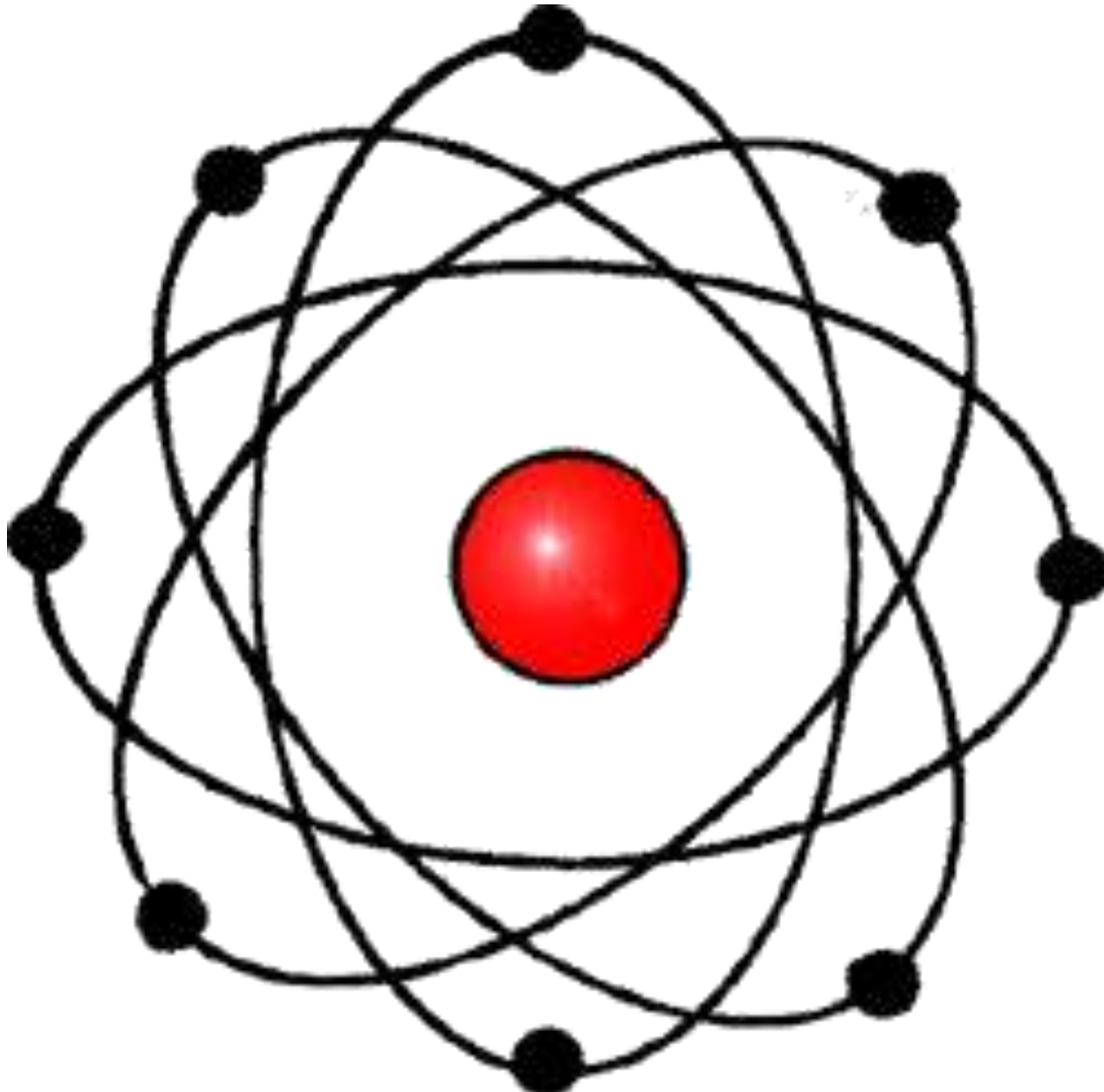


Atomic Structure & the Periodic Table

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	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	80 Hg	81 Tl	82 Pb	83 Bi	84 Po	85 At	86 Rn
87 Fr	88 Ra	89 Ac	104 Unq	105 Unp	106 Unh	107 Uns	108 Uno	109 Une	110 Unn								

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

Structure of the Atom



Symbols

- **Symbols are used to represent different elements. Example: C carbon, Al aluminum**
- **Some symbols are from the Latin words. Example: sodium – natrium symbol Na; silver or argentum symbol Ag**

