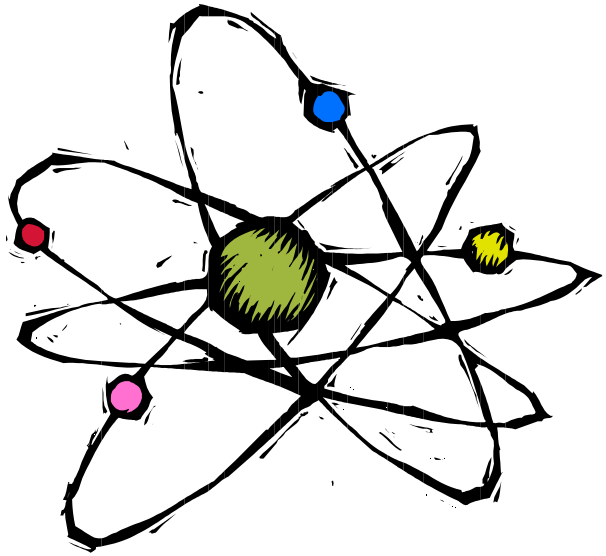


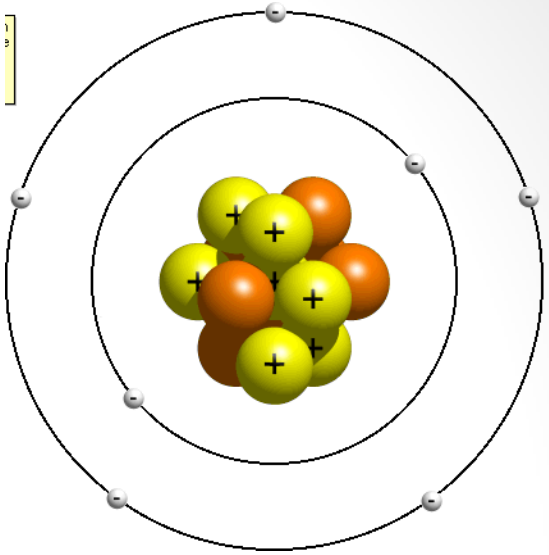
Atomic Structure

An element refresher

- **Matter** is anything that takes up space and has mass.
  - It can not be created or destroyed but transferred.
- Everything on the planet is made of elements.
- Each element has an atom unique from any other element.
- Atoms are the building blocks of matter
  - *How bricks are the building blocks of houses.*

Picture from
http://education.jlab.org/qa/atom_model_03.gif

Atoms



- An atom has three parts:
- **Proton** = positive
- **Neutron** = no charge
- **Electron** = negative

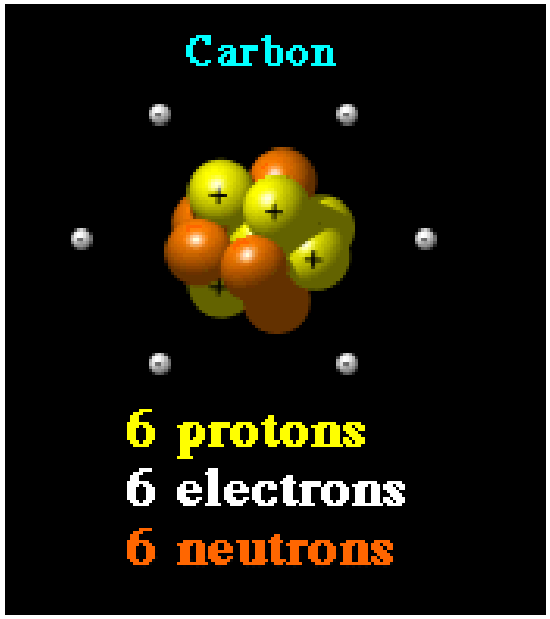
- The proton & neutron are found in the center of the atom, a place called the **nucleus**.
- The *electrons* orbit the nucleus.

How small are atoms?

