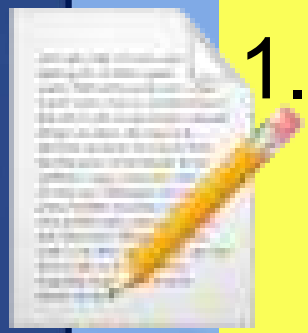
Introduction to the Periodic Table

- **Group** → a vertical column of elements on the periodic table.
  - –Families of elements with similar chemical properties.
  - –Referred to by the number over the column.
  - –Many of the groups have special names.

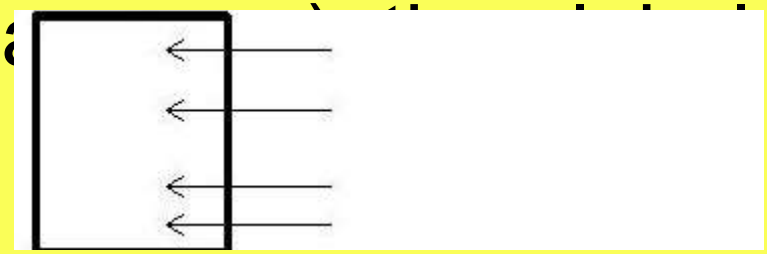
Introduction to the Periodic Table

Optional Assignment

- Download, print, and fill out this **PERIODIC TABLE** as you view the presentation



1. Fill in the box below the title with information about your favorite element (choose a [illegible] the parts.

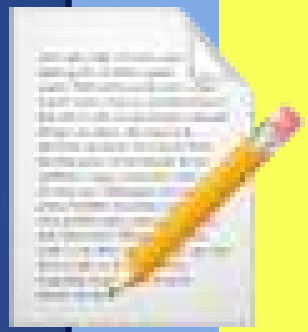


Introduction to the Periodic Table

Optional Assignment Cont'd

Color the SYMBOLS for gases and liquids

(the **solids** are already colored **Black**)



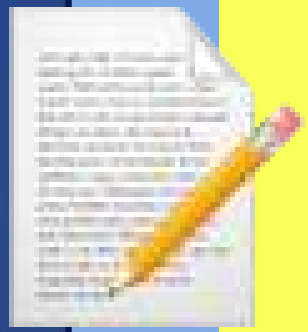
- Color the SYMBOL of the **gases** using **RED**
  - ❑ H, He, N, O, F, Ne, Cl, Ar, Kr, Xe, and Rn.
- Color the SYMBOL of the **liquids** using **Blue**.
  - ❑ Br and Hg.
- Fill out the key at the bottom.

H

Introduction to the Periodic Table

Optional Assignment Cont'D

3. Pick a color for each of the groups listed in the legend.
   - Color the box of the elements to match the groups listed in the legend.



1
H
hydrogen
1.008

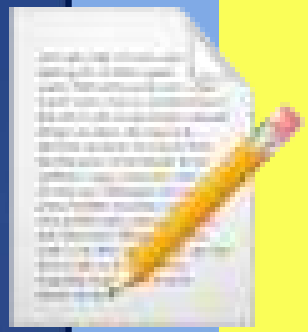
LEGEND

- ☐ Alkali Metals
- ☐ Alkaline Earth Metals
- ☐ Transition Metals
- ☐ Halogens
- ☐ Noble Gases
- ☐ Lanthanides
- ☐ Actinides

Introduction to the Periodic Table

Optional Assignment Cont'd

4. Pick a way to designate the difference between metals, nonmetals, and metalloids/ semimetals.



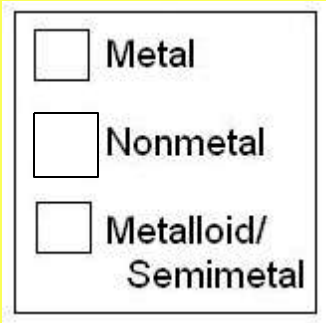
- Make the box for each element match the classification legend.

1

H

hydrogen

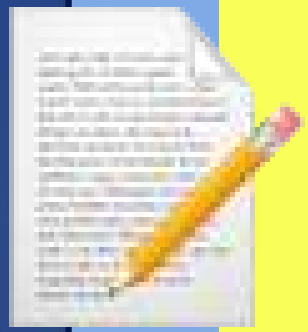
1.008



Introduction to the Periodic Table

Optional Assignment Cont'd

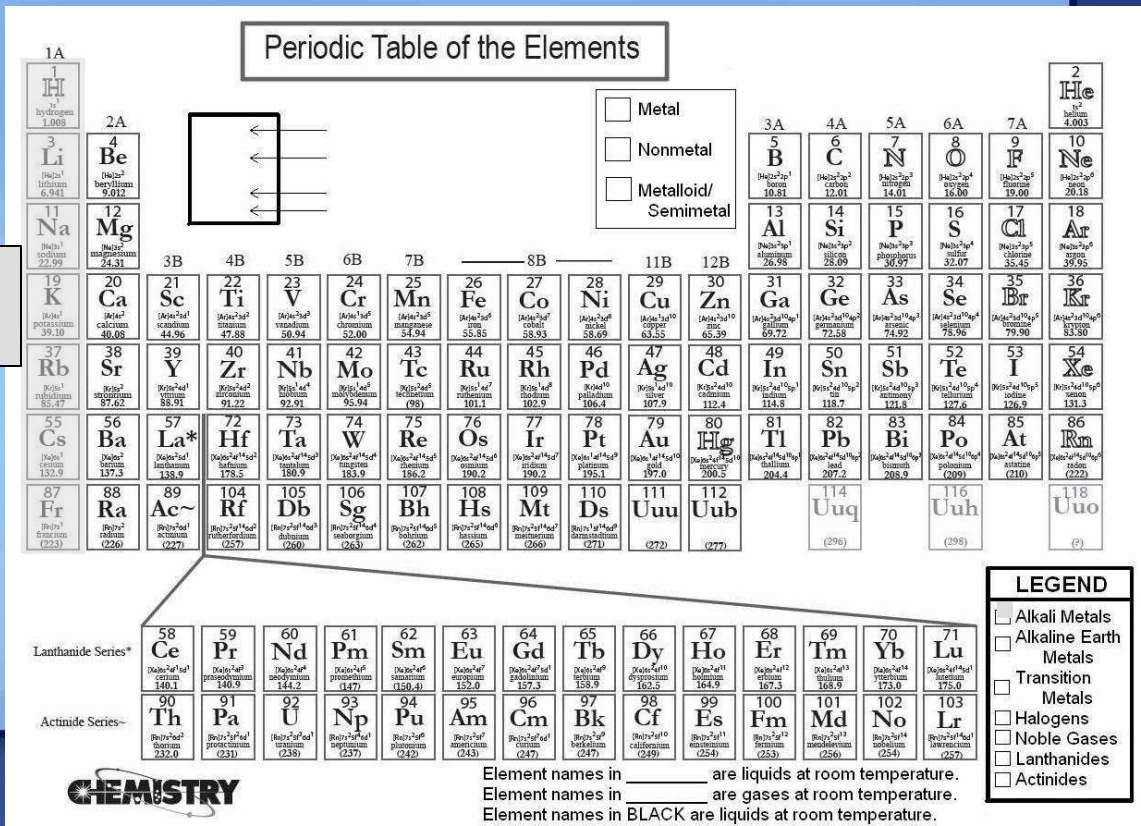
5. Scan and save your periodic table.
   - We will refer back to the periodic table multiple times during this course.
   - I suggest you keep it in your notebook and add labels and notations as we go through the course.



