

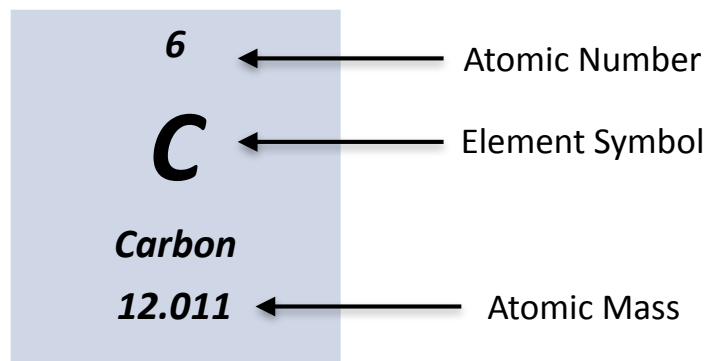
## **Tutorial 4: The Periodic Table, Isotopes and Electron Configuration**

### Goals:

- ✓ To understand the structure of the atom and the location of protons, neutrons and electrons.
- ✓ To be able to use the periodic table to determine atomic number, atomic mass, group number, period number, electron configuration and the number of valence electrons for main group elements.
- ✓ To understand what isotopes are and be able to represent them with a chemical symbol.

## The Periodic Table

- **Groups:** The vertical columns.
- **Periods:** The horizontal rows.
- **Element Symbol:** The abbreviation for the full element name.
- **Atomic Number:** Tells the number of protons in the element; this is fundamental to the identity of an element!
- **Atomic Mass:** The weighted average mass of all the naturally occurring isotopes of an element.



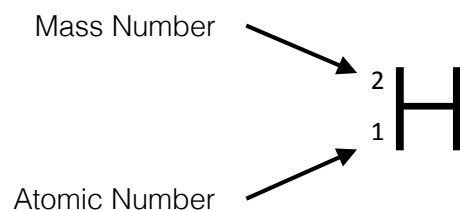
# The Periodic Table Continued

		Alkali Earth Metals										Halogens						Noble Gases	
		Alkali Metals												3A	4A	5A	6A	7A	8A
1	1 H hydrogen 1.01																	2 He helium 4.00	
2	3 Li lithium 6.94	4 Be beryllium 9.01											5 B boron 10.8	6 C carbon 12.0	7 N nitrogen 14.0	8 O oxygen 16.0	9 F fluorine 19.0	10 Ne neon 20.2	
3	11 Na sodium 23.0	12 Mg magnesium 24.3											13 Al aluminum 27.0	14 Si silicon 28.1	15 P phosphorus 31.0	16 S sulfur 32.1	17 Cl chlorine 35.5	18 Ar argon 39.9	
4	19 K potassium 39.1	20 Ca calcium 40.1	21 Sc 45.0	22 Ti 47.9	23 V 50.9	24 Cr 52.0	25 Mn 54.9	26 Fe 55.8	27 Co 58.9	28 Ni 58.7	29 Cu 63.5	30 Zn 65.4	31 Ga gallium 69.7	32 Ge germanium 72.6	33 As arsenic 74.9	34 Se selenium 79.0	35 Br bromine 79.9	36 Kr krypton 83.8	
5	37 Rb rubidium 85.5	38 Sr strontium 87.6	39 Y 88.9	40 Zr 91.2	41 Nb 92.9	42 Mo 95.9	43 Tc 98	44 Ru 101	45 Rh 103	46 Pd 106	47 Ag 108	48 Cd 112	49 In indium 115	50 Sn tin 119	51 Sb antimony 122	52 Te tellurium 128	53 I iodine 127	54 Xe xenon 131	
6	55 Cs cesium 133	56 Ba barium 137	57 La 139	72 Hf 178	73 Ta 181	74 W 184	75 Re 186	76 Os 190	77 Ir 192	78 Pt 195	79 Au 197	80 Hg 201	81 Tl thallium 204	82 Pb lead 207	83 Bi bismuth 209	84 Po polonium m 209	85 At astatine 210	86 Rn radon 222	
7	87 Fr francium 223	88 Ra radium 226	89 Ac 227	104 Rf 261	105 Db 262	106 Sg 271	107 Bh 272	108 Hs 270	109 Mt 276	110 Ds 281									

