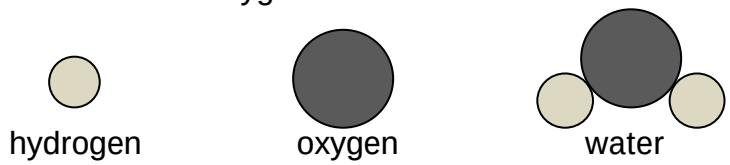
SNC2D1

# The Atom

John Dalton developed the atomic theory in 1803. He proposed that all matter is made of atoms which he thought of as tiny, indivisible spheres, like billiard balls. Elements (e.g. hydrogen, oxygen) were composed of identical atoms, while compounds (e.g. water) were composed of combinations of elements. Elements and compounds are both considered pure substances since every water molecule is composed of exactly two hydrogen atoms and 1 oxygen atom.



hydrogen oxygen water

**Ernest Rutherford and Neils Bohr** - The Bohr-Rutherford Model of the Atom

Before this development model, little was known about the subatomic structure of the atom. J.J. Thomson discovered that tiny charged particles called **electrons** can move between atoms through empty space. However Ernest Rutherford made the remarkable discovery that most of the atom is actually empty space; almost all the mass of the atom is found in a very tiny area called the **nucleus**. The nucleus contains heavy particles called **protons** and **neutrons** while the tiny electrons exist outside the nucleus. These three particles make up all atoms in the universe.

| Particle Name | Location | Charge | Mass (amu) |
|---|---|---|---|
| Proton (p) | | | 1.0073 |
| | nucleus | | 1.0087 |
| | | - 1 | 0.00055 |

Another scientist named Neils Bohr proposed a modification to the Rutherford. He proposed that electrons can only circle the nucleus at very specific distances he called *orbits* or *energy levels*. Bohr proposed that the first orbit could contain two electrons and the second and third could hold eight. The Bohr-Rutherford model of a beryllium atom, therefore, looked like this:

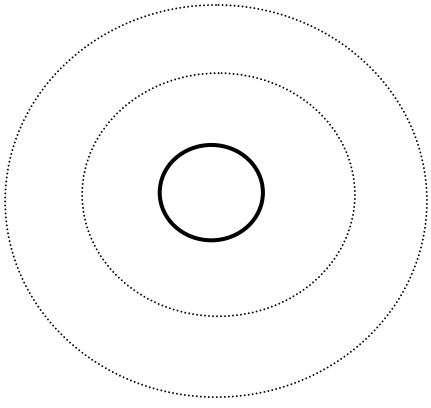
Atomic Number = _____ (from periodic table)

Atomic Mass = _____ (from periodic table )

# proton = _____

# electrons = _____

# neutrons = _____



**How to Count the Subatomic Particles:**
You will always be able to use a periodic table in chemistry. The periodic table lets you determine the number of protons, neutrons and electrons in an atom.

1. The number of protons is ALWAYS equal to the **atomic number**.
2. The number of **electrons** for a neutral atom is **equal to** the number of **protons**. #e =#p
3. Since the protons and the neutron are the only heavy particles:

**Atomic Mass* = protons + neutrons**

* Rounded to the nearest whole number.

Therefore: number of neutrons = atomic mass – atomic number

Complete this table.

| Atomic Number | Element | Symbol | Atomic Mass | Protons | Electrons | Neutrons |
|---|---|---|---|---|---|---|
| 1 | hydrogen | H | 1 | 1 | 1 | 0 |
| 2 | helium | He | | 2 | 2 | 2 |
| 6 | carbon | C | 12 | 6 | | |
| 8 | oxygen | | 16 | | | |
| 16 | | | 32 | | | |
| | | K | | 19 | | 20 |
| | gold | | | 79 | | |

How many electrons are in each orbit? Remember:

1. The number of total electrons is equal to the number of protons, which is equal to the atomic number.
2. The first level gets 2 electrons, the second level 8, and the third (well, you'll see)

| | | Number of Electrons in the Level | | |
|---|---|---|---|---|
| Element | Atomic Number | 1st Level | 2nd Level | 3rd Level |
| hydrogen | 1 | 1 | 0 | 0 |
| carbon | 6 | | | |
| oxygen | | | | |
| magnesium | | | | |
| chlorine | | | | |
| argon | | | | |