~~6. Submit the scanned image in the assignment for this lesson.~~

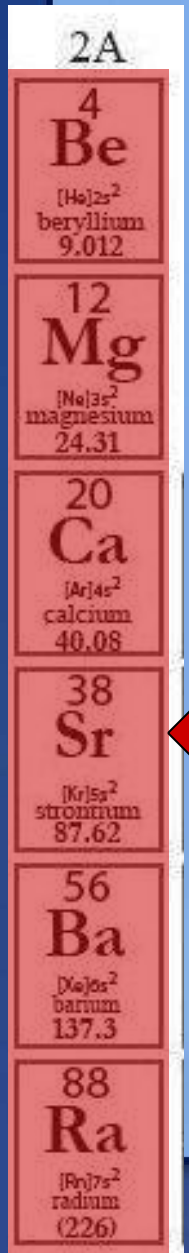
Introduction to the Periodic Table

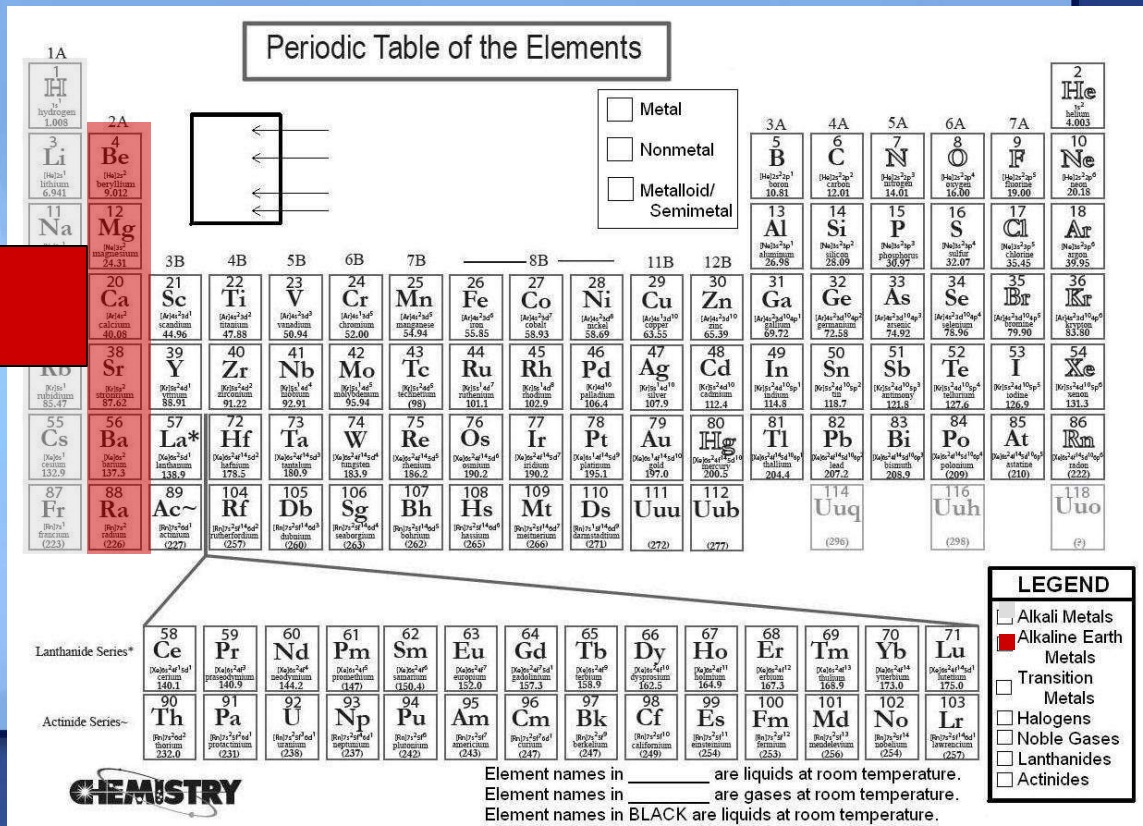
- The first column of elements, Group 1, are the **alkali metals**.



Introduction to the Periodic Table

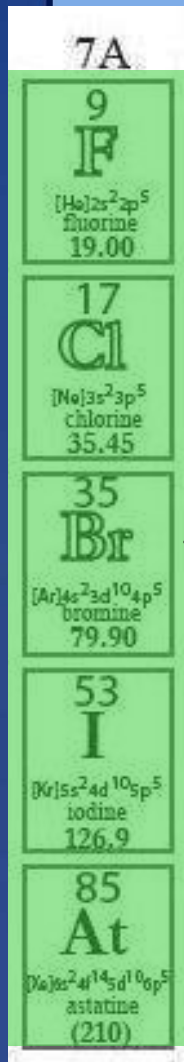
- Group 2 elements are the **alkali earth metals**.