58 Ce 140	59 Pr 141	60 Nd 144	61 Pm 145	62 Sm 150	63 Eu 152	64 Gd 157	65 Tb 159	66 Dy 163	67 Ho 165	68 Er 167	69 Tm 169	70 Yb 173	71 Lu 175
90 Th 232	91 Pa 231	92 U 238	93 Np 237	94 Pu 244	95 Am 243	96 Cm 247	97 Bk 247	98 Cf 251	99 Es 252	100 Fm 257	101 Md 258	102 No 259	103 Lr 262

## Subatomic Particles

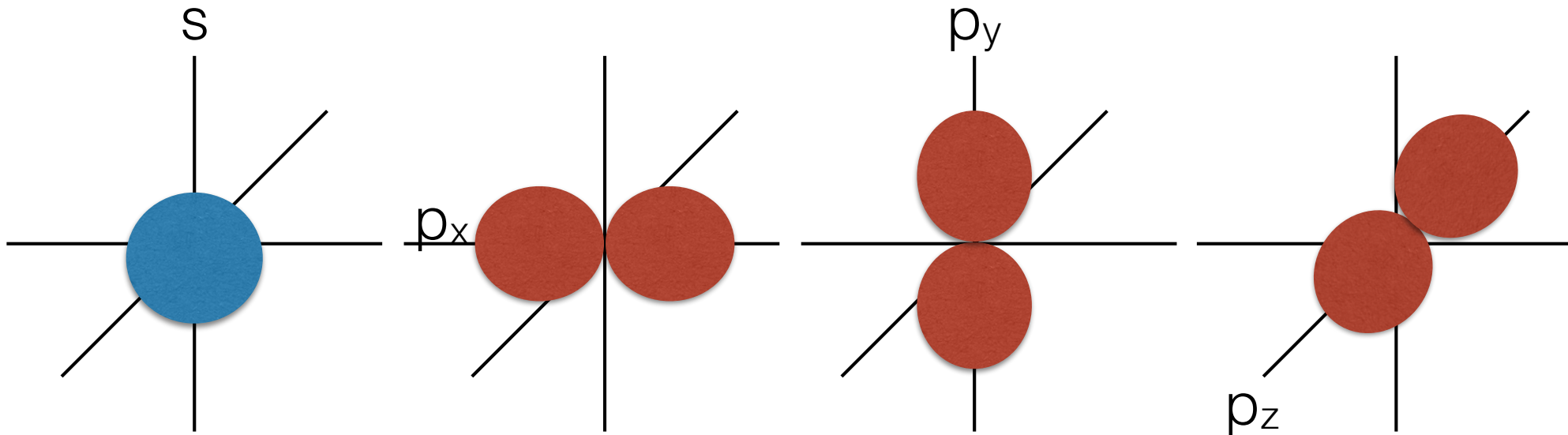
- The number of protons is given in the periodic table as the atomic number. This is fundamental to the identity of the element.
- Electrons are equal to the number of protons in a neutral atom. Electrons can be gained or lost without changing the identity of the atom. Metals commonly lose electrons to form cations. Nonmetals commonly gain electrons to form anions.
- The number of neutrons can vary without changing the identity of the atom. Two atoms with the same number of protons but a different number of neutrons are isotopes of the same element. You can determine the number of neutrons in a particular isotope from the mass number. The mass number is the sum of the protons and neutrons in an atom. Thus, the number of neutrons can be found by subtracting the atomic number from the mass number.



- In the example above, the hydrogen atom has 1 proton (atomic number 1), 1 neutron (2-1), and 1 electron (equal number of protons and electrons).

# Electron Configuration

- Electrons are restricted to certain regions of space within an atom called orbitals. An orbital can only house up to two electrons.
  - Electrons occupy energy levels (1, 2, 3...)
  - Within each energy level there are certain sub-levels available (s, p, d and f)
  - Within an s sub-level there is one spherical shaped orbital that may contain up to two electrons max
  - Within a p sub-level there are three dumbbell shaped orbitals that may contain up to two electrons each (therefore 6 electrons max in a p sub-level)



- We show the location of electrons through written electron configurations.

