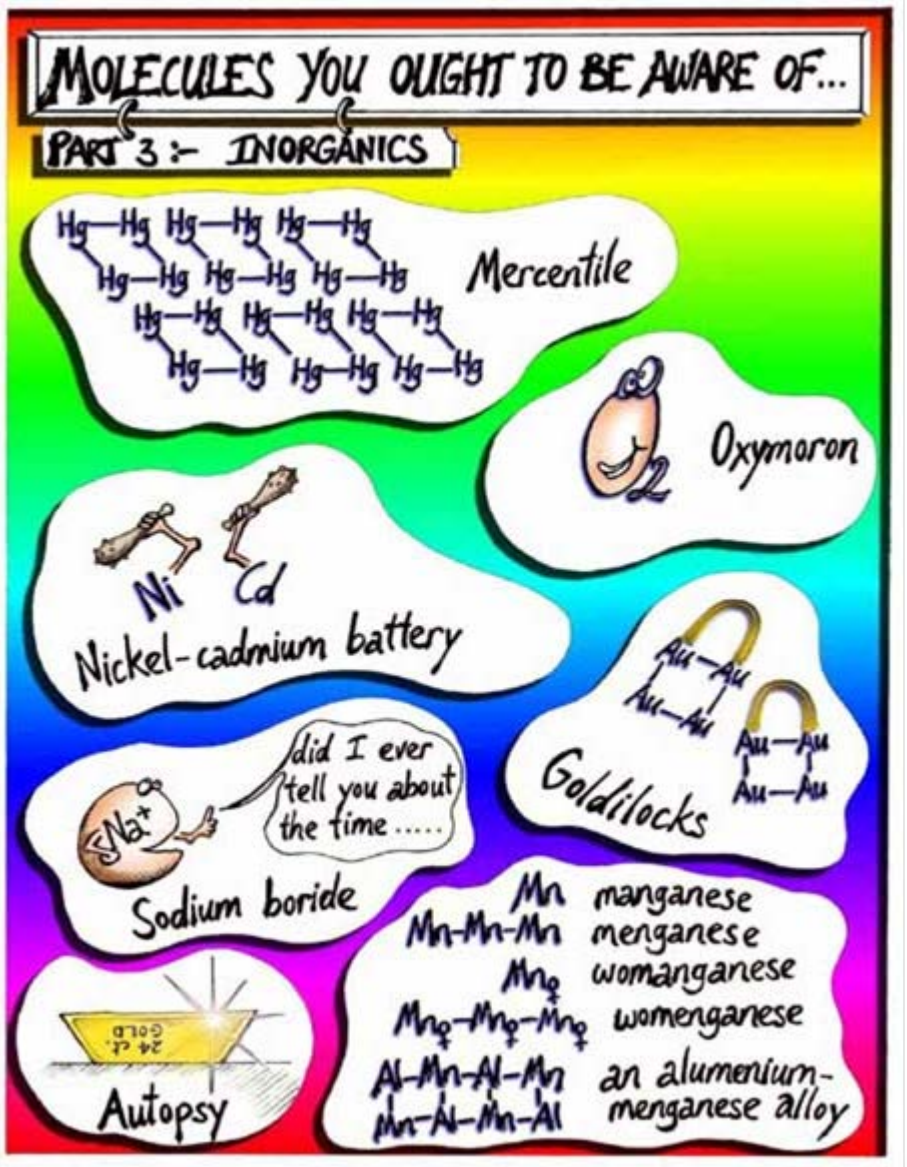
Chemistry in Action

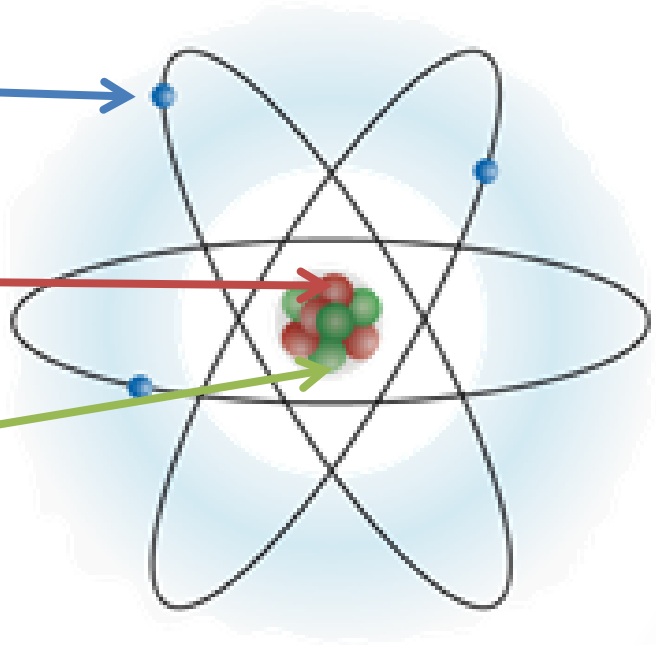


A bit of review…

Chemistry is the study of **MATTER** and **ENERGY**. Matter is anything that has **MASS**. All matter is made of super small particles called **ATOMS**.