THERE ARE 2 X 10^{22} ATOMS IN A PENNY. If all the atoms in a penny were blown up to the size of a grain of sand they would cover the entire state of California

Atoms

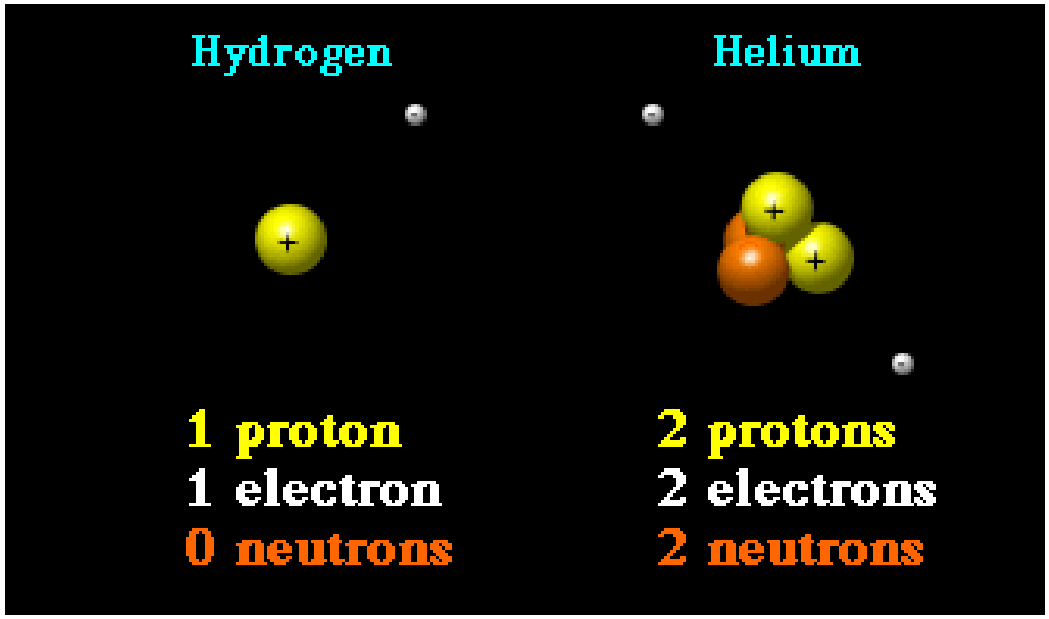
- Atoms for element's are commonly found without charge (neutral).
- If an atom is neutral, # of protons = # of electrons.



Graphic from http://education.jlab.org/atomtour/fact2.html

Atoms

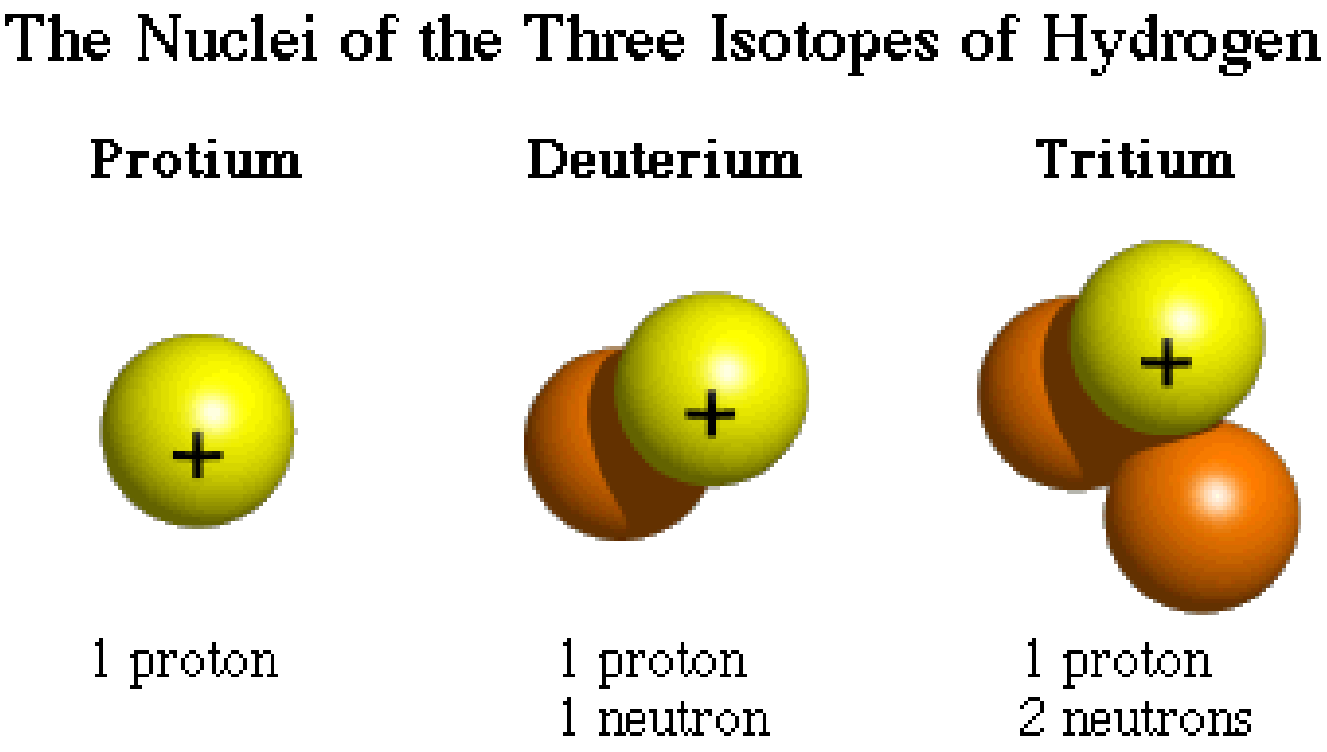
- Changing the number of protons create a new element!



