Name: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Date: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Period: \_\_\_\_\_\_\_\_

UNIT NOTES: ATOMIC STUCTURE

**PPT 1: History of the Atom** (See your Timeline!)

* Democritus – 400 B.C.
  + Greek philosopher
  + first to say matter is made up of individual particles
  + named them atoms from the Greek word “atomos” meaning uncuttable
* Aristotle – 400 B.C.
  + Greek philosopher
  + disputed Democritus’ theory
  + believed everything was made of earth, air, water and fire – not atoms
* John Dalton – 1808
  + English scientist
  + developed an Atomic Theory
  + elements are made of atoms
  + atoms of an element are the same
  + atoms of different elements are not the same
  + atoms of one element can combine with atoms of other elements to form compounds
  + atoms are indivisible in chemical processes (cannot be created or destroyed)
* J.J. Thomson – 1897
  + Physicist from England
  + discovered the electron
  + imagined the atom must have positive particles to balance out the negative particles
* Ernest Rutherford -1911
  + Physicist from New Zealand
  + discovered the nucleus with the gold foil experiment
  + by 1919, he concluded that the nucleus contain protons
* Niels Bohr – 1915
  + Physicist from Denmark
  + came up with a new model of the atom; the planetary model
    - the atom is a positively charged center with electrons moving around it in orbits like planets moving around the sun

**PPT 2: Subatomic Particles**

* element
  + \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_that is composed of one type of *\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_-*
* atom
  + the \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ of an element that still retains the properties of the element
  + composed of \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_, \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_, and \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
* nucleus
  + \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_charged center of an atom that contains \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_and \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ and is surrounded by a \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ of electrons
* proton
  + particle inside the \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_of an atom that has a charge of \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
* neutron
  + \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_particle inside the \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ of an atom
* electron cloud
  + area \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ the nucleus of an atom where the atom’s \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_are most likely to be found
* electrons
  + particles \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ the center of an atom that have a charge of \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Atomic Number

* by looking at the number of \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ you can tell what atom the element is
* atomic number
  + \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ in an atom’s nucleus
  + found \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_the chemical symbol on the periodic table
  + \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ the number of \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ in a \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ atom
* **atomic # = protons = electrons**

Atomic Mass

* average atomic mass
  + \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_-average mass of the mixture of an element’s isotopes
* mass number
  + \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_of the number of \_\_\_\_\_\_\_\_\_\_\_\_\_\_and \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ in an atom’s nucleus
  + to find, \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ the average atomic mass
* **mass # = protons + neutrons**
* **neutrons = mass # - protons**

Atomic Forces

* \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ attract
* Negative electrons attracted to positive protons
* Protons and neutrons are attracted to each other by the strong \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.

Atomic Number & Mass Number

* Nucleus contains the\_\_\_\_\_\_\_\_\_\_\_\_\_\_ but little volume
* Electrons have almost no mass, but \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ takes most of the volume
* **Atomic mass unit (\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_)** – the SI unit for the mass of an atom
* One atomic mass unit equals the \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_of one \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
* Each neutron has an atomic mass unit of \_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.

Ions

* **Ions** – atoms that lose or gain \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
* \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ or \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_charged
* Do not have the same number of protons and electrons
* **Cations** –\_\_\_\_\_\_\_\_\_\_\_\_\_ electrons and become \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ charged
* **Anions** – \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ electrons and become \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ charged
* <https://www.brainpop.com/science/matterandchemistry/ions/>

Isotopes

* Isotopes of an element have THE \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_atomic number but different \_\_\_\_\_\_\_\_\_\_\_\_\_\_NUMBERS because they have a \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_number of neutrons
* Ex: Every atom of \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ has 8 protons but some oxygen have 8 neutrons and some have 9 neutrons depending upon the mass number.
  + To distinguish different isotopes from one another we write them like this:
    - * element name-atomic mass
    - Ex: oxygen-18, silicon-28, sulfur-34

**PPT 3: MODERN ATOMIC THEORY**

Bohr Model- Atomic Structure

* Electrons are contained in \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ that surround the \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
* Each electron shell can hold a certain number of \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
* Electron shells are \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_from the \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ out

|  |  |
| --- | --- |
| **Energy Level** | **Maximum Number of Electrons** |
| 1 | 2 |
| 2 | 8 |
| 3 | 8 |
| 4 | 18 |
| 5 | 18 |

Energy levels

* There are \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_energy levels.
* They are the \_\_\_\_\_\_\_\_\_\_\_\_\_ places electrons can be found.
* An electron can occupy one energy level at a time and \_\_\_\_\_\_\_\_\_\_\_\_the space in between.
* The level with the least energy is the one \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_to the nucleus (center).

Valence Electrons

* Electrons in the \_\_\_\_\_\_\_\_\_\_\_\_\_\_ most electron shell are called valence electrons
* The shell containing electrons that is \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_from the nucleus is called the valence shell
* Atoms will try to \_\_\_\_\_\_\_\_\_\_\_\_ or \_\_\_\_\_\_\_\_\_\_\_\_ electrons in order to have a \_\_\_\_\_\_\_\_\_\_\_\_\_ valence shell

Electron Cloud and Orbitals

* Electrons do not travel in fixed paths.
* They only have a certain chance of being in any particular place.
* Electrons have wave-like properties.

Electron Cloud Model

* Electron cloud – an area around the nucleus where electrons are likely to be.

Orbitals

* **Orbitals** – regions of the electron cloud that are \_\_\_\_\_\_\_\_\_\_\_\_where electrons are most likely to be.
* Each orbital has a maximum of just two electrons.
* Different energy levels have different numbers of \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.
* Therefore different energy levels have different \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_numbers of electrons.

Valence Electrons

* Electrons in the \_\_\_\_\_\_\_\_\_\_\_\_\_\_ most electron shell are called valence electrons
* The shell containing electrons that is \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_from the nucleus is called the valence shell
* Atoms will try to \_\_\_\_\_\_\_\_\_\_\_\_ or \_\_\_\_\_\_\_\_\_\_\_\_ electrons in order to have a \_\_\_\_\_\_\_\_\_\_\_\_\_ valence shell
* Each electron shell can hold a certain number of electrons
* Electron shells are filled from the **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**out
* Noble Gases have **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**outer electron shells
* All other elements have **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_** outer electron shells

Lewis Dot Diagrams

* Use the element symbol and the number of valence electrons
* <https://www.youtube.com/watch?v=ulyopnxjAZ8>

Bohr Model Examples

* + For an atom of carbon, draw the model, write the number of protons, number of neutrons, number of electrons, number of valence electrons.
  + Carbon
  + Chlorine