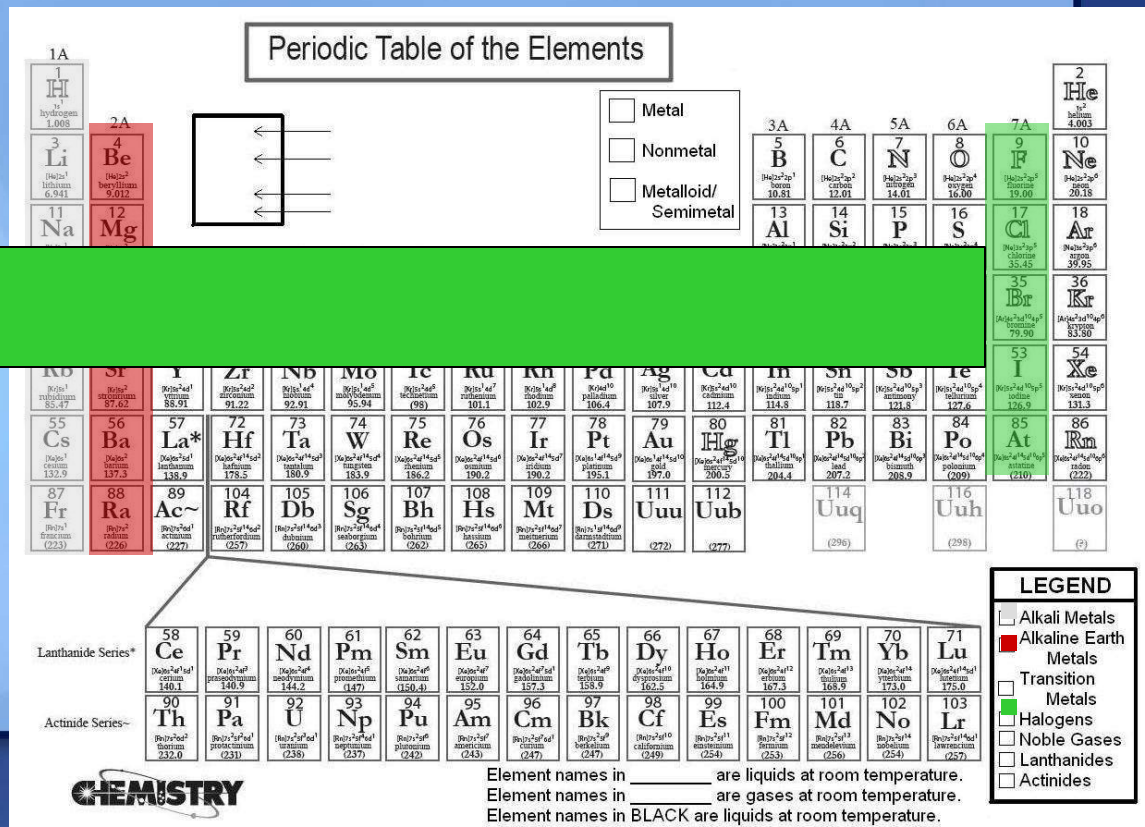




Introduction to the Periodic Table

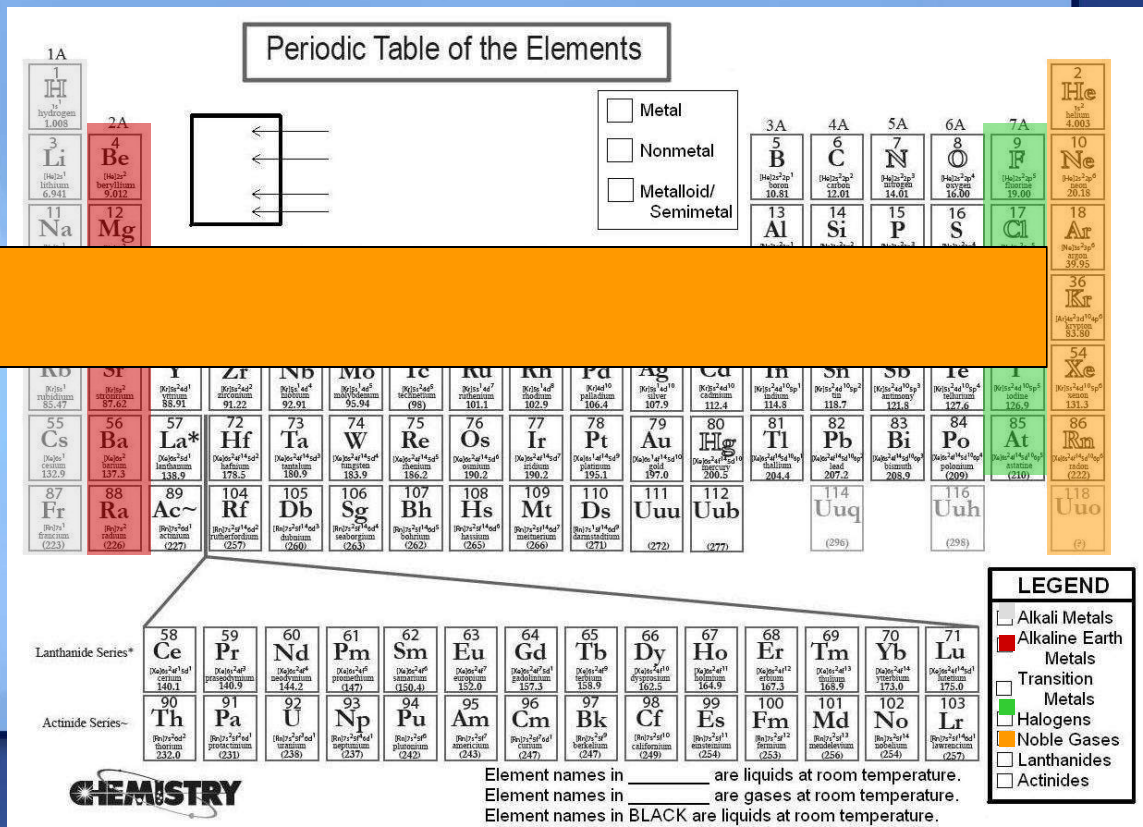
- Group 7 (17) elements are the **halogens**.





