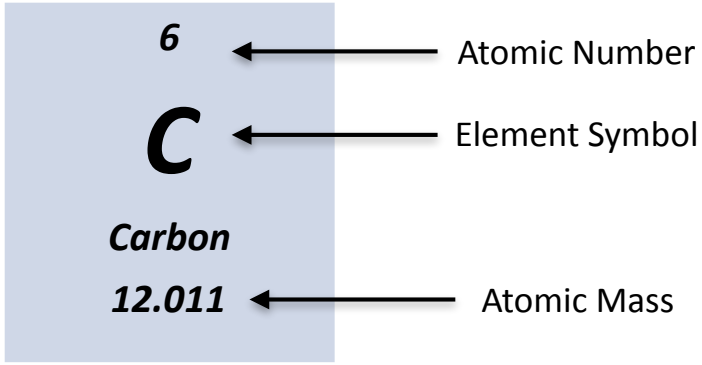
Tutorial 4: The Periodic Table, Isotopes and Electron Configuration

Goals:

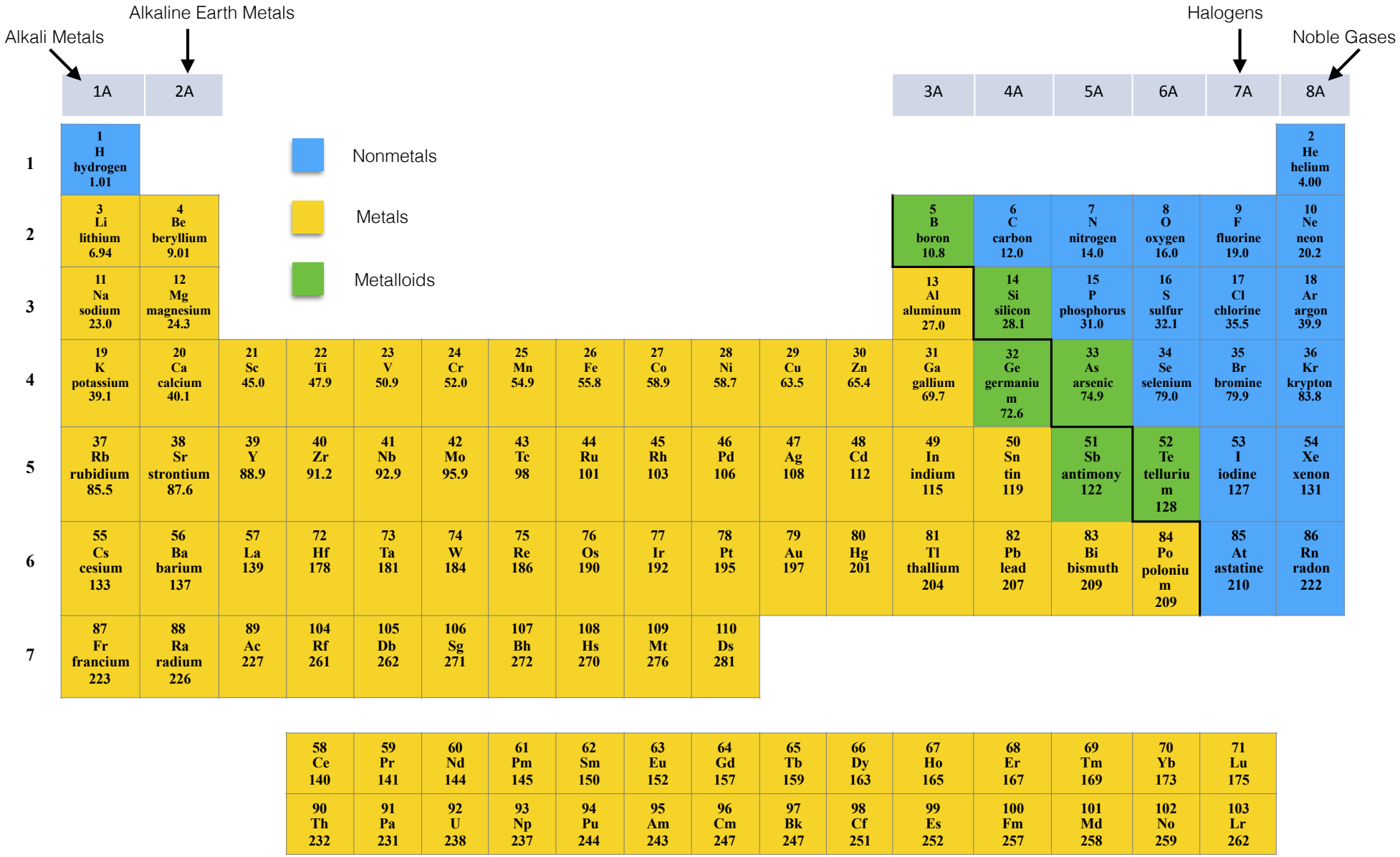
- ✓ To understand the structure of the atom and the location of protons, neutrons and electrons.
- ✓ To be able to use the periodic table to determine atomic number, atomic mass, group number, period number, electron configuration and the number of valence electrons for main group elements.
- ✓ To understand 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