Graphic from http://education.jlab.org/atomtour/fact2.html

Atoms - ISOTOPE

- Changing the number of NEUTRONS create an ISOTOPE.



Graphic from http://education.jlab.org/glossary/isotope.html

Periodic Table

Atomic Number:

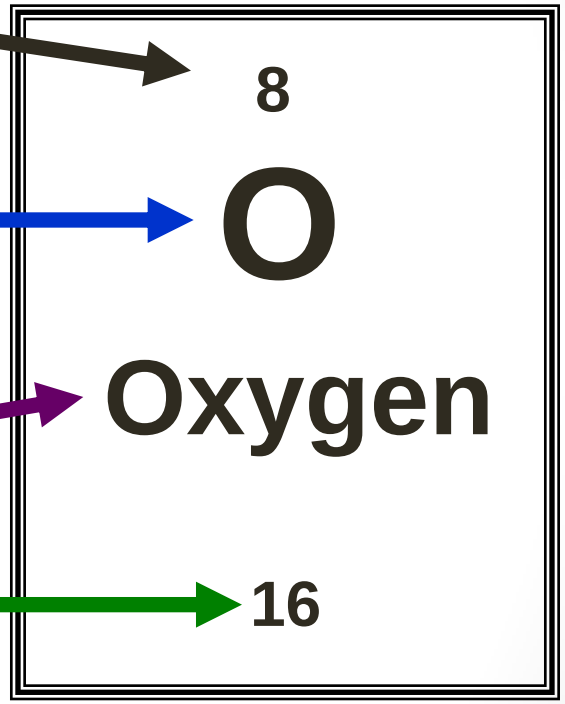
Number of protons and it is also the number of electrons in an atom of an element.

Element's Symbol:
An abbreviation for the element.

Elements Name

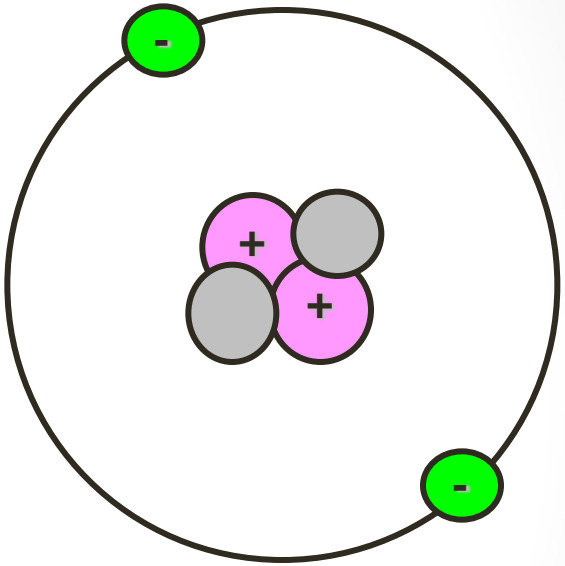
Atomic Mass/Weight:

Number of protons + neutrons.