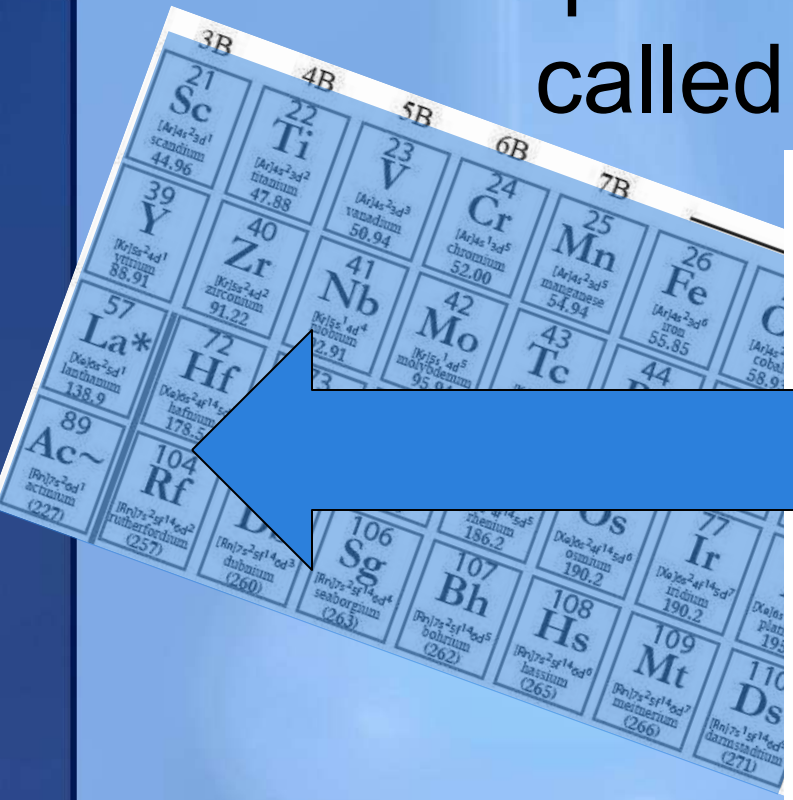
Introduction to the Periodic Table

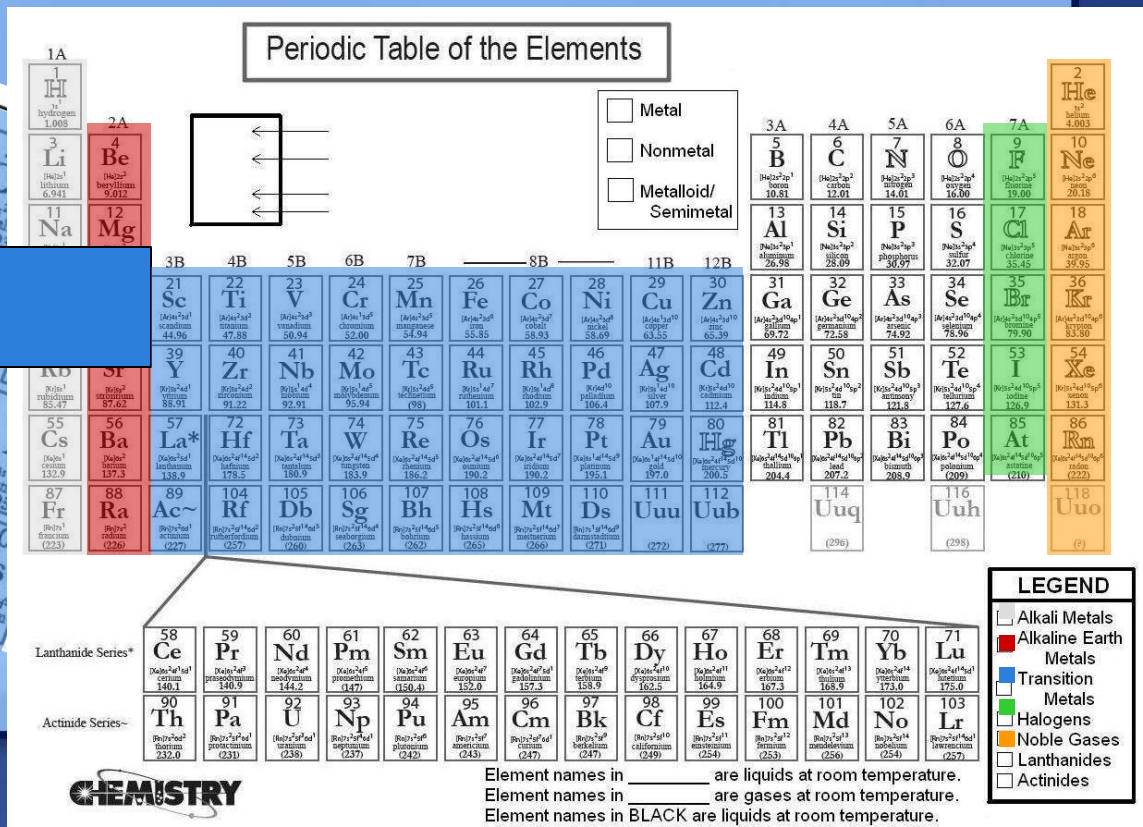
- Group 8 (18) elements are the **noble gases**.



Introduction to the Periodic Table

- Groups 3 – 12 contain elements called the **transition metals**.