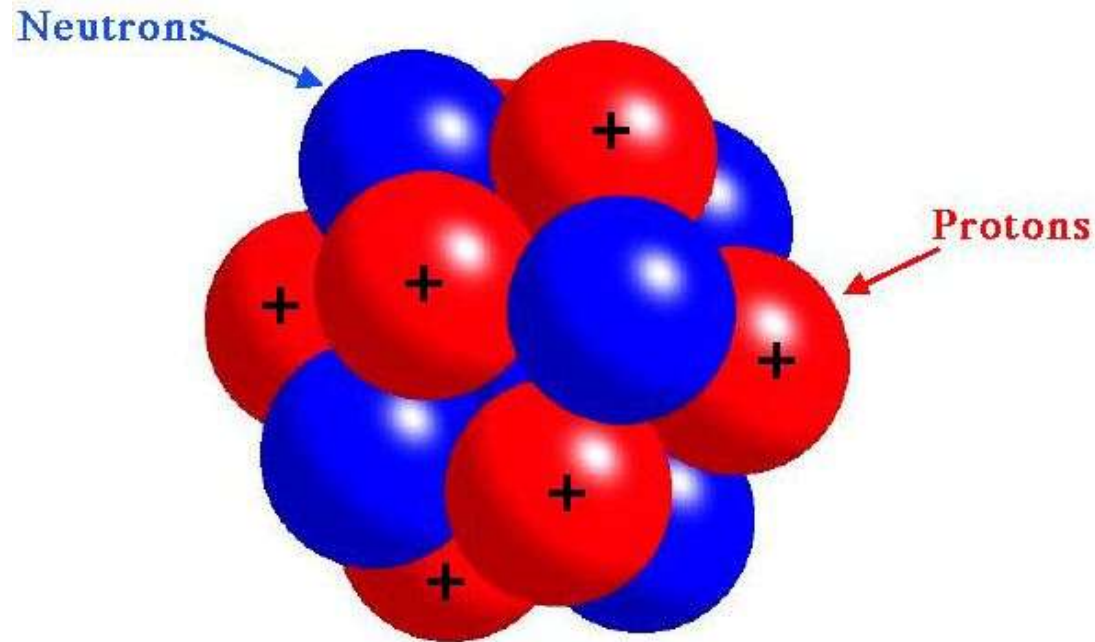
Atoms

- Nucleus
- Electron Cloud



Nucleus

- Contains the mass of the atom
- Protons are positively charged with a mass of 1 AMU
- Neutrons are neutral with a mass of 1 AMU
- Atomic # is equal to the number of protons



Electron Cloud

A diagram of an atom. At the center is a dark, dense nucleus. Surrounding the nucleus is a large, diffuse, red-colored cloud representing the electron cloud. Several thin black lines radiate from the nucleus, representing electron shells or orbitals.

- **The number of electrons are equal to the number of protons if the atom is neutral**
- **Electrons are in a cloud around the nucleus of the atoms**
- **Electrons have a negative charge and almost no mass**

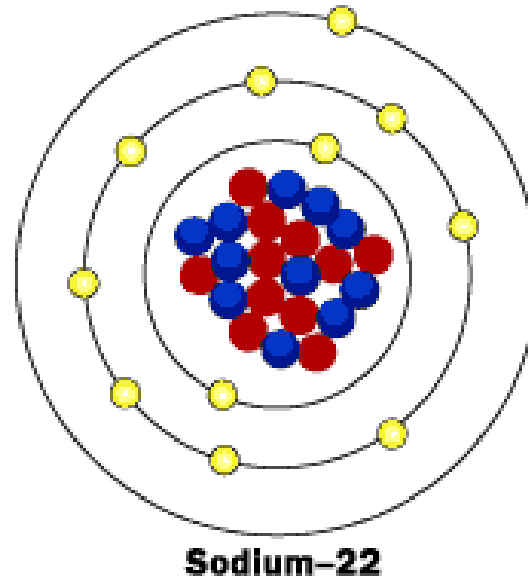
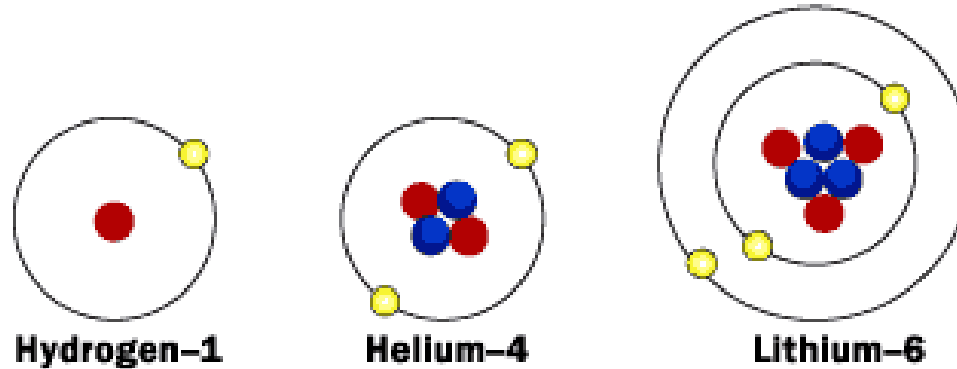
*What is the name of the particle that moves around the nucleus with a negative charge?**

Particle's Relative mass Charge & Location

	Location	Charge	Mass
Proton	Nucleus	Positive	1 Atomic mass unit
Neutron	Nucleus	No charge	1 atomic mass unit
Electron	Electron Cloud	Negative	Almost no mass

