



Unit 2: Atomic Structure and Nuclear Chemistry

Section 1: Atoms

Elements

- Substances that cannot be broken down into simpler substances by chemical or physical means
- Organized on the periodic table
- It consists of atoms that all have the **same number of protons**



The Periodic Table

Periodic Table of the Elements

I	II											III	IV	V	VI	VII	VIII	
1	2											13	14	15	16	17	18	
1 H 1.008																		2 He 4.003
3 Li 6.941	4 Be 9.012											5 B 10.811	6 C 12.011	7 N 14.007	8 O 15.999	9 F 18.998	10 Ne 20.180	
11 Na 22.990	12 Mg 24.305	3	4	5	6	7	8	9	10	11	12	13 Al 26.982	14 Si 28.086	15 P 30.974	16 S 32.066	17 Cl 35.453	18 Ar 39.948	
19 K 39.098	20 Ca 40.078	21 Sc 44.956	22 Ti 47.88	23 V 50.942	24 Cr 51.996	25 Mn 54.938	26 Fe 55.847	27 Co 58.933	28 Ni 58.69	29 Cu 63.546	30 Zn 65.39	31 Ga 69.723	32 Ge 72.61	33 As 74.922	34 Se 78.96	35 Br 79.904	36 Kr 83.80	
37 Rb 85.468	38 Sr 87.62	39 Y 88.906	40 Zr 91.224	41 Nb 92.906	42 Mo 95.94	43 Tc (98)	44 Ru 101.07	45 Rh 102.906	46 Pd 106.42	47 Ag 107.868	48 Cd 112.411	49 In 114.82	50 Sn 118.710	51 Sb 121.757	52 Te 127.60	53 I 126.905	54 Xe 131.29	
55 Cs 132.905	56 Ba 137.327	71 Lu 174.967	72 Hf 178.49	73 Ta 180.948	74 W 183.85	75 Re 186.207	76 Os 190.2	77 Ir 192.22	78 Pt 195.08	79 Au 196.967	80 Hg 200.59	81 Tl 204.383	82 Pb 207.2	83 Bi 208.980	84 Po (209)	85 At (210)	86 Rn (222)	
87 Fr (223)	88 Ra 226.025	103 Lr (260)	104 Rf (261)	105 Db (262)	106 Sg (263)	107 Bh (264)	108 Hs (265)	109 Mt (266)	110 Ds (268)	111 Rg (272)								

57 La 138.906	58 Ce 140.115	59 Pr 140.908	60 Nd 144.24	61 Pm (145)	62 Sm 150.36	63 Eu 151.965	64 Gd 157.25	65 Tb 158.925	66 Dy 162.50	67 Ho 164.93	68 Er 167.26	69 Tm 168.934	70 Yb 173.04
89 Ac 227.028	90 Th 232.038	91 Pa 231.036	92 U 238.029	93 Np 237.048	94 Pu (244)	95 Am (245)	96 Cm (247)	97 Bk (247)	98 Cf (251)	99 Es (252)	100 Fm (257)	101 Md (288)	102 No (289)

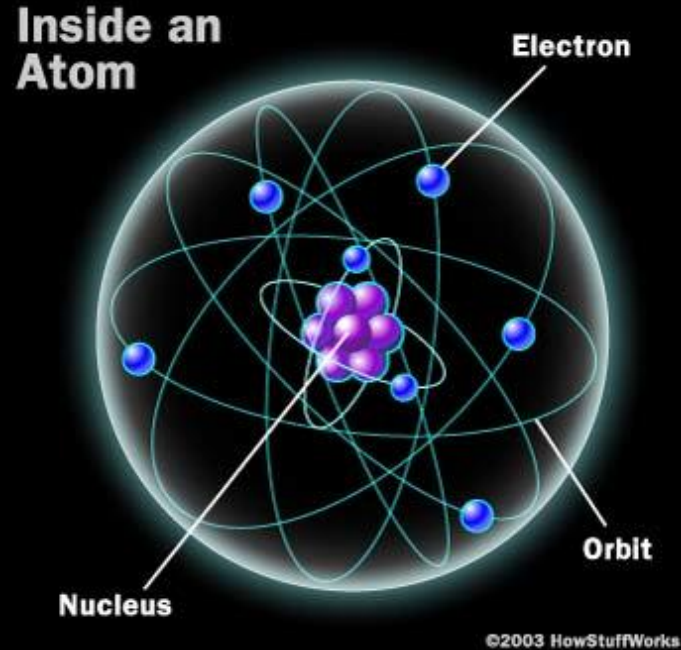
- Table that organizes the different **elements**
- Organized by **atomic number (number of protons)** and properties of the elements

Elements

An element's name can be abbreviated using its chemical symbol.

