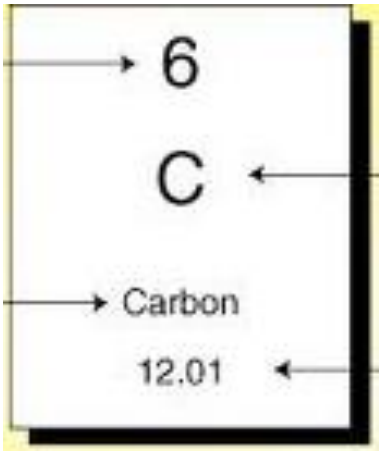
Honors Chemistry **Name _____**
Chapter 4 – Atomic Structure Notes **Date _____**

ATOMS & SUBATOMIC PARTICLES

- **Atoms** – Are the smallest particle of an _____ that still behaves like that element.
    - Atoms are arranged to have the _____ at the center.
    - Three key subatomic particles are _____, _____, and _____.
- **Protons**
    - **Location:**
    - **