Models of the atom

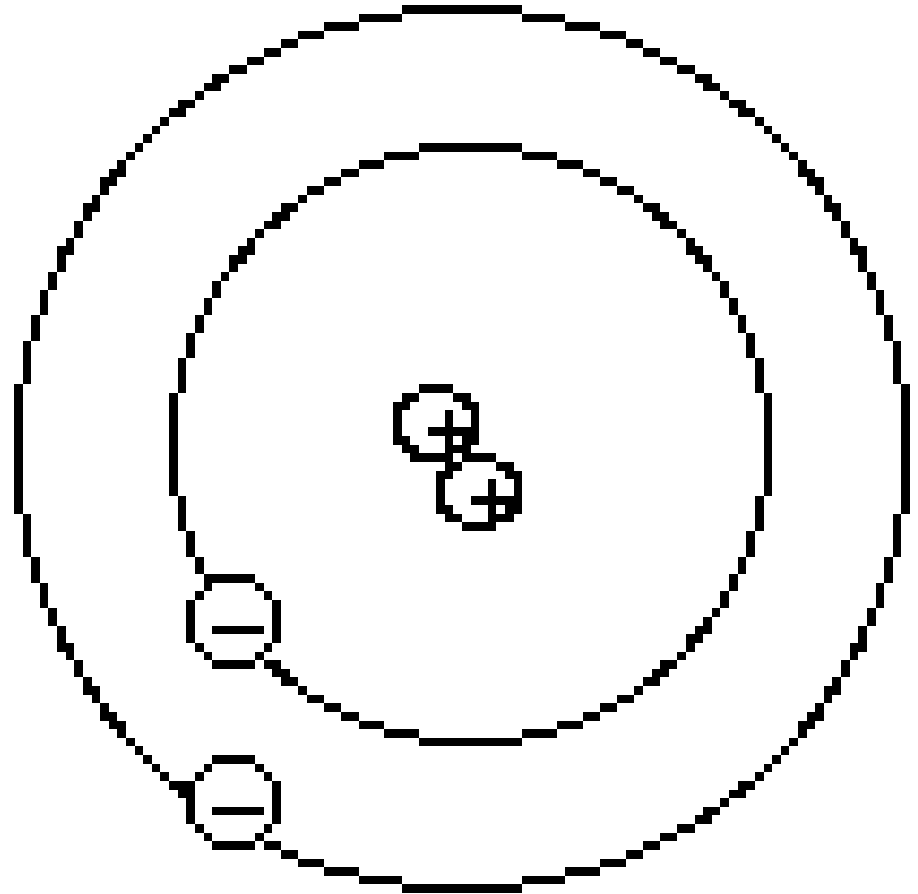
Isotopes of Hydrogen, Helium, Lithium and Sodium



● Neutron ● Proton ● Electron

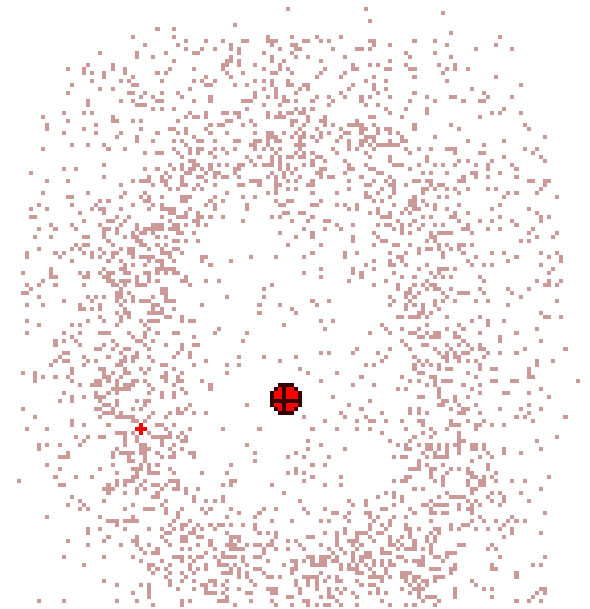
Neils Bohr Model

- in 1913 Neils Bohr imagined that an atom was a nucleus with electrons moving around it in a well-defined path.



The Electron Cloud Model

- **Electron Cloud Model is the modern model of the atom**
- **Electron Cloud Model is a very small nucleus with electrons moving around the nucleus near the speed of light**
- **The diameter of the nucleus is 1/100,000 the size of the electron Cloud**



Electron Probability

- **Electron Cloud probability is the mathematically calculated area that an electron could be found**
- **Electrons are in energy levels around the nucleus**