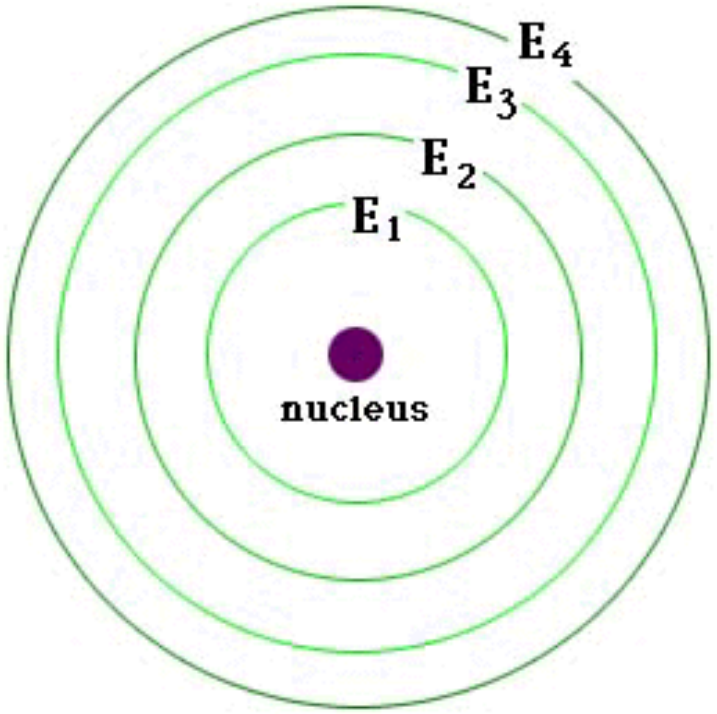
Bohr Model

- The Bohr Model shows all of the particles in the atom.
- In the center is circles. Each circle represents a single neutron or proton.
  - Protons should have a plus or P written on them.
  - Neutrons should be blank or have an N.
- In a circle around the nucleus are the electrons. Electrons should have a minus sign or an e.