Atoms are made of 3 different **SUB**-**ATOMIC** **PARTICLES**:

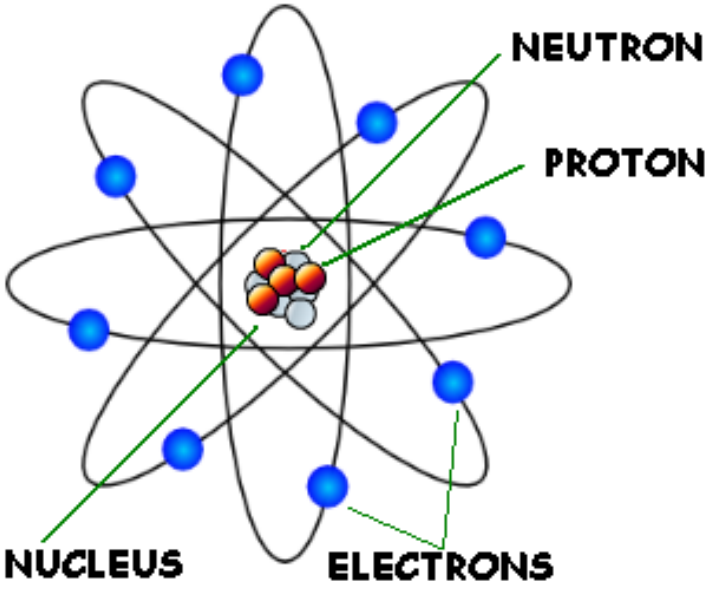
1. **ELECTRONS**
2. **PROTONS**
3. **NEUTRONS**



Atomic Structure…

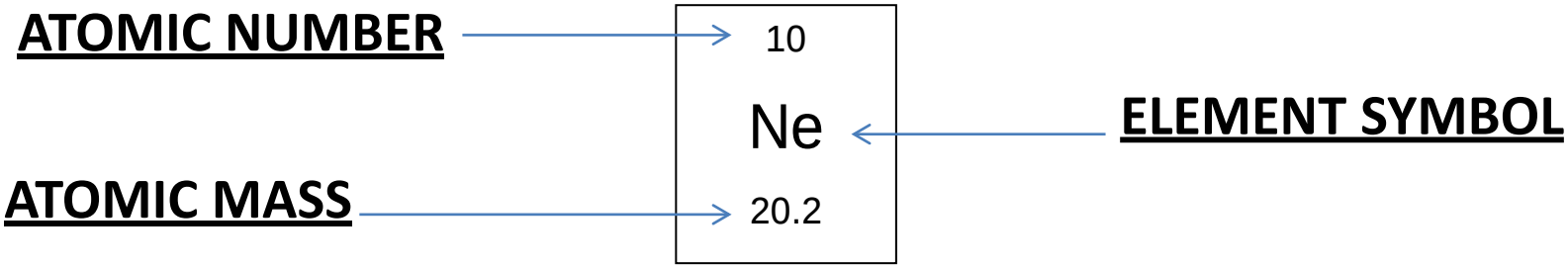
Recall the following information with respect to the parts of the atom:

Sub-Atomic Particle:	*Charge:*	*Mass:*	*Location:*
Proton	Positive (+1)	1 amu	Nucleus
Electron	Negative (-1)	0 amu	Electron Shells
Neutron	Neutral (0)	1 amu	Nucleus



The periodic table…

The information on your periodic table is arranged as follows:



Atomic Number

- Tells us the number of **PROTONS** in the **NUCLEUS**.
- In our example, an atom of neon has 10 protons in its nucleus.

The periodic table…

Atomic Mass

- Is the mass of one atom in **ATOMIC MASS UNITS** (amu). **1 amu = 1.66×10^{-27} Kg** 0.000000000000000000000001 66 Kg
- We usually **ROUND** the mass off to the nearest **WHOLE NUMBER**.
- Since the protons and neutrons weigh 1 amu each, and electrons weigh nothing, we can say that:

Atomic Mass = #protons + #neutrons

OR

 # neutrons = atomic mass – #of protons

The periodic table…

Example

Count the number of protons, electrons and neutrons in the following:

- Neon

#=10

mass=20

p^+ n^0

10 p^+
10 e^-
10 n^0

- Aluminum

#13

mass=27

p^+ n^0

13 p^+
13 e^-
14 n^0

Carbon #6

mass=12

6 p^+
6 e^-
6 n^0

Try this one…

Count the number of p^+, n^0, and e^- in potassium.

#19

mass=39

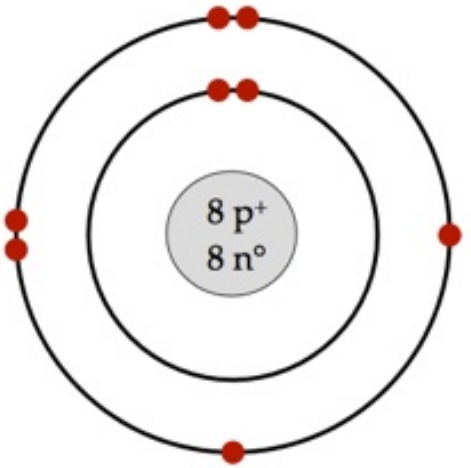
19 p^+
19 e^-
20 n^0

Bohr diagrams…

We use Bohr Diagrams to **REPRESENT** atoms

- simple drawings that show the **POSITIONS** of the **ELECTRONS** in **ORBITS** around the **NUCLEUS**, and the **# OF PROTONS** and **NEUTRONS** in the **NUCLEUS**.

- Each **ORBIT** (**SHELL**) can hold a specific amount of **ELECTRONS**:
  - **First Shell** – *Maximum of 2 electrons*
  - **Second Shell** – *Maximum of 8 electrons*
  - **Third Shell** – *Maximum of 8 electrons*



Oxygen

- Electrons in the outermost orbit are called **VALENCE ELECTRONS**.

Bohr diagrams…

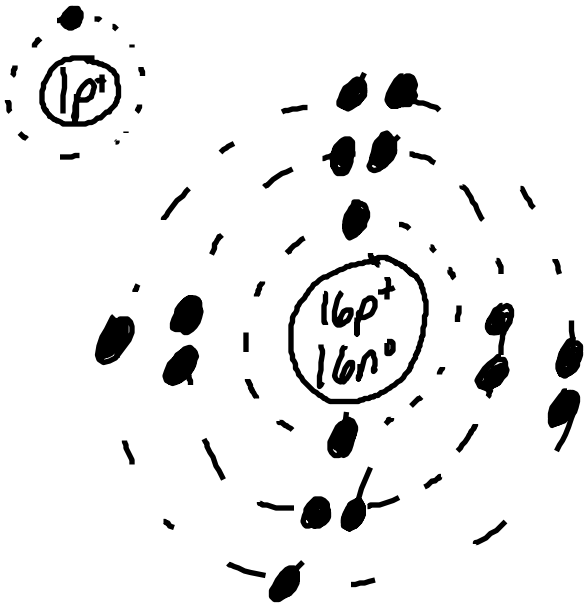
Examples:

Draw Bohr Diagrams for the following elements:

- Hydrogen

#1
mass = 1

1p+
1e-
0n°



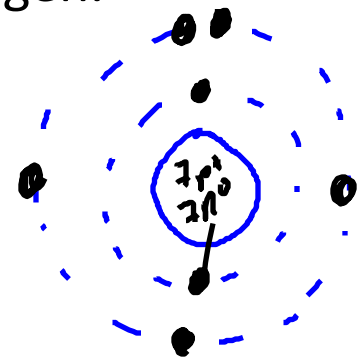
- Sulphur

#16
mass = 32

16p+
16e-
16n°

Try this one…

Draw a Bohr Diagram for Nitrogen.

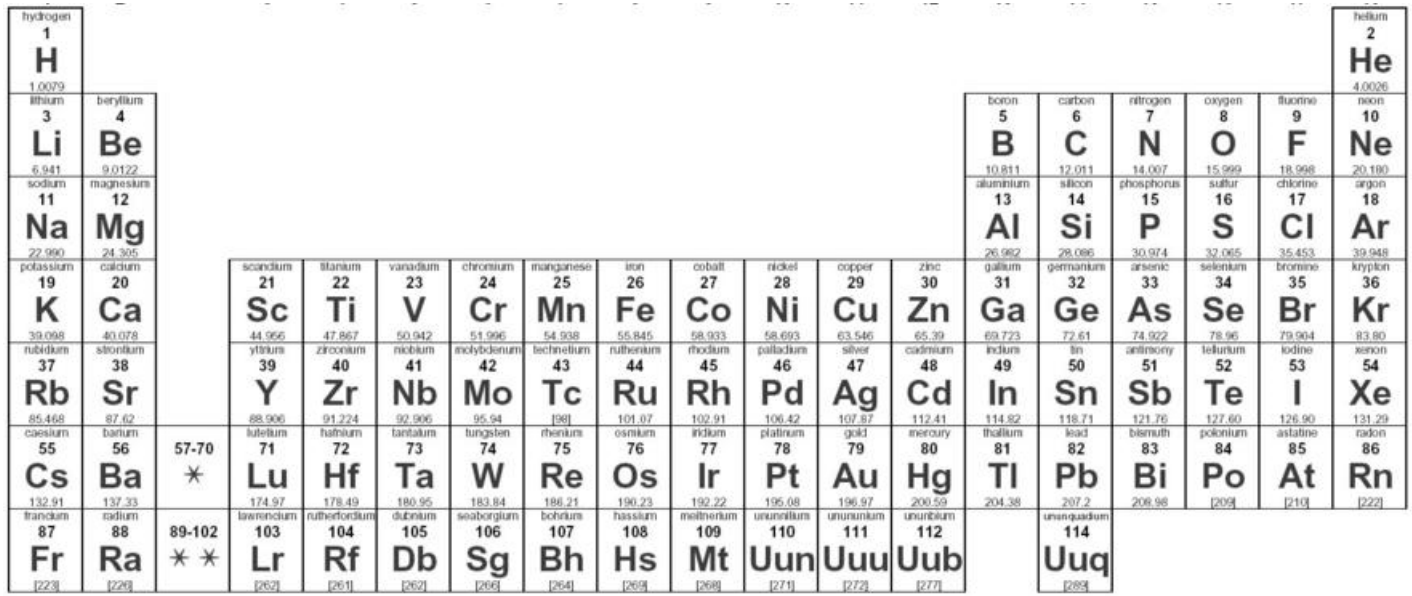


More on the periodic table…

Organizing the Periodic Table

The periodic table is arranged into:

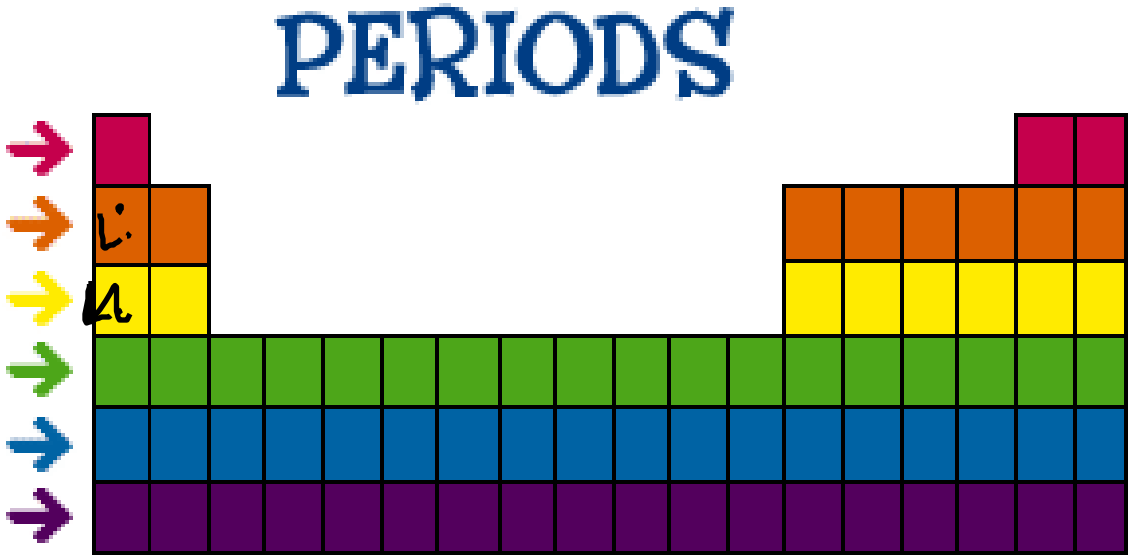
- **GROUPS/FAMILIES**
- **PERIODS**



More on the periodic table…

Periods:

- **HORIZONTAL ROWS** (side to side) on the periodic table.
- Are numbered and have no names.
- Each **PERIOD** represents an **ENERGY LEVEL** or **SHELL**