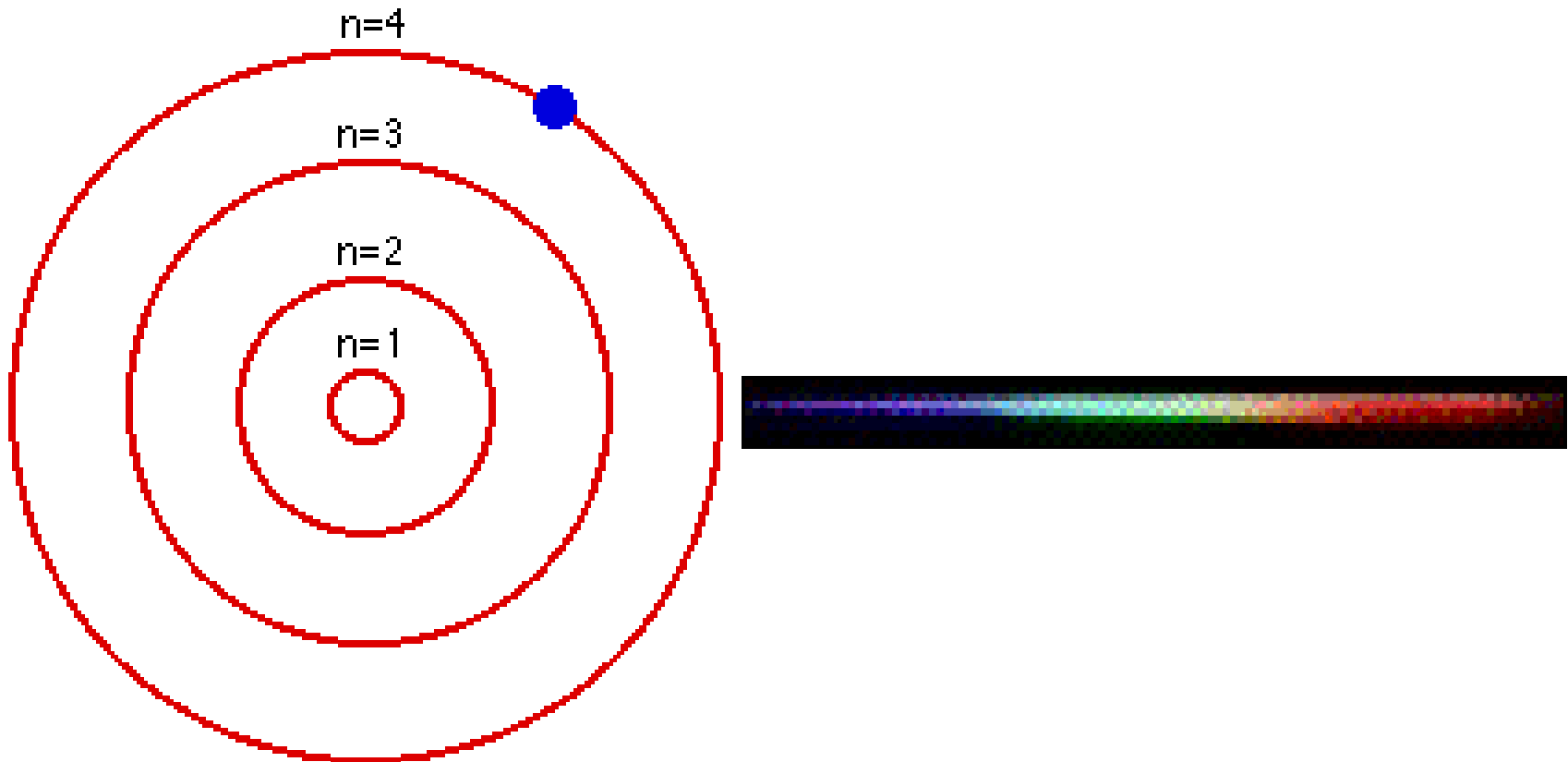
Electrons in Energy Levels

- **Energy level in Atom Maximum number of Electrons:**
 - 1st 2 electrons
 - 2nd 8 electrons
 - 3rd 18 electrons
 - 4th 32 electrons
- **To calculate how many electrons each energy level can hold you use the equation $2(\text{energy level})^2$ or $2n^2$**

*How many electrons can each energy level hold?**

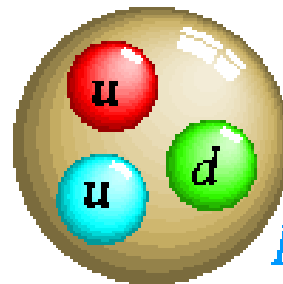
Sublevels

- The energy levels also have sublevels

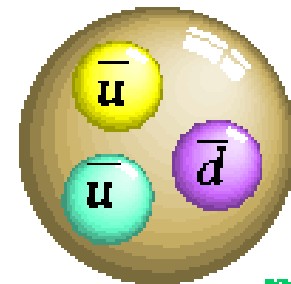


Smaller particles of matter

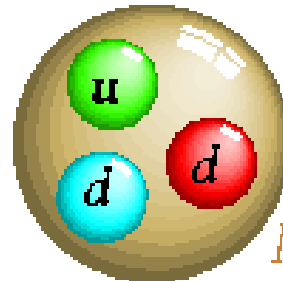
- Quarks
- Discovered by firing subatomic particles at matter
- read pages 276 & 277