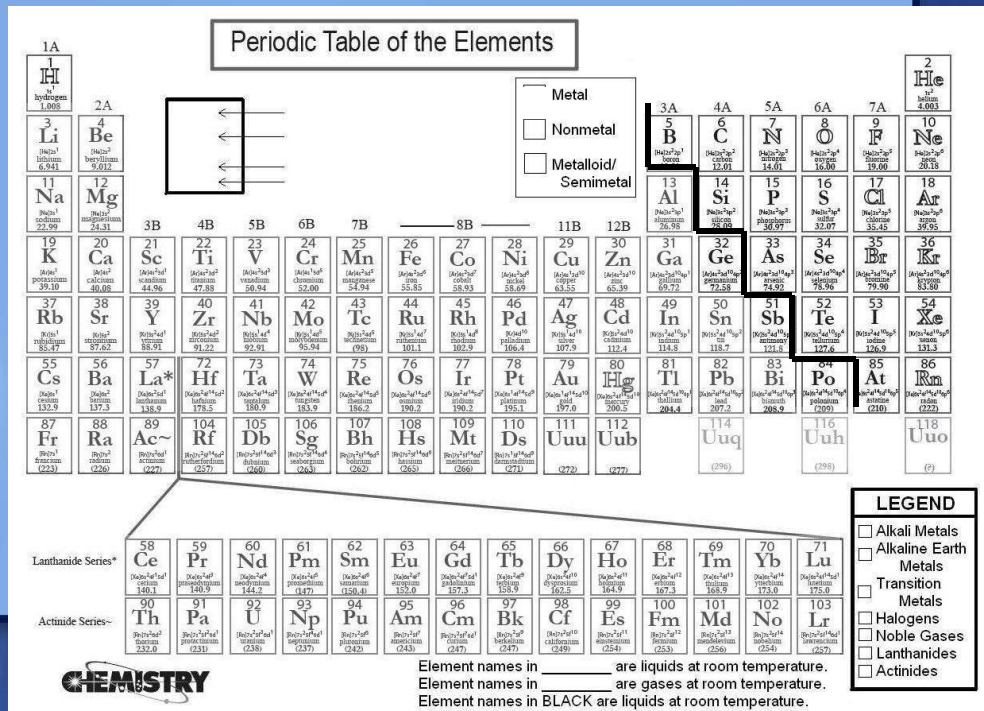


Introduction to the Periodic Table

- Most of the elements are **metals**.

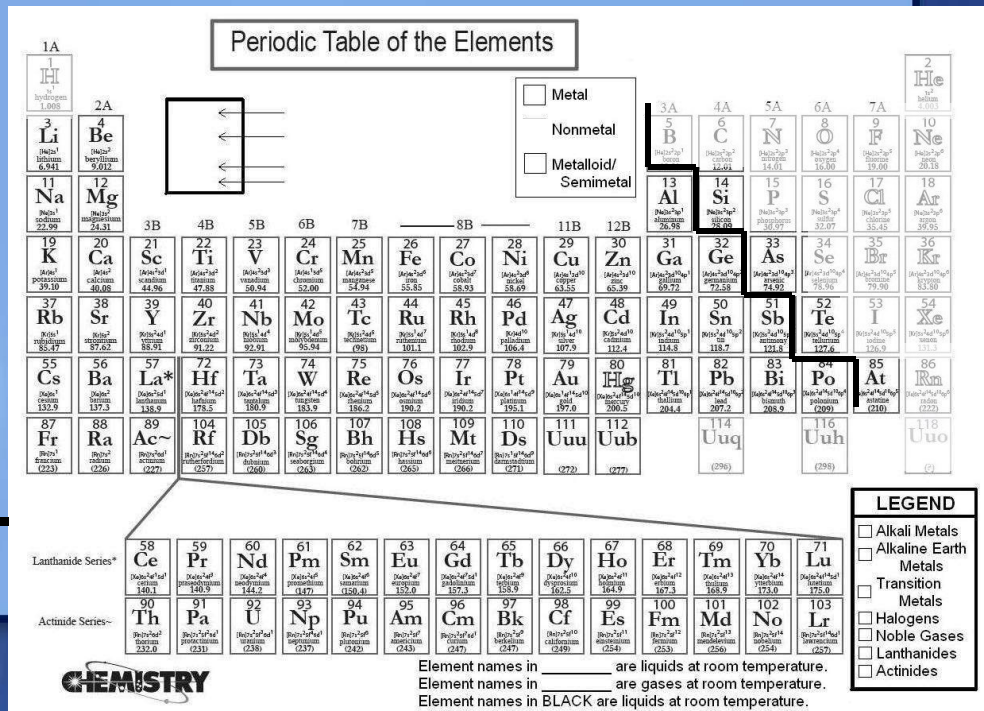
Physical properties of metals:

1. Conductors of heat and electricity
2. Malleable
3. Ductile
4. Lustrous



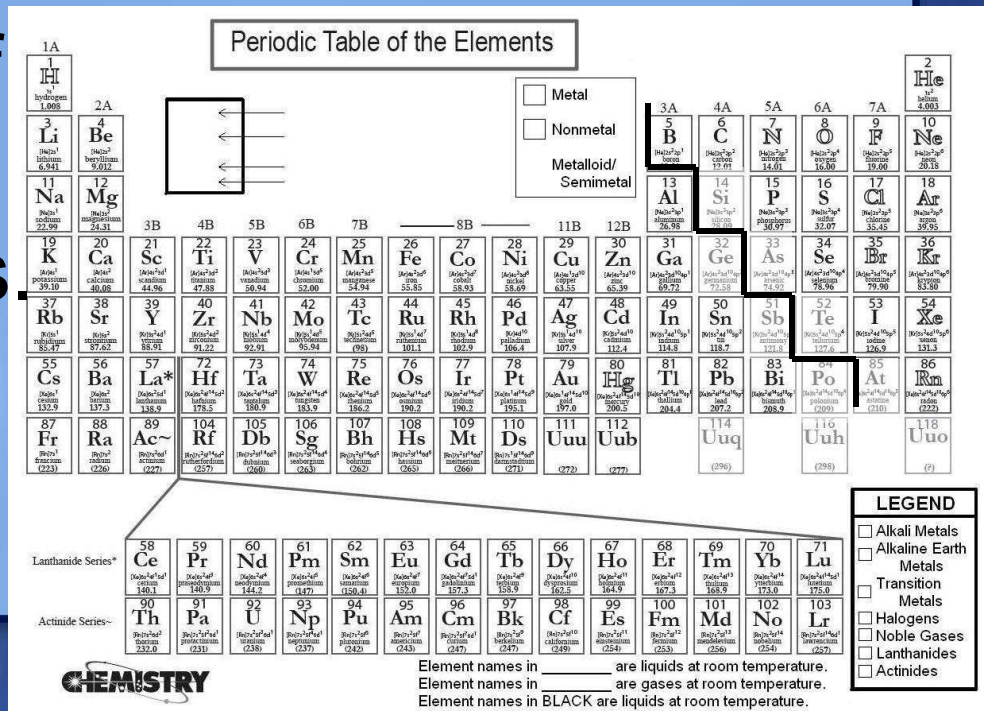
Introduction to the Periodic Table

- **Nonmetals** appear in the upper right hand corner of the periodic table and include hydrogen.
  - Lack the characteristics of metals.
  - Include gases, liquids, and solids.



Introduction to the Periodic Table

- Elements that lie close to the "stair-step" line are called **metalloids** or **semimetals**.
  - Show a mixture of metallic and non-metallic properties.