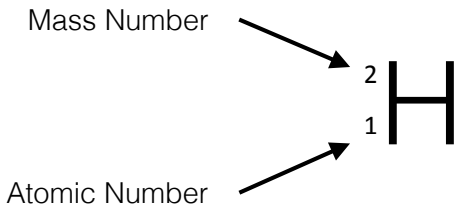


Subatomic Particles

- 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.

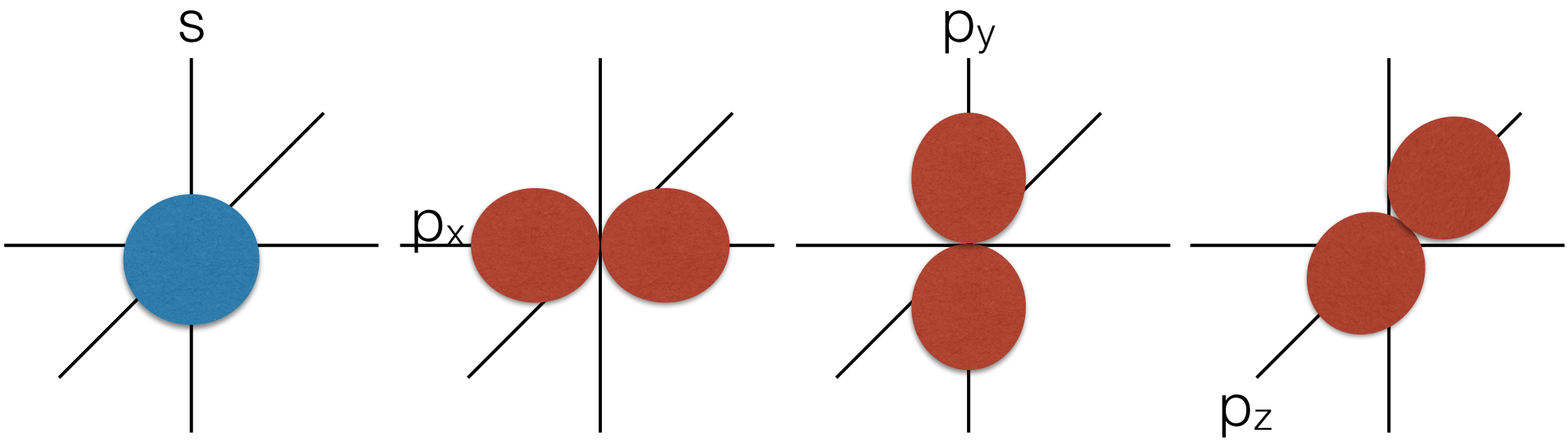
- The number of neutrons can vary without changing the identity of the atom. Two atoms with the same number of protons but a different number of neutrons are isotopes of the same element. You can determine the number of neutrons in a particular isotope from the mass number. The mass number is the sum 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.