- A chemical symbol is either 1 or 2 letters
- The first letter is always capitalized
- The second letter is always lower case
- The letters represent the element's name (often Latin, Greek, or German)

The Atom



- All matter is made up of atoms
- Basic unit of matter

Parts of an Atom

Nucleus:

- The central part of an atom

Electron Cloud:

- Whirling electrons found orbiting the nucleus

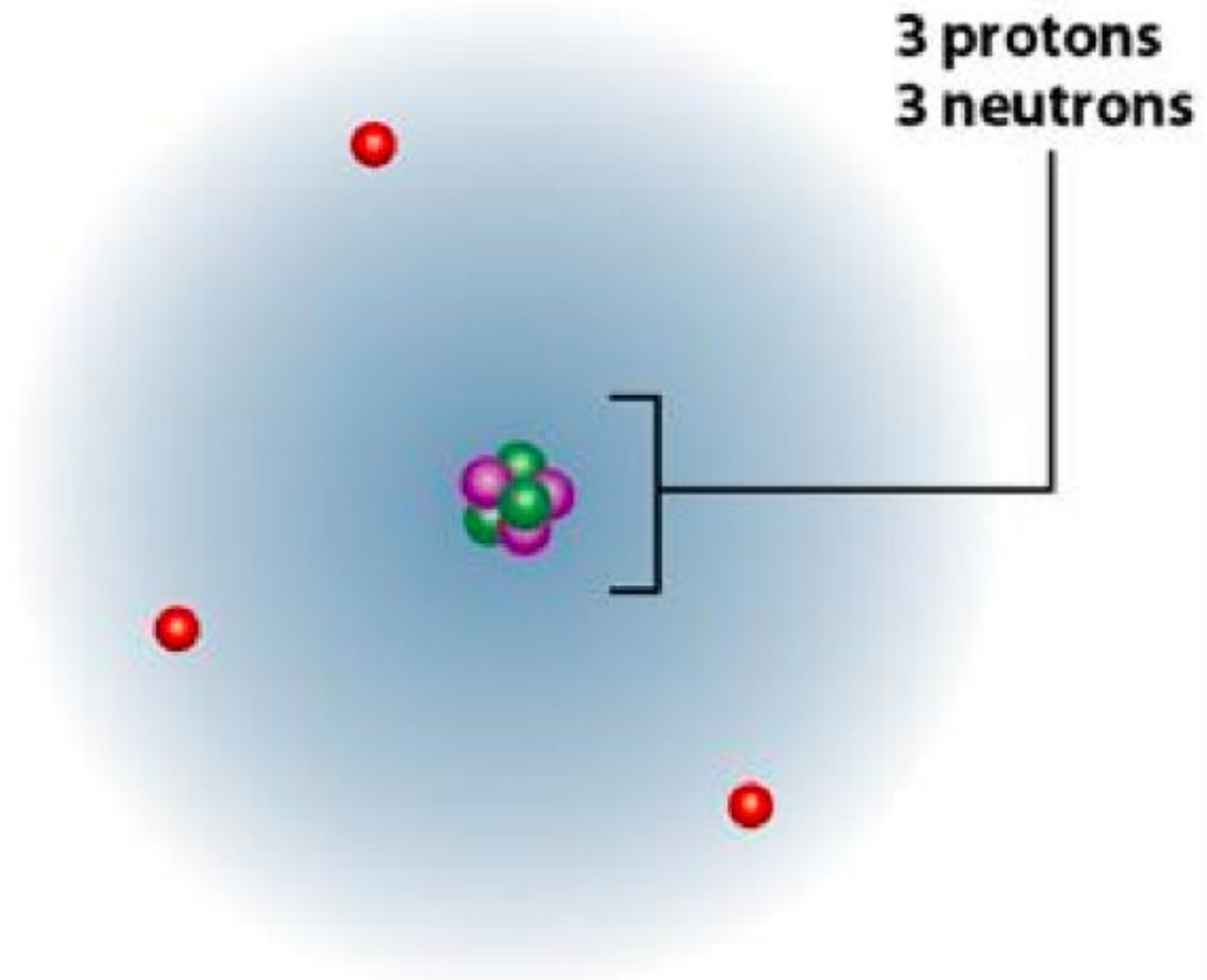
Proton



Neutron



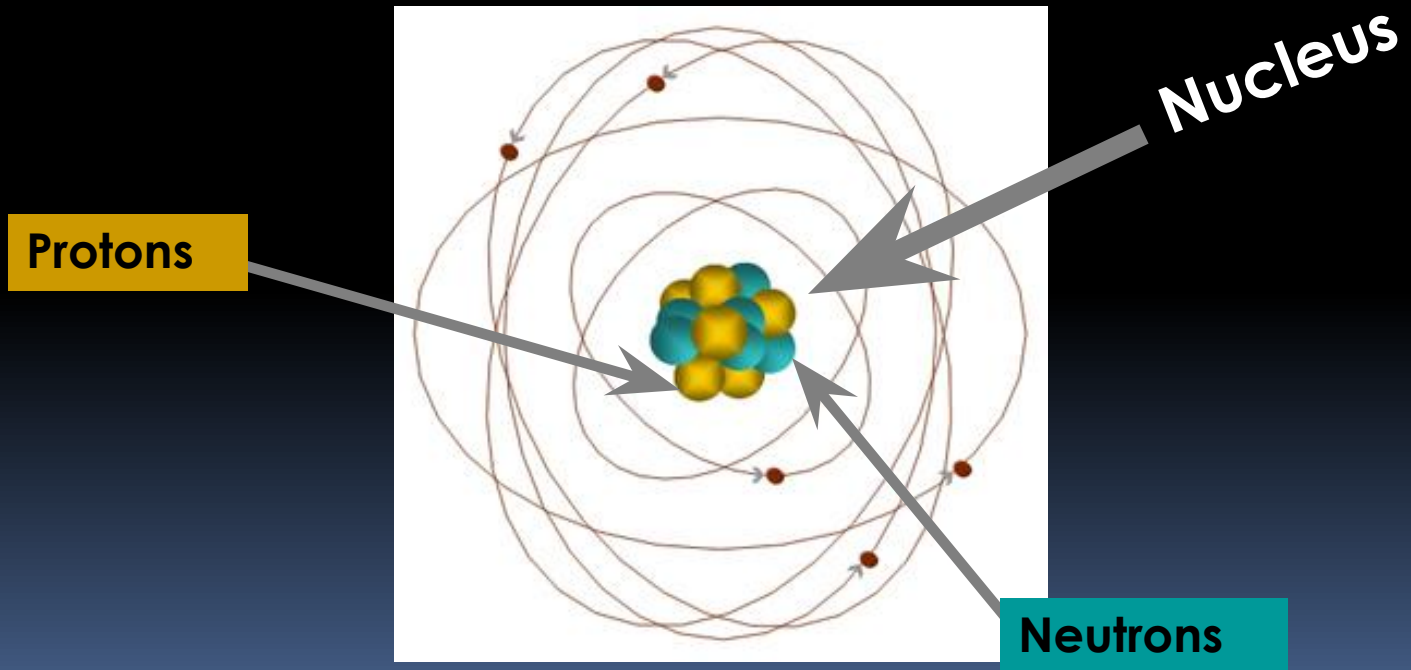
