**Ch. 4- The Atom**

[**Early Models of the Atom:**](file:///\\swain.local\storage-ns\homes\high\staff\kgray\Kgray%20folder\Chemistry\chapter%204,5-atomic%20structure,%20electrons%20in%20atoms\atom%20models.flipchart)

**Democritus: (~335 BC Greek Era)**

* Atoms were indivisible and indestructible

**Dalton’s Atomic Theory (1808):**

* Atom= simple sphere, no internal structure

**JJ Thomson (1904):**

* Plum Pudding Model

**Rutherford (1911):**

* Discovered the nucleus – central core of atom

**(Gold-Foil experiment)**

* Planetary model- protons + neutrons in a nucleus; electrons

distributed around the nucleus

**Structure of the Nuclear Atom:**

**Atom:**

* Smallest particle of an element
* Made up sub-atomic particles:

**Protons:** + charge (**Goldstein 1886)**

**Electrons:** - charge ([**J.J. Thomson**](http://www.youtube.com/watch?v=7YHwMWcxeX8) **1897, R.Millikan 1916)**

# Neutrons: no charge (Chadwick 1932)

* No net electric charge

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Properties of Sub-atomic particles | | | | |
| Particle | **Symbol** | **Relative Charge** | **Relative mass**  **(mass of proton = 1)** | **Actual mass (g)** |
| **Electron** | e- | -1 | 1/1840 | 9.109381 x 10-28 g |
| **Proton** | P + | +1 | 1 | 1.67 x 10 –24 g |
| Neutron | n 0 | 0 | 1 | 1.67 x 10 –24 g |

**4.3** [**Distinguishing Among Atoms:**](file:///H:\Kgray%20folder\Chemistry\chapter%204,5-atomic%20structure,%20electrons%20in%20atoms\how%20many%20protons%20electrons%20and%20neutrons-1.ppt)

**Atomic number:**

* # of protons (and electrons)
* IDs the element

**Mass number (atomic mass):**

* # of protons (or atomic #) + neutrons

\*Number of neutrons = mass # - # of protons (or atomic #)

**Representing Atomic # and Mass # shorthand:**

* mass # = superscript (A)
* atomic # = subscript (Z)
* 

ex.

or Gold- 197, Au-197

[**Isotopes:**](http://www.ncsu.edu/ncsu/pams/chem/msf/pdf/IsotopicMass_NaturalAbundance.pdf)

* Atoms w/same # of protons (and electrons) different

# of neutrons

* Led to the discovery of neutrons

ex. [3 Hydrogens isotopes](file:///\\swain.local\storage-ns\homes\high\staff\kgray\Kgray%20folder\Chemistry\chapter%204,5-atomic%20structure,%20electrons%20in%20atoms\isotopes%20of%20hydrogen.flipchart):

Hydrogen-1 () – 1 proton, no neutrons (mass # =1)

Hydrogen-2 () – 1 proton, 1 neutron (mass #= 2)

Hydrogen-3 () – 1 proton, 2 neutrons (mass# = 3)

[**Fill in Rest of chart**](file:///Z:\Chemistry\chapter%204,5-atomic%20structure,%20electrons%20in%20atoms\Fill%20in%20Atomic%20Info.flipchart)

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **Element** | **Symbol** | **# of protons** | **# of electrons** | **# of neutrons** | **Atomic #** | **Mass #** | **Shorthand** |
| **Manganese** |  | 25 |  | 30 |  |  |  |
| **Sodium** |  |  | 11 | 12 |  |  |  |
| **Bromine** |  | 35 |  | 45 |  |  |  |
| **Yttrium** |  |  |  |  | 39 | 89 |  |
| **Arsenic** |  |  | 33 |  |  | 75 |  |
| **Actinium** |  |  |  |  |  | 227 |  |

**Average Atomic Mass:**

* A weighted average of the masses of the isotopes of an

element (reflects both the mass and the relative

abundance in nature)

* Atomic mass unit = (amu)

**Calculating average atomic mass:**

* Mass of each isotope x relative abundance (expressed as

a decimal) then add the products.

Ex. 2 most abundant isotopes of carbon are **carbon 12** (mass= 12.00amu)

and **carbon-13** (mass = 13.003 amu). Their percent abundances are

98.89% and 1.11%. Calculate the atomic mass of carbon.

12.00 x .9889 = 11.87

13.003 x .0111 = + .1443

Average Atomic Mass = 12.014 amu = 12.01 amu