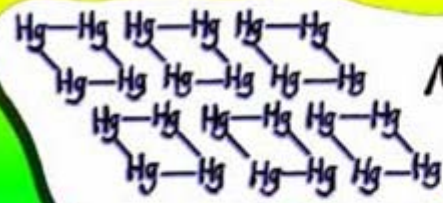




# Chemistry in Action


**MOLECULES YOU OUGHT TO BE AWARE OF...**


**PART 3 :- INORGANICS**



 Mercentile


 did I ever tell you about the time .....  
 Sodium boride


 Oxymoron


 Nickel-cadmium battery


 Goldilocks


 Autopsy

Mn manganese  
 Mn-Mn-Mn manganese  
 Mn<sub>2</sub> womanganese  
 Mn<sub>2</sub>-Mn<sub>2</sub>-Mn<sub>2</sub> womenganesse  
 Al-Mn-Al-Mn an alumenium-manganese alloy  
 Mn-Al-Mn-Al

# 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**:

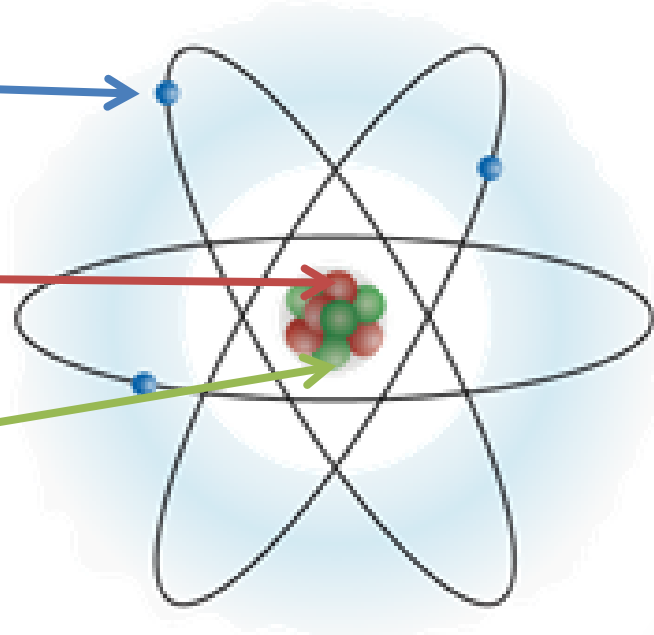
1. **ELECTRONS**



2. **PROTONS**



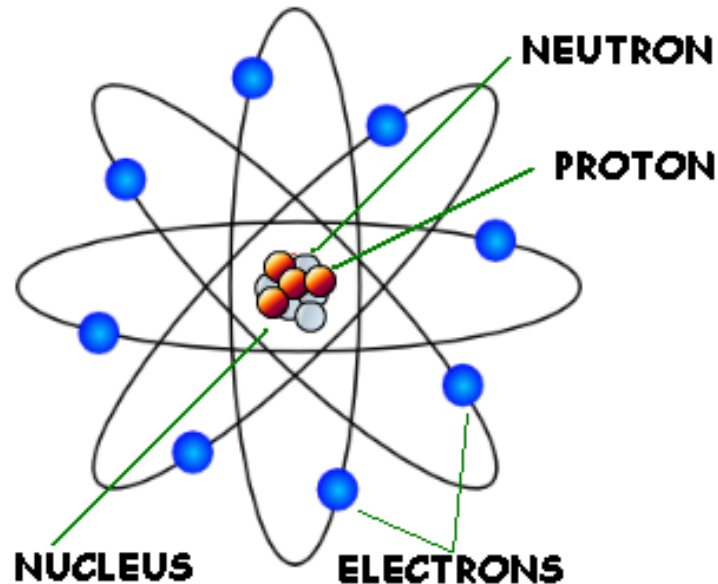
3. **NEUTRONS**



# Atomic Structure...

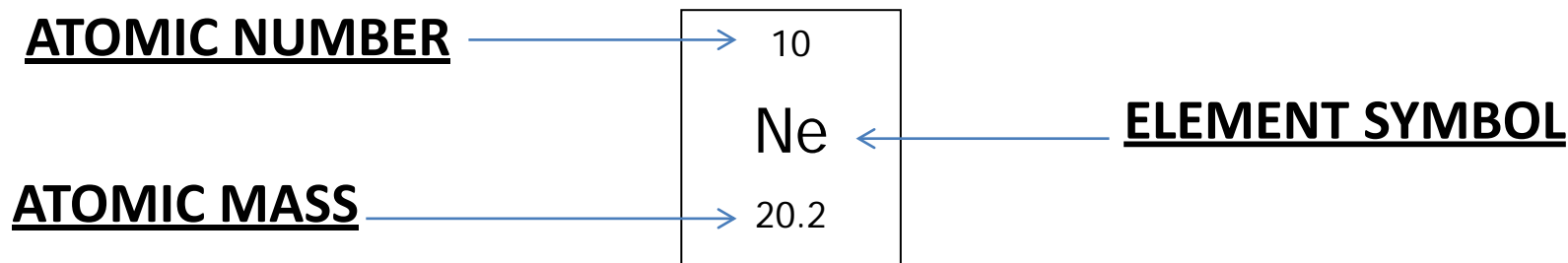
Recall the following information with respect to the parts of the atom:

<b><i>Sub-Atomic Particle:</i></b>	<b><i>Charge:</i></b>	<b><i>Mass:</i></b>	<b><i>Location:</i></b>
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 =  $1.66 \times 10^{-27}$  Kg      *0.00000000000000000000000000166Kg*
- 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:

$$\textit{Atomic Mass} = \textit{\#protons} + \textit{\#neutrons}$$

**OR**

$$\textit{\# neutrons} = \textit{atomic mass} - \textit{\#of protons}$$

# The periodic table...

## Example

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

- Neon

# = 10  
mass = 20  
p<sup>+</sup> → n<sup>0</sup>

10p<sup>+</sup>  
10e<sup>-</sup>  
10n<sup>0</sup>

- Aluminum

# 13  
mass = 27  
p<sup>+</sup> → n<sup>0</sup>

13p<sup>+</sup>  
13e<sup>-</sup>  
14n<sup>0</sup>

Carbon #6  
mass = 12  
6p<sup>+</sup>  
6e<sup>-</sup>  
6n<sup>0</sup>

**Try this one...**

Count the number of p<sup>+</sup>, n<sup>0</sup>, and e<sup>-</sup> in potassium.

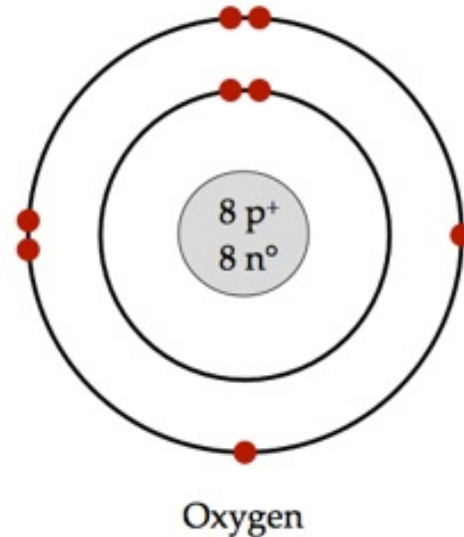
#19  
mass = 39

19p<sup>+</sup>  
19e<sup>-</sup>  
20n<sup>0</sup>

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



# Bohr diagrams...

## Examples:

Draw Bohr Diagrams for the following elements:

- Hydrogen

#1  
mass = 1  
 $1p^+$   
 $1e^-$   
 $0n^0$



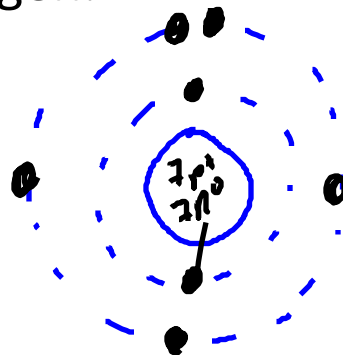
- Sulphur

#16  
mass = 32  
 $16p^+$   
 $16e^-$   
 $16n^0$



**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

hydrogen 1 H 1.0079																	helium 2 He 4.0026	
lithium 3 Li 6.941	beryllium 4 Be 9.0122											boron 5 B 10.811	carbon 6 C 12.011	nitrogen 7 N 14.007	oxygen 8 O 15.999	fluorine 9 F 18.998	neon 10 Ne 20.180	
sodium 11 Na 22.990	magnesium 12 Mg 24.305											aluminum 13 Al 26.982	silicon 14 Si 28.086	phosphorus 15 P 30.974	sulfur 16 S 32.065	chlorine 17 Cl 35.453	argon 18 Ar 39.948	
potassium 19 K 39.098	calcium 20 Ca 40.078	scandium 21 Sc 44.956	titanium 22 Ti 47.867	vanadium 23 V 50.942	chromium 24 Cr 51.996	manganese 25 Mn 54.938	iron 26 Fe 55.845	cobalt 27 Co 58.933	nickel 28 Ni 58.693	copper 29 Cu 63.546	zinc 30 Zn 65.39	gallium 31 Ga 69.723	germanium 32 Ge 72.61	arsenic 33 As 74.922	selenium 34 Se 78.96	bromine 35 Br 79.904	krypton 36 Kr 83.80	
rubidium 37 Rb 85.468	strontium 38 Sr 87.62	yttrium 39 Y 88.906	zirconium 40 Zr 91.224	niobium 41 Nb 92.906	molybdenum 42 Mo 95.94	technetium 43 Tc [98]	ruthenium 44 Ru 101.07	rhodium 45 Rh 102.91	palladium 46 Pd 106.42	silver 47 Ag 107.87	cadmium 48 Cd 112.41	indium 49 In 114.82	tin 50 Sn 118.71	antimony 51 Sb 121.76	tellurium 52 Te 127.60	iodine 53 I 126.90	xenon 54 Xe 131.29	
caesium 55 Cs 132.91	barium 56 Ba 137.33	57-70 *	lanthanum 71 Lu 174.97	hafnium 72 Hf 178.49	tantalum 73 Ta 180.95	tungsten 74 W 183.84	rhenium 75 Re 186.21	osmium 76 Os 190.23	iridium 77 Ir 192.22	platinum 78 Pt 195.08	gold 79 Au 196.97	mercury 80 Hg 200.59	thallium 81 Tl 204.38	lead 82 Pb 207.2	bismuth 83 Bi 208.98	polonium 84 Po [209]	astatine 85 At [210]	radon 86 Rn [222]
francium 87 Fr [223]	radium 88 Ra [226]	89-102 **	lawrencium 103 Lr [262]	rutherfordium 104 Rf [261]	dubnium 105 Db [262]	seaborgium 106 Sg [266]	bohrium 107 Bh [264]	hassium 108 Hs [269]	meitnerium 109 Mt [268]	ununennium 110 Uun [271]	ununium 111 Uuu [272]	ununbium 112 Uub [277]	ununquadium 114 Uuq [289]					

\* Lanthanide series

lanthanum 57 La 138.91	cerium 58 Ce 140.12	praseodymium 59 Pr 140.91	neodymium 60 Nd 144.24	promethium 61 Pm [145]	samarium 62 Sm 150.36	europium 63 Eu 151.96	gadolinium 64 Gd 157.25	terbium 65 Tb 158.93	dysprosium 66 Dy 162.50	holmium 67 Ho 164.93	erbium 68 Er 167.26	thulium 69 Tm 168.93	ytterbium 70 Yb 173.04
actinium 89 Ac	thorium 90 Th	protactinium 91 Pa	uranium 92 U	neptunium 93 Np	plutonium 94 Pu	americium 95 Am	curium 96 Cm	berkelium 97 Bk	californium 98 Cf	einsteinium 99 Es	fermium 100 Fm	mendelevium 101 Md	nobelium 102 No

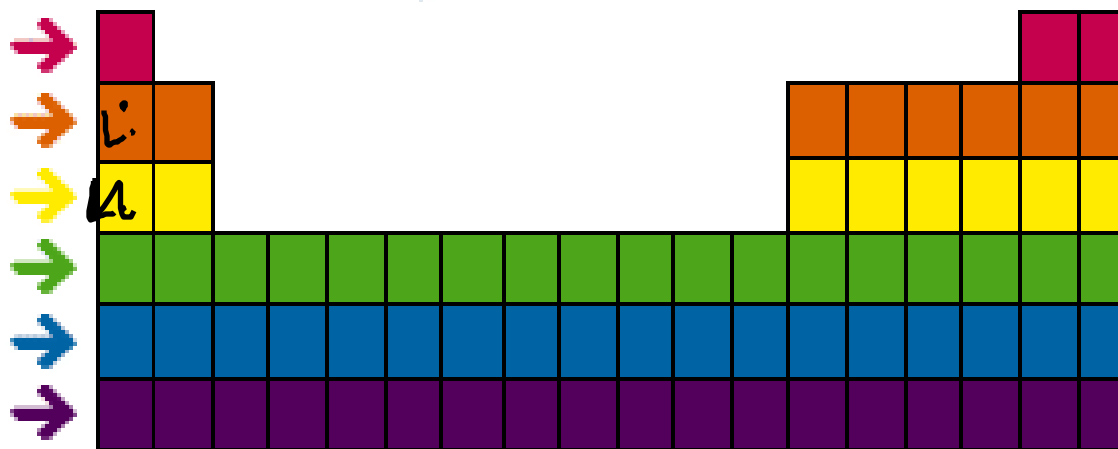
\*\* Actinide series

# 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**

## PERIODS



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**.