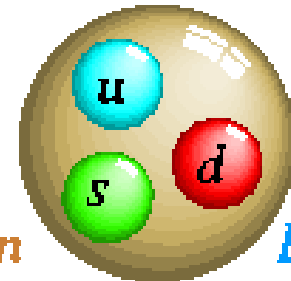
Proton



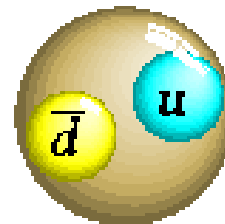
Anti-proton



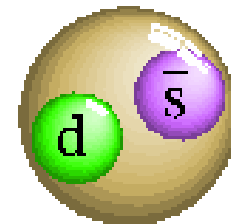
Neutron



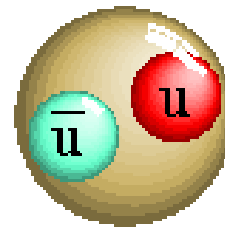
Lambda



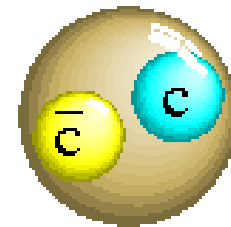
π^+



K^0

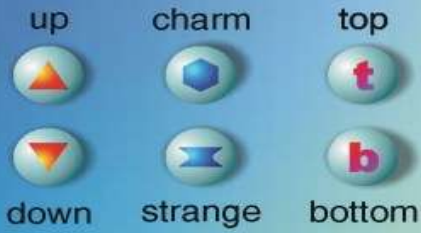


π^0



J/ψ

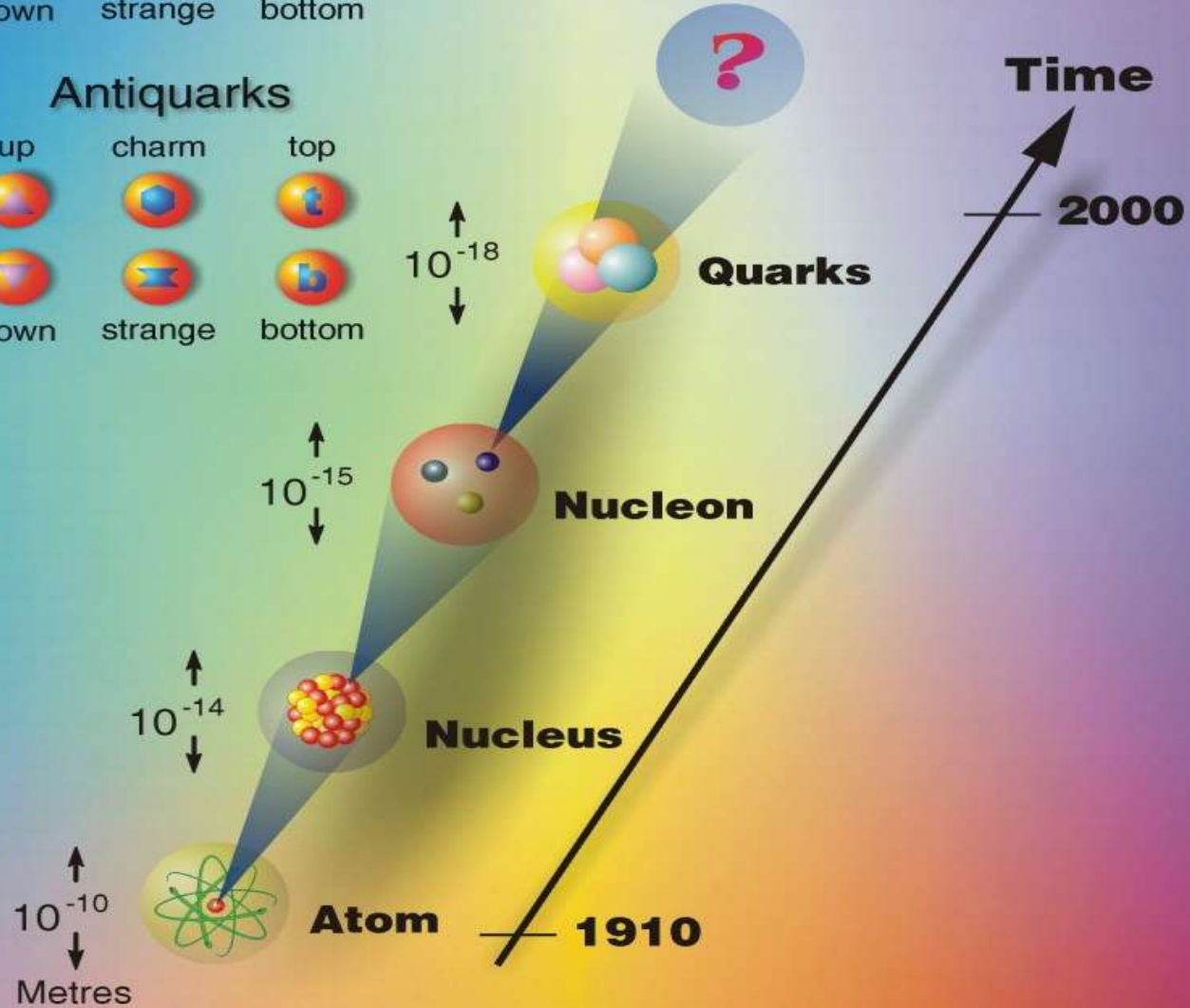
Quarks



Antiquarks



Future ?