Electron



Li

Nucleus

- Centermost part of the atom
 - Made up of **protons** and **neutrons**
 - **Dense, positively charged area**

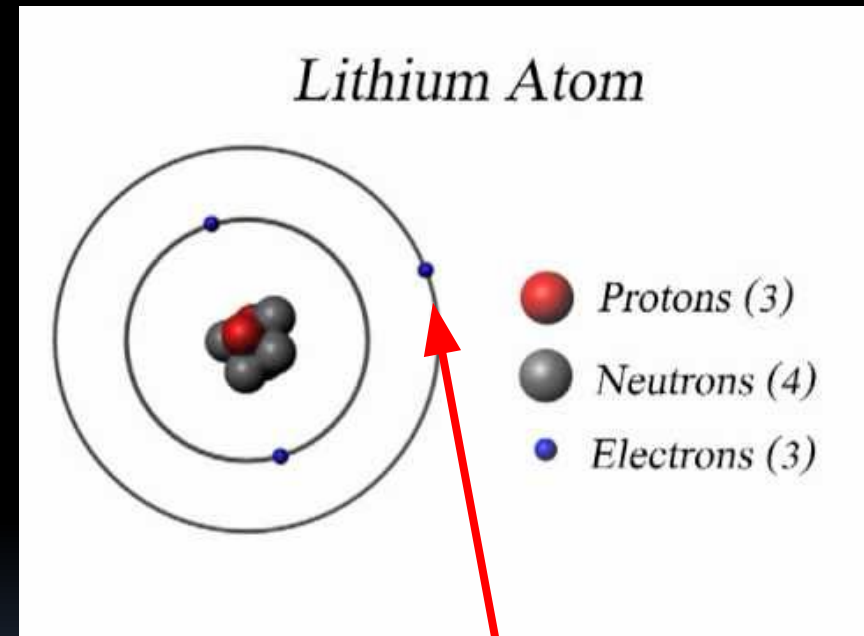


Subatomic Particles - particles that make up the atom

Particle	Symbol	Charge	Mass (amu - atomic mass unit)	Location in the Atom
Electrons	e^{-1}	Negative (-1)	1/1872 amu (almost none)	Outside nucleus (energy levels or electron cloud)
Protons	p	Positive (+1)	1 amu	Nucleus
Neutrons	n	Neutral (0)	1 amu	Nucleus