Introduction to the Periodic Table

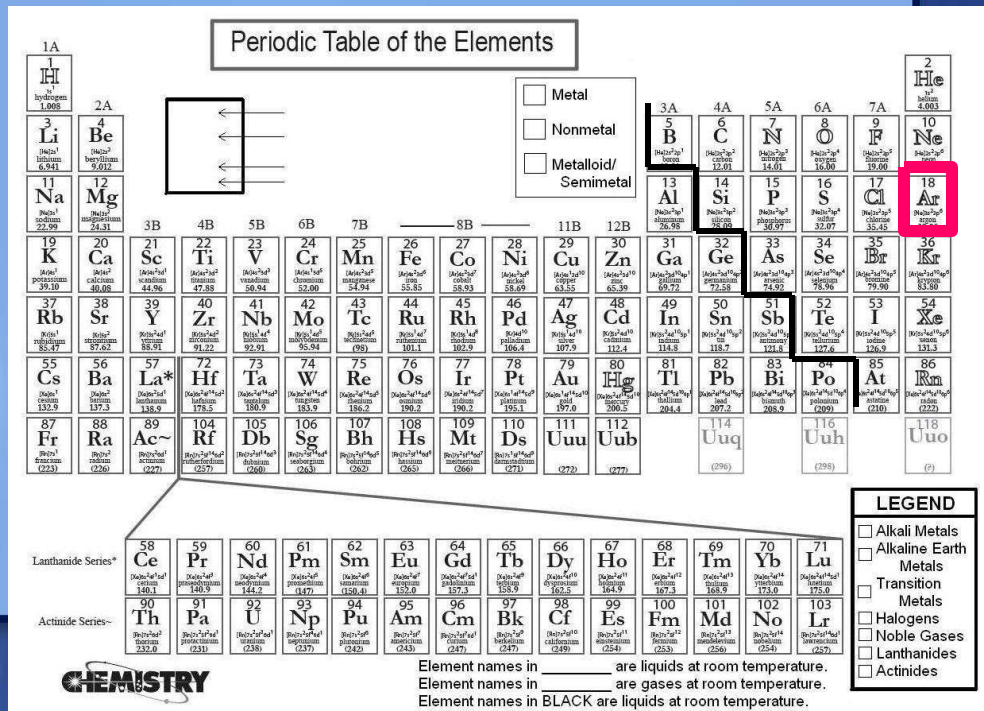
- We will see soon that the periodic table is a valuable tool for organizing and knowledge.
- It can be used to help us predict the properties we expect a given element to exhibit.

Introduction to the Periodic Table

Interpreting the Periodic Table

For the element, give the symbol and atomic number. Indicate whether each element is a metal or a nonmetal and whether it is a member of a named family.

a. argon
- Ar
- 18
- nonmetal
- noble gas



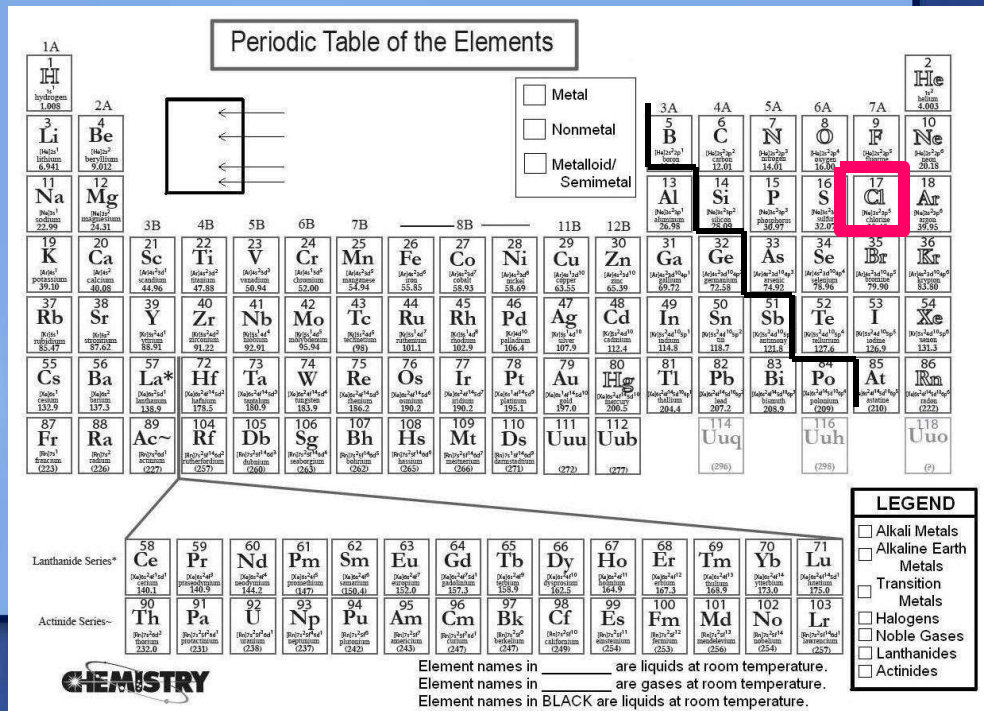
Introduction to the Periodic Table

Interpreting the Periodic Table

For the element, give the symbol and atomic number. Indicate whether each element is a metal or a nonmetal and whether it is a member of a named family.