Masses of Atoms

- **Atomic mass**
 - **Proton has a mass of 1AMU**
 - **Neutron has a mass of 1 AMU**
 - **Electron has very little mass compared to a proton or a neutron**

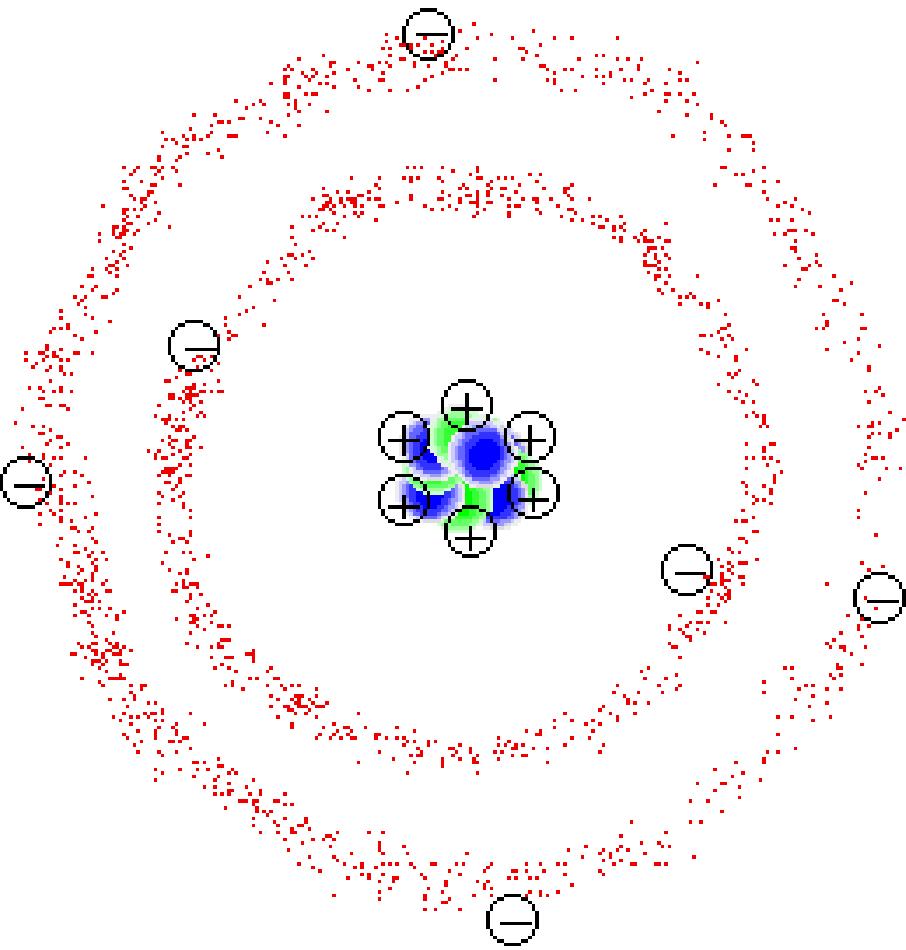
Mass

- **The atomic mass number is then the # of protons + the # of Neutrons**
- **The number of neutrons is the mass number minus the atomic # (Atomic # is the # of protons)**

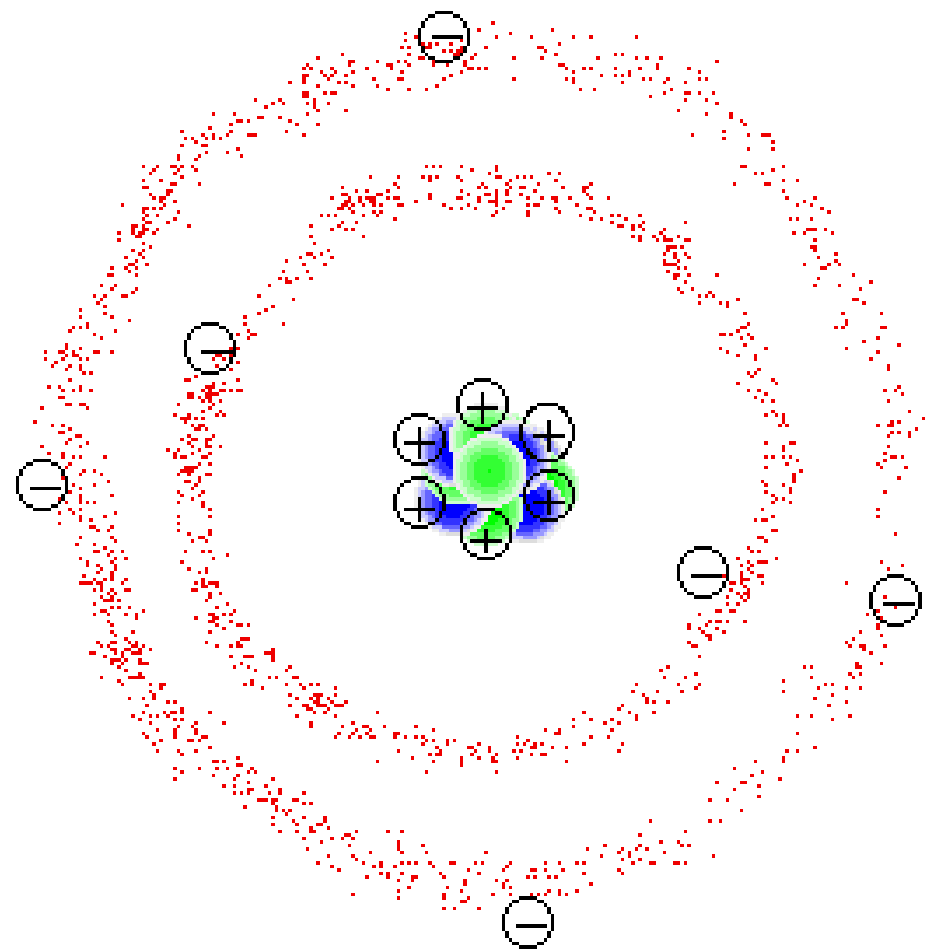
*How do you calculate the number of protons neutrons and electrons?**