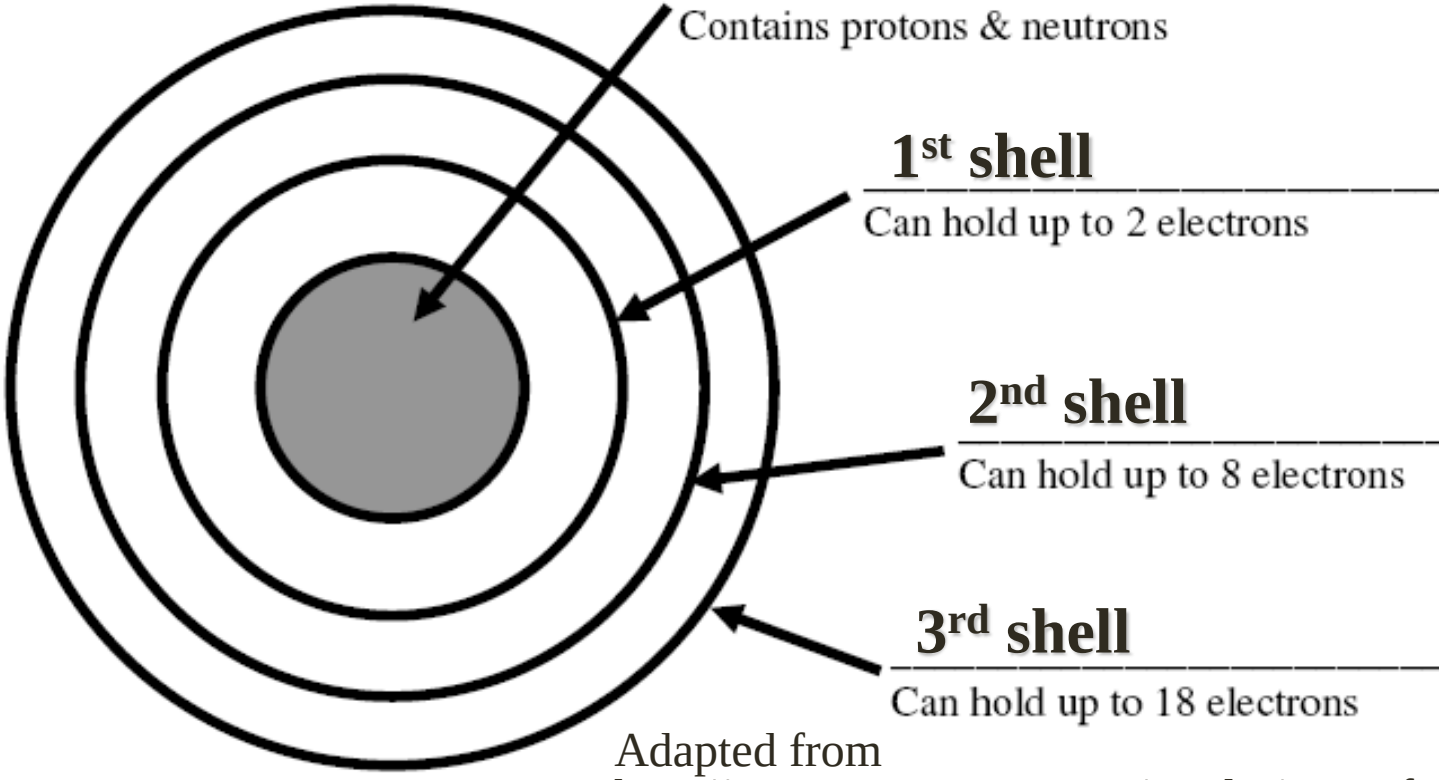


Electrons have special rules….

- You can't just shove all of the electrons into the first orbit of an electron.
- Electrons live in something called **shells or energy levels**.
- Only so many can be in any certain shell.
- The electrons in the outer most shell of any element are called **valance electrons**.



Electrons have special rules….

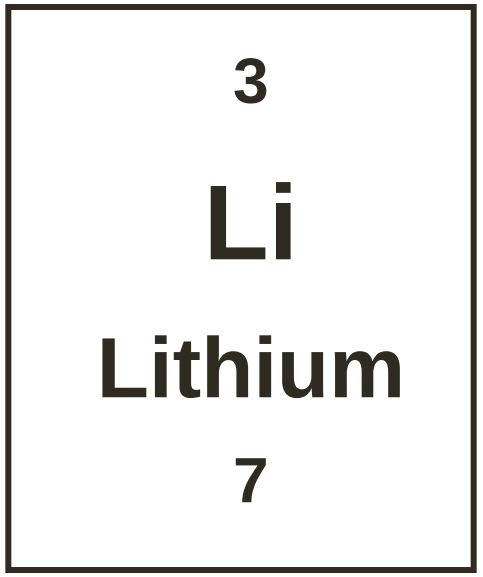


Adapted from
http://www.sciencespot.net/Media/atomsfam.pdf

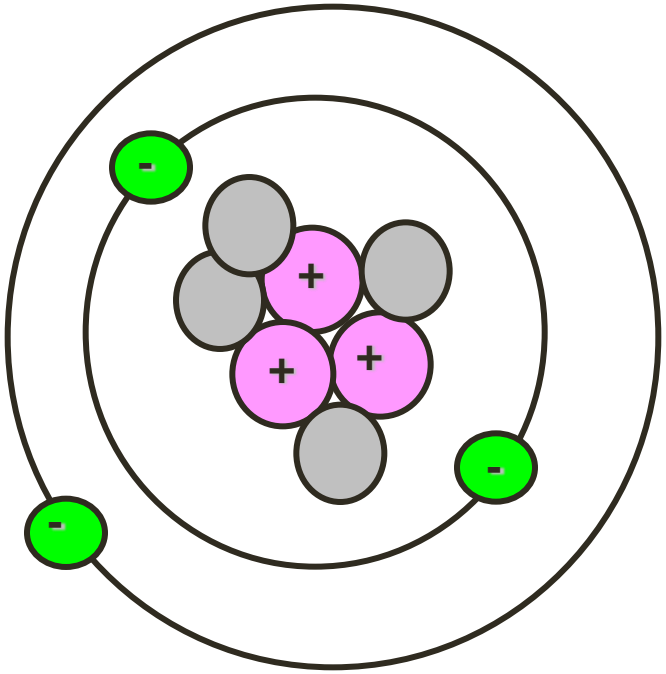
Electrons that are closer to the nucleus have less energy than those that are farther away from the nucleus

So let's try it….

- How to draw a Lithium atom
- First, look at the Periodic Table
- Second, determine the number of protons
  - (Look @ the atomic number)
- Then determine the number of neutrons
  - (Atomic mass – atomic number)
- Then determine the number of electrons
  - (Look @ the atomic number)



So let's try it….