**GROUPS**

Red	Orange										Yellow	Green	Cyan	Blue (6)	Purple	Pink
Red	Orange										Yellow	Green	Cyan	Blue	Purple	Pink
Red	Orange										Yellow	Green	Cyan	Blue	Purple	Pink
Red	Orange										Yellow	Green	Cyan	Blue	Purple	Pink
Red	Orange										Yellow	Green	Cyan	Blue	Purple	Pink
Red	Orange										Yellow	Green	Cyan	Blue	Purple	Pink
Red	Orange										Yellow	Green	Cyan	Blue	Purple	Pink
Red	Orange										Yellow	Green	Cyan	Blue	Purple	Pink
Red	Orange										Yellow	Green	Cyan	Blue	Purple	Pink
Red	Orange										Yellow	Green	Cyan	Blue	Purple	Pink

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<sup>-</sup>** 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...)

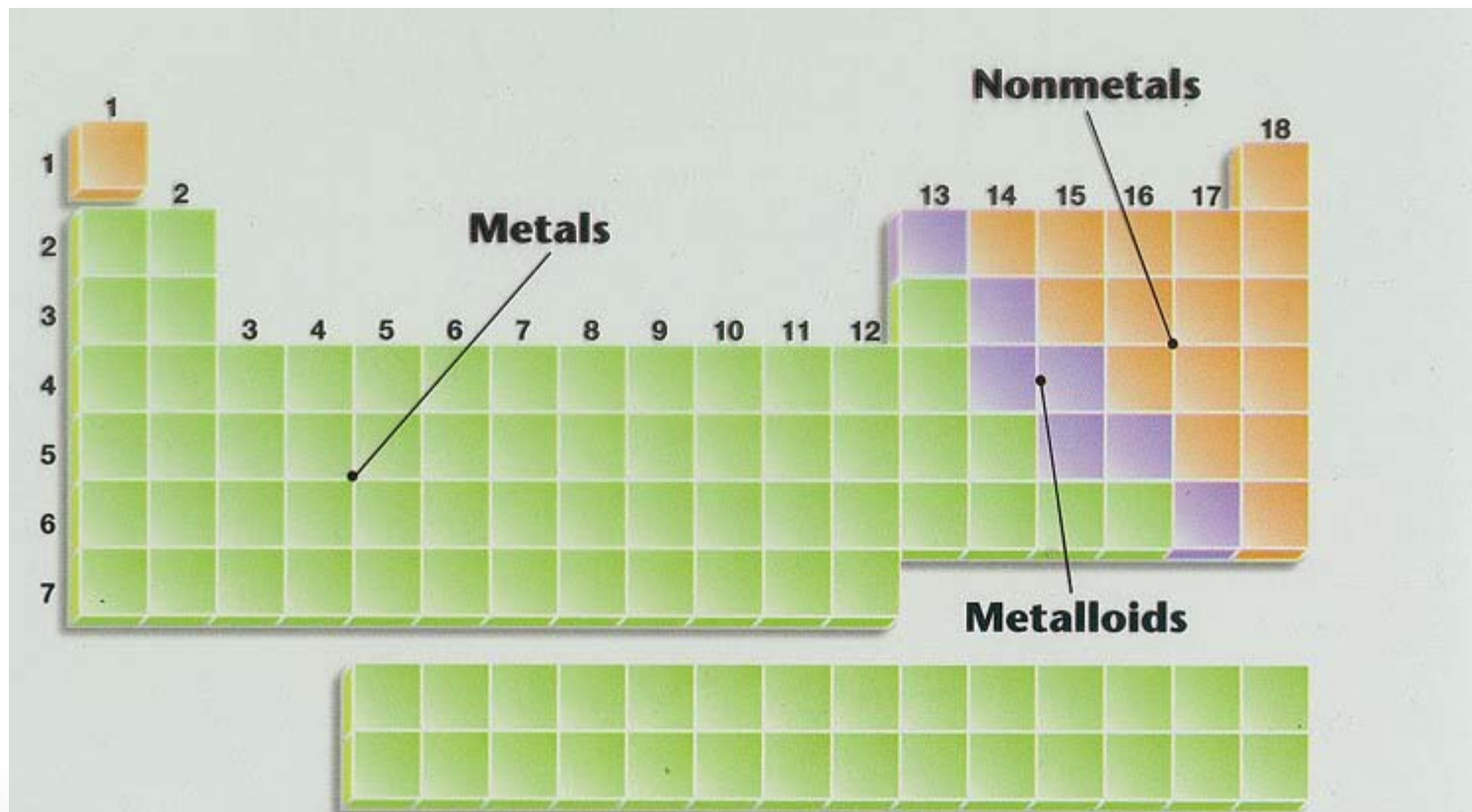
Ex. iron can lose TWO or THREE electrons

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