Isotopes

- Same number of protons (same element) but different number of neutrons
- The # of protons is what determines what an element is
- Carbon – 12 would have 6 protons and 6 neutrons
- Carbon – 14 would have 6 proton and 8 neutrons



¹²Carbon
6 protons
6 neutrons
6 electrons



¹⁴Carbon
6 protons
8 neutrons
6 electrons

Atomic Mass

- The atomic mass given on the periodic chart is the average of the masses of all isotopes (Average Atomic Mass)

Name	Atomic mass	Atomic #	# of protons	# of neutrons
Hydrogen-1				
Hydrogen-2				
Hydrogen-3				

The Periodic Table

- **Structure of the periodic table**
- **Dmitri Mendeleev a Russian chemist arranged elements on the chart in the late 1800**
- **He put elements in horizontal rows called periods.**
- **He put elements with similar properties in groups or columns and predicted the discovery of more elements and their properties**
- **Mendeleev's chart needed some changes to make it correct, because he placed the in order of increasing atomic mass**



Dmitri Mendeleev

Modern Periodic Table

- **used the number of protons and electron arrangement to place the elements in their proper place**

Reading the periodic Table

- Metals are to the left of the stair step
- Nonmetals are to the right of the stair step
- Metalloids that have properties of both metals and nonmetals border both sides of the stair step

Main groups

1 1A	2 2A	Transition-metal groups										Main groups					18 8A							
1 H	2 He	3 3B	4 4B	5 5B	6 6B	7 7B	8 8B	9 9B	10 10B	11 1B	12 2B	13 3A	14 4A	15 5A	16 6A	17 7A	18 8A							
3 Li	4 Be	11 Na	12 Mg	21 Sc	22 Ti	23 V	24 Cr	25 Mn	26 Fe	27 Co	28 Ni	29 Cu	30 Zn	5 B	6 C	7 N	8 O	9 F	10 Ne					
19 K	20 Ca	37 Rb	38 Sr	39 Y	40 Zr	41 Nb	42 Mo	43 Tc	44 Ru	45 Rh	46 Pd	47 Ag	48 Cd	13 Al	14 Si	15 P	16 S	17 Cl	18 Ar					
55 Cs	56 Ba	57 La	72 Hf	73 Ta	74 W	75 Re	76 Os	77 Ir	78 Pt	79 Au	80 Hg	49 In	50 Sn	51 Sb	52 Te	53 I	54 Xe	81 Tl	82 Pb	83 Bi	84 Po	85 At	86 Rn	
87 Fr	88 Ra	89 Ac	104 Rf	105 Db	106 Sg	107 Bh	108 Hs	109 Mt	110	111	112		114		116									

Lanthanides

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

Actinides

Reading the periodic Table

- Transitions elements are between groups 2 & 13
- Lanthanides and actinides are found at the bottom of the periodic table

Main groups

1 1A	2 2A	Transition-metal groups										Main groups						18 8A	
1 H	2 He	3 3B	4 4B	5 5B	6 6B	7 7B	8 8B	9 8B	10 8B	11 1B	12 2B	13 3A	14 4A	15 5A	16 6A	17 7A	18 8A		
3 Li	4 Be	11 Na	12 Mg	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
19 K	20 Ca	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	80 Hg	81 Tl	82 Pb	83 Bi	84 Po	85 At	86 Rn		
87 Fr	88 Ra	89 Ac	104 Rf	105 Db	106 Sg	107 Bh	108 Hs	109 Mt	110	111	112		114		116				

Lanthanides

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
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Actinides

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
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Reading the periodic Table

- **Groups are vertical columns on the periodic table**
- **All elements in group have same # of electrons in the outer energy level**
- **As you go down in a group each element gains energy**
- **Groups are many times called families because elements react similarly**