Valence Electrons

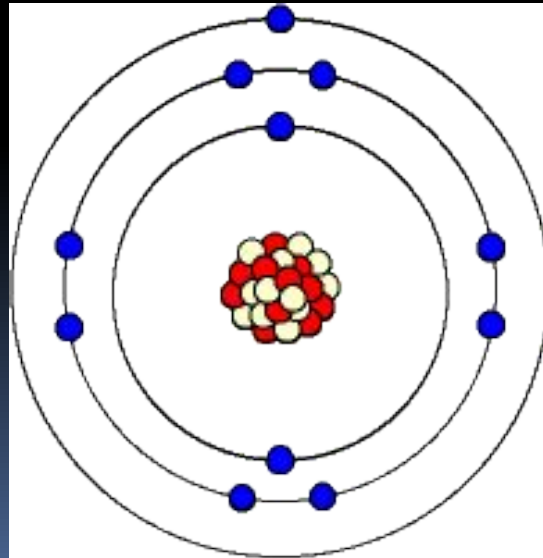
- Found in the **outermost energy level** of an element
- Electrons that an atom uses when forming **bonds** with other atoms
- Also, electrons gained or lost when forming **ions**



Valence
Electron for
Lithium

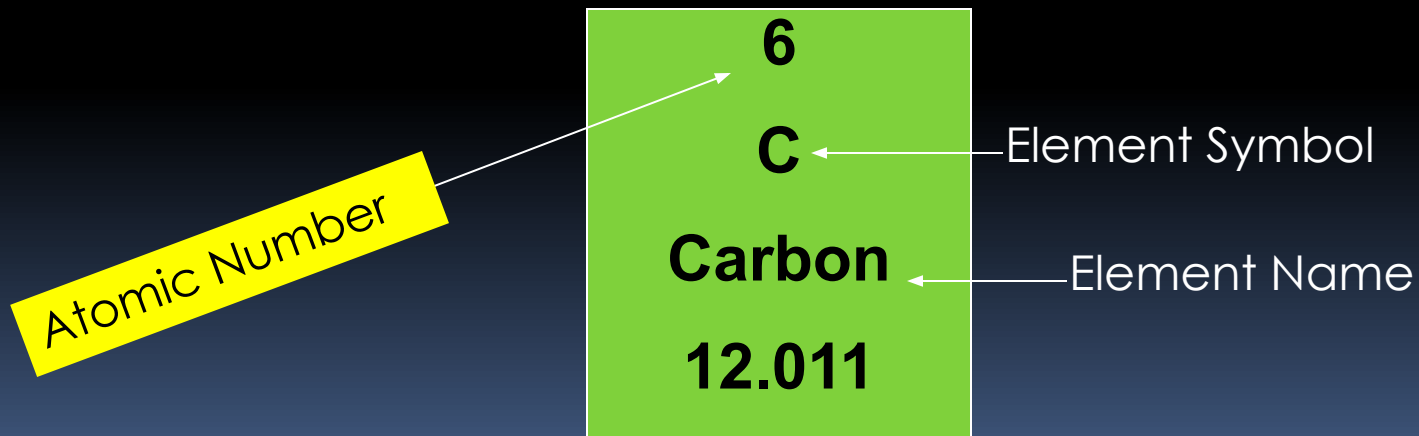
Mass vs. Size

- Nucleus is the heaviest, but smallest region of the atom (densest)
- Electrons are the lightest, but largest region of the atom



Atomic Number

- Number of **protons** in an atom
- Found on the periodic table; the **smaller** number in the element box



Average Atomic Mass

- The average mass of all **isotopes** of that element, taking into account percent abundance of each.
- Found on the periodic table; the **larger** number in the element box

6
C
Carbon
12.011

Avg. Atomic Mass



Calculating Protons, Neutrons, & Electrons

- Protons = atomic number
 - 79 protons
- Electrons = atomic number
 - 79 electrons
- Neutrons = atomic mass – atomic number
 - Mass of ENTIRE nucleus minus the protons (leaving behind just the neutrons)
 - Round Atomic Mass first!
 - $197 - 79 = 118$ neutrons

79

Au

Gold

196.96