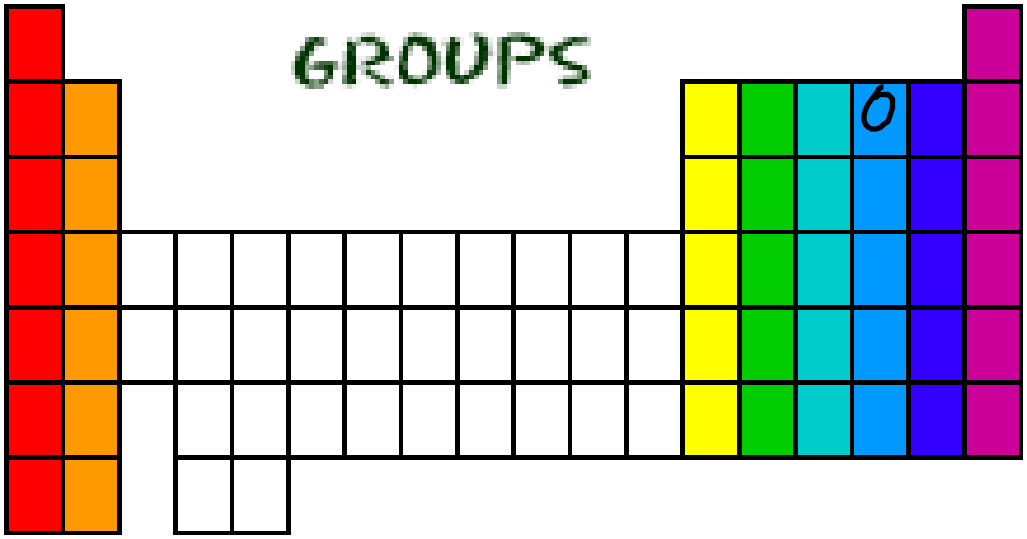


Ex) Lithium has **2** electron shells.

Families of the periodic table…

Groups/Families:

- **VERTICAL COLUMNS** (up and down) on the periodic table.
- **GROUPS** contain elements with **SIMILAR CHEMICAL PROPERTIES** because they all have the **SAME NUMBER** of **VALENCE ELECTRONS.**
- **ROMAN NUMERAL GROUP #** = number of **VALENCE ELECTRONS**.



Ex) Oxygen has **6** valence electrons

Families of the periodic table…

Recall that for an atom to become **STABLE**, it must **FILL** its **OUTER SHELL**. i.e. Oxygen wants to **GAIN 2 e^-** to fill its outer shell.

The major groups/families of the periodic table are as follows:

ALKALI METALS: Group 1 or IA

- Contains: ***Li, Na, K, etc.***
- Are the **MOST REACTIVE** of the metals because they have only **1 VALENCE ELECTRON**.
- They must **LOSE ONE** electron to gain a stable energy level/shell.

Families of the periodic table…

ALKALINE EARTH METALS: Group 2 or IIA

- Contains: ***Be, Mg, Ca, Sr, Ba, Ra***
- These are **REACTIVE** metals, but slightly **LESS THAN GROUP 1**.
- They must **LOSE TWO** electrons to gain a stable energy level/shell.

CHALCOGENS: Group 16 or VIA

- Contains: ***O, S, Se, Te, Po***
- They must **GAIN TWO** electrons to gain a stable energy level or shell.
- These are **REACTIVE** nonmetals, but slightly **LESS THAN GROUP 17**.

Families of the periodic table…

HALOGENS: Group 17 or VIIA

- Contains: ***F, Cl, Br, I, At***
- They must **GAIN ONE** electron to gain a stable energy level or shell.
- These are the **MOST REACTIVE** nonmetals in the periodic table because they have **SEVEN** valence electrons.

NOBLE GASES: Group 18 or VIIIA

- Contains: ***He, Ne, Ar, Kr, Xe, Rn***
- These are the most **NON-REACTIVE** elements in the periodic table because they already have 8 valence electrons. (they do not need to lose or gain electrons)

Families of the periodic table…

HYDROGEN (H)

- Is considered to be a family of one. It can act as a non-metal or a metal (for the most part of the unit, it will act as a nonmetal)

TRANSITION METALS: Groups 3-12 or the B groups

- Have a "**TRANSITIONAL**" outer shell.
- The number of electrons being lost **DEPENDS** on a variety of **CONDITIONS** (**TEMP.**, **PRESSURE**…)

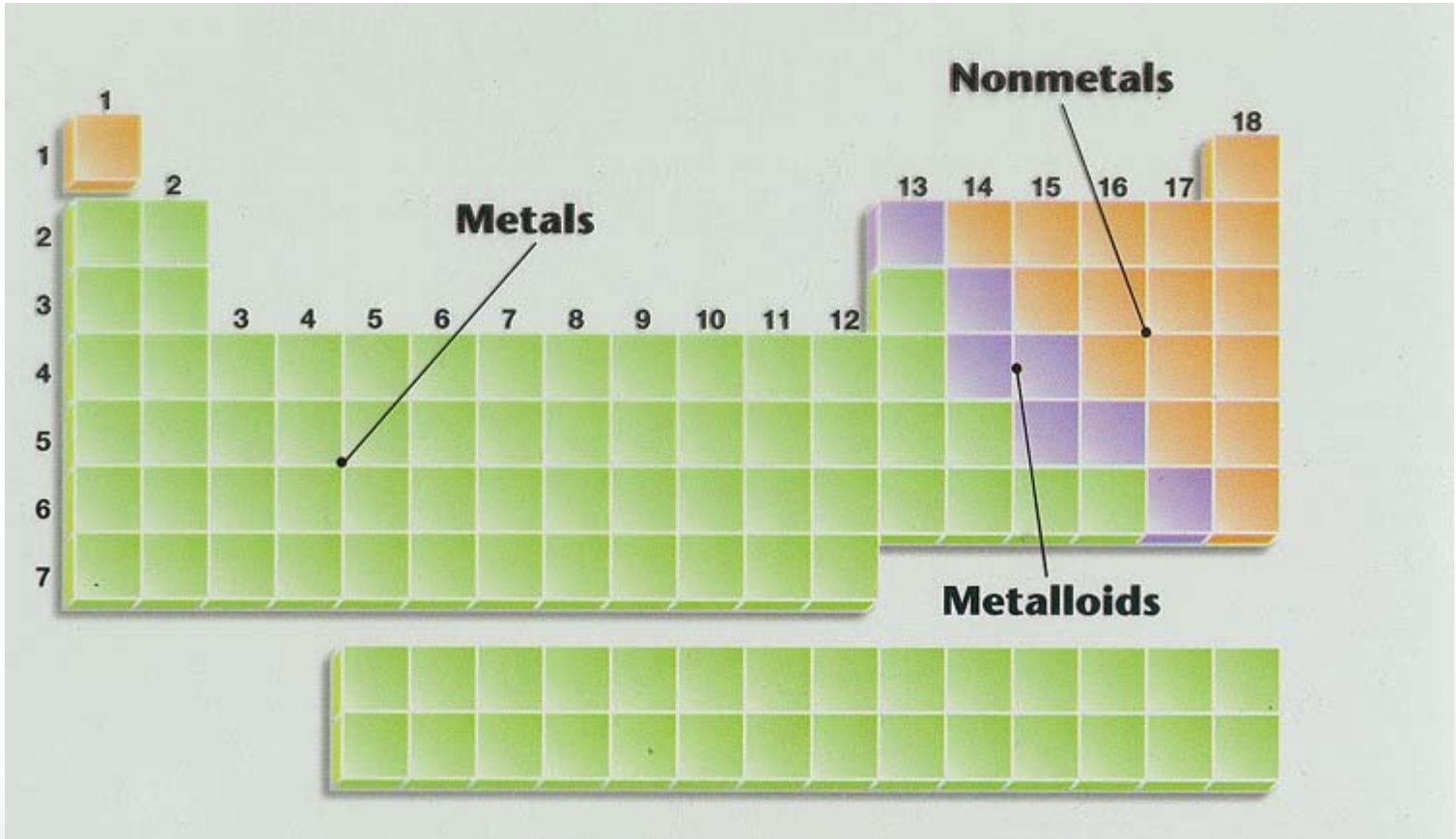
Ex. iron can lose **TWO** or **THREE** electrons

Ex. copper can lose either **ONE** or **TWO** electrons

Groups of elements…

The periodic table is organized in another manner:

1. **METALS**
2. **NONMETALS**
3. **METALLOIDS.**



Groups of elements…

METALS

- Are on the **LEFT** side of the "**STAIRCASE**".
- **HYDROGEN** is an **EXCEPTION**, it is a nonmetal but is placed on the left side because it has one valence electron

NONMETALS

- Are on the **RIGHT** side of the "**STAIRCASE**".

METALLOIDS

- Are found **ALONG** the "**STAIRCASE**".
- Metalloids are elements that share some characteristics of metals and some characteristics of nonmetals.
- The following elements are metalloid **B,Si,Ge,As,Sb,Te,Po**