*Where are the metals on the periodic chart?**

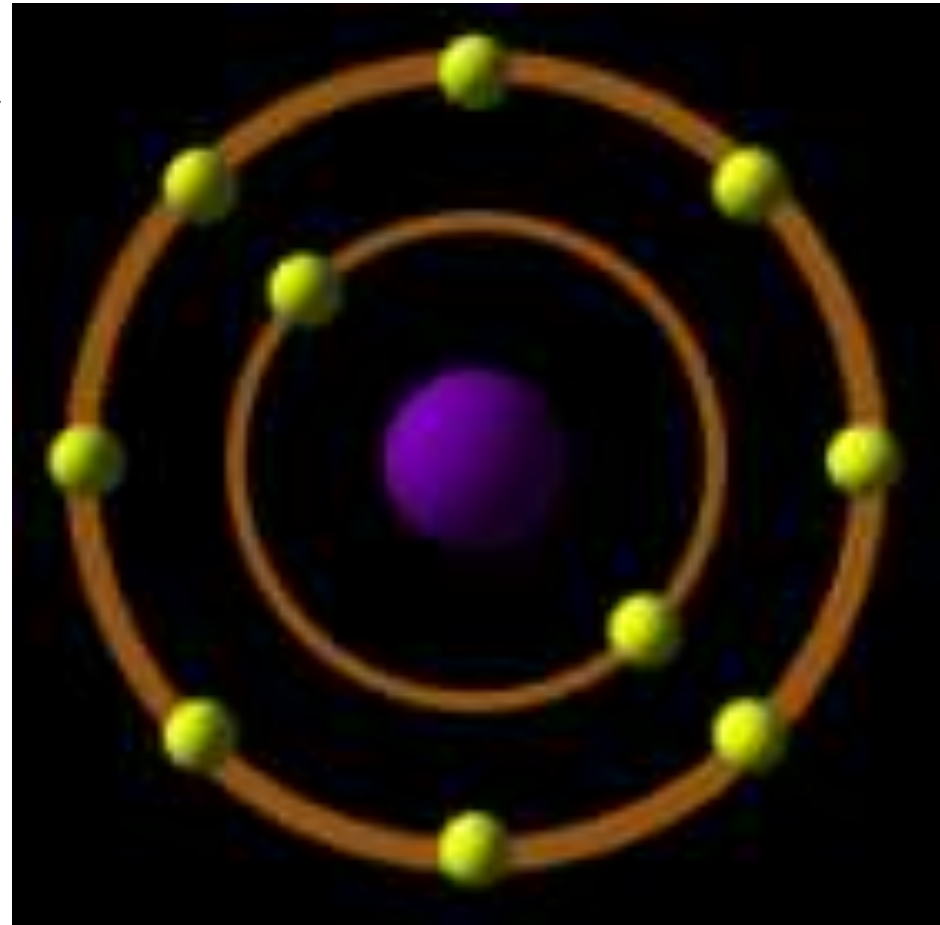
*Where are the nonmetals on the periodic chart?**

Reading the periodic Table

- Group 1 have 1 electron in their outer energy level (alkali metals)
- Group 17 have 7 electrons in their outer energy level (halogens)
- Group 18 have eight electrons in their outer energy level (noble gases)
 - Eight electrons make them stable
 - Stable octet – eight electrons in outer energy level

*Why are noble gases stable?**

*Why do atoms combine?**



Quiz

1. Fill in the following chart.

	Location	Charge	Mass
Proton			
Neutron			
Electron			

Reading the periodic Table

- **Periods**
 - Horizontal rows of elements
 - Energy levels

*Explain why the periodic table is such a useful tool for both scientist and students.**

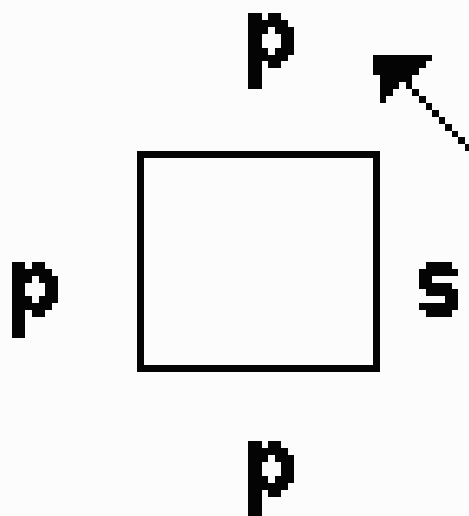
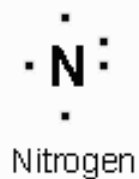
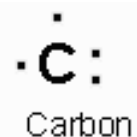
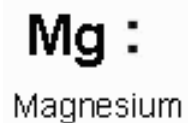
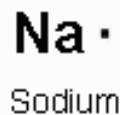
*What do the horizontal rows in the period represent?**

Chemical activity

- **The way in which atoms react with other atoms**
- **The activeness of an element is directly related to the electron structure of the atom**
- **Metals chemical activity increases as atomic # increases**
- **Nonmetals chemical activity decrease with an increase in atomic #**

*Where do you find the most active elements on the periodic chart?**

Examples of electron-dot diagrams



*How do you do the electron dot formula for oxygen?**

<http://www.sciencespot.net/Pages/classroom.html>