Protons = 3

3

Li

Lithium

7

Electrons = 3

2 in the 1st shell, 1 in the 2nd shell

Neutrons = 4

(7-3=4)

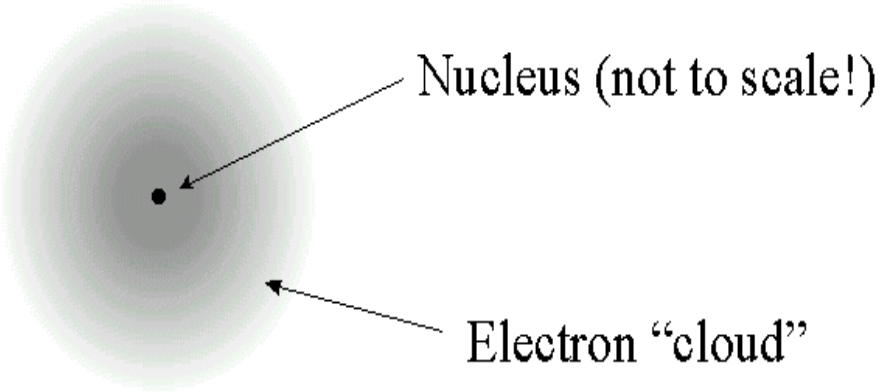
Modern Atomic Theory

In the real world electrons do not move in rings around the nucleus.

They are found rotating around the nucleus at a speed that causes a cloud formation.

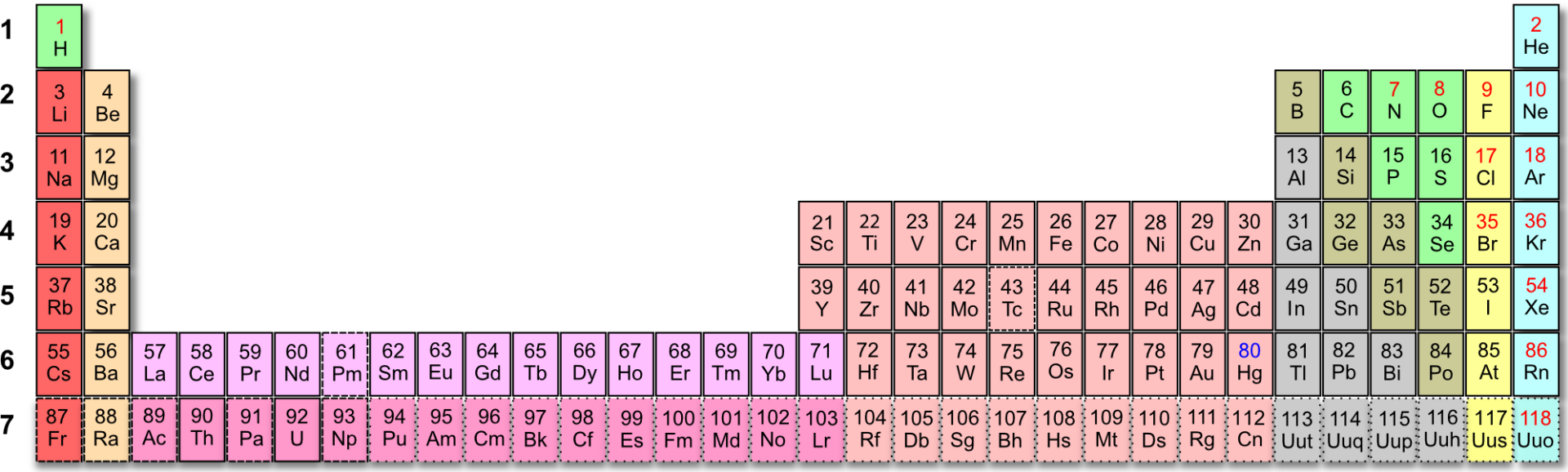
The electron cloud is a cloud of varying density surrounding the nucleus. The varying density shows where an electron is more or less likely to be.

Atoms with electrons in higher energy levels have additional electron clouds of different shapes that also show where those electrons are likely to be.



Additional Information

Particle	Electric Charge (C)	Atomic Charge	Mass(g)	Atomic Mass (amu)
Protons	$+1.6022 \times 10^{-19}$	+1	1.6726×10^{-24}	1.0073
Neutrons	0	0	1.6740×10^{-24}	1.0078
Electrons	-1.6022×10^{-19}	-1	9.1094×10^{-28}	0.00054858



Alkali metals	Alkaline earth metals	Lanthanides	Actinides	Transition metals
Poor metals	Metalloids	Nonmetals	Halogens	Noble gases

State at standard tempurature and pressure

Atomic number in red: gas

Atomic number in blue: liquid

Atomic number in black: solid

solid border: at least one isotope is older than the Earth (Primordial elements)

dashed border: at least one isotope naturally arise from decay of other chemical elements and no isotopes are older than the earth

dotted border: only artificially made isotopes (synthetic elements)

no border: undiscovered