b. chlorine

- Cl
- 17
- nonmetal
- halogen

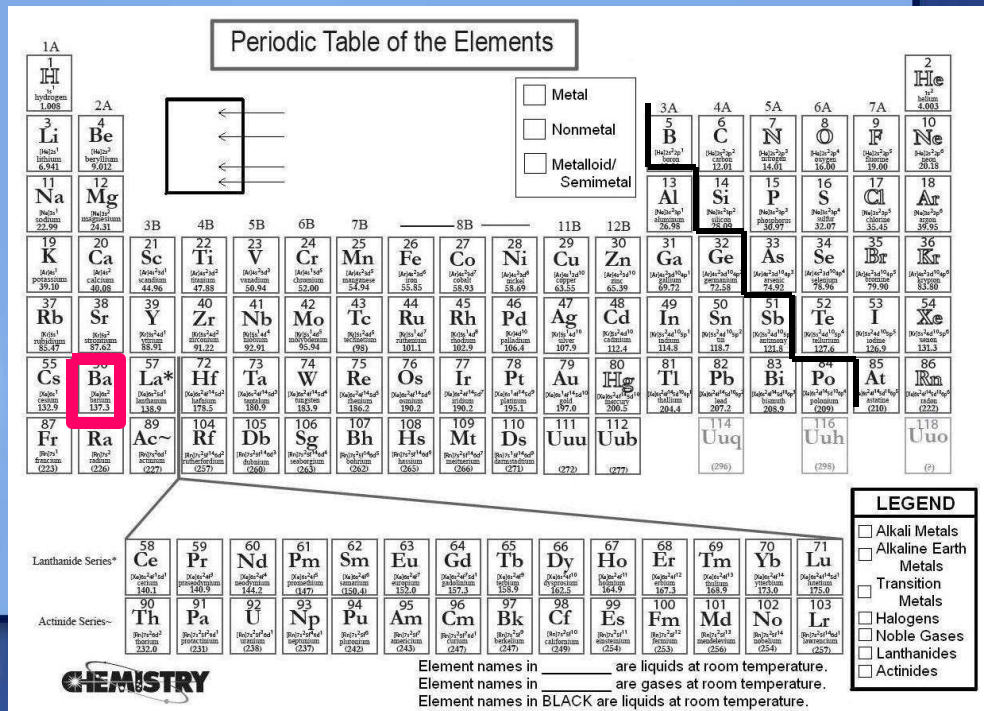


Introduction to the Periodic Table

Interpreting the Periodic Table

For the element, give the symbol and atomic number. Indicate whether each element is a metal or a nonmetal and whether it is a member of a named family.

c. barium
- Ba
- 56
- metal
- alkaline earth metal



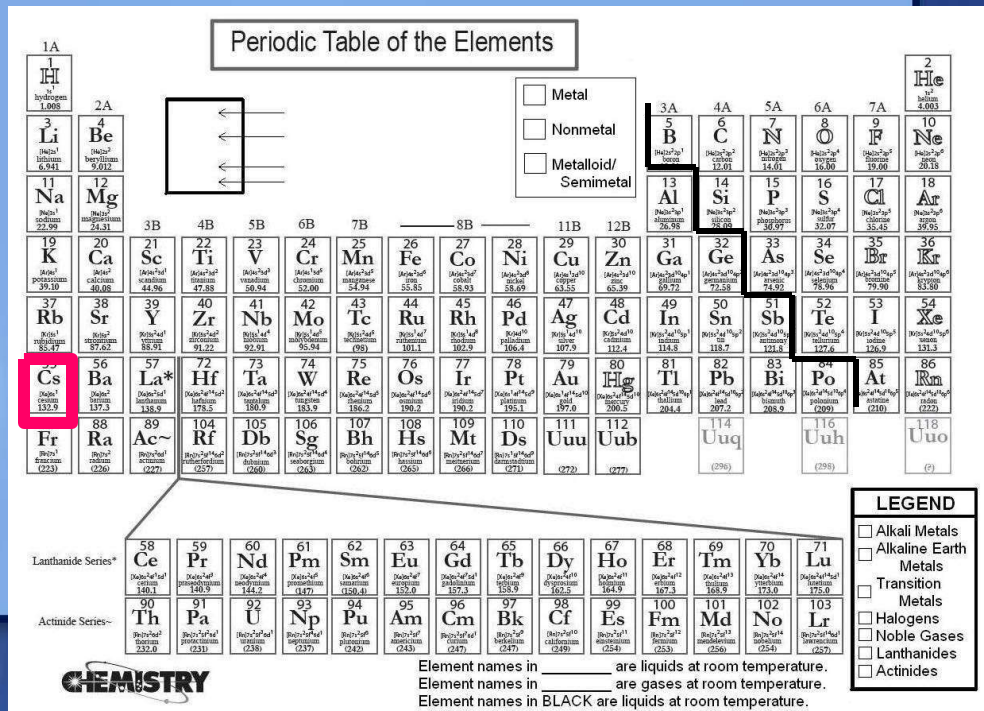
Introduction to the Periodic Table

Interpreting the Periodic Table

For the element, give the symbol and atomic number. Indicate whether each element is a metal or a nonmetal and whether it is a member of a named family.

d. cesium

- Cs
- 55
- metal
- alkali metal



Introduction to the Periodic Table

Listen to "The Elements" song by Tom Lehrer.

http://www.privatehand.com/flash/elements.html

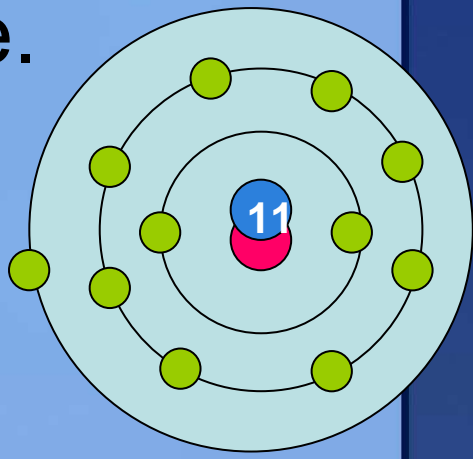
Atomic Number and Mass Number

- All atoms of the same element have the same number of protons and electrons.
- In a free atom, the + and - charges always balance to yield a net zero charge.

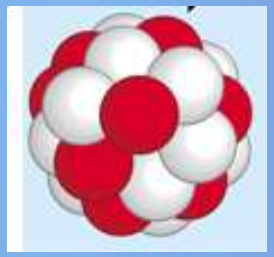
sodium (Na)

11 protons ***11 electrons***

+ ***=*** ***–***



Atomic Number and Mass Number



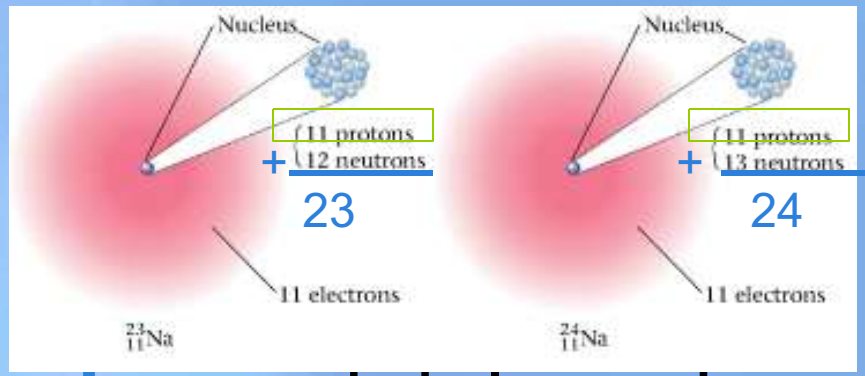
- Each atom also has neutrons in its nucleus.
- When Chadwick discovered that the nucleus contained neutrons along with protons, it became evident that not all atoms of an element were identical.

"All atoms of the same element contain the same number of protons and electrons, but atoms of a given element may have different numbers of neutrons."

Atomic Number and Mass Number

- **Isotopes** → atoms with the same number of protons but different numbers of neutrons.

$^{23}_{11}Na$



$^{24}_{11}Na$

- **Mass number** → total number of protons and neutrons (sum) in the nucleus- this is an average of all the possible isotopes so it is **not a whole number**

Atomic Number and Mass Number

- **Atomic number** → → → → 1
  number of protons in the nucleus of a given atom.

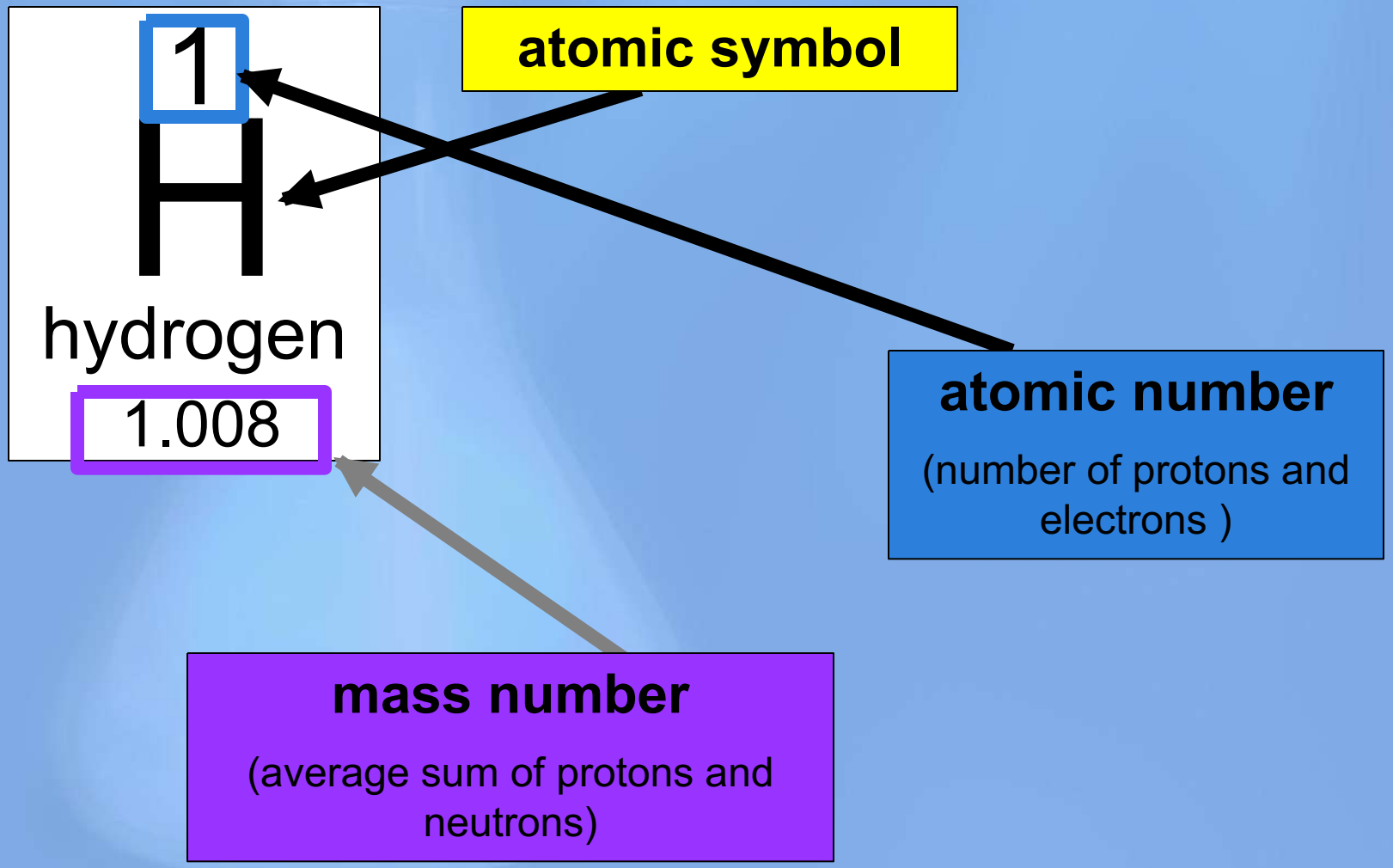
H

hydrogen

- **Mass number** → → → → 1.008
  Average sum of protons and neutrons (sum) in the nucleus

Mass number is also called Atomic Mass or Atomic Weight

Atomic Number and Mass Number



Atomic Number and Mass Number

- Example: sodium

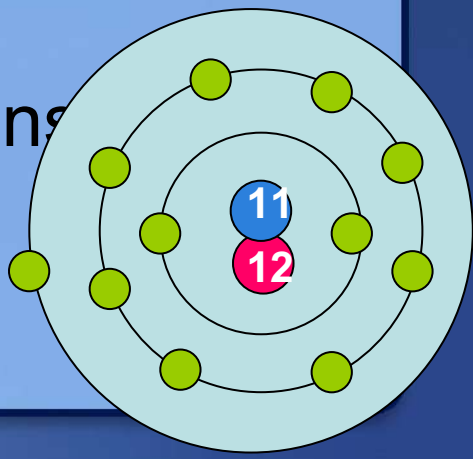
11

Na

22.99

  - How many of each subatomic particle does it have?
    - Protons = atomic number = **11**
    - Electrons = protons = **11**
    - Neutrons = mass number – protons

= 22.99(round to 23) – 11 = **12**



Atomic Number and Mass Number

Interpreting Element Symbols

1. Strontium-

38

Sr

87.62

Protons = atomic number = **38**

Electrons = protons = **38**

Neutrons = mass number – **protons**

88 – 38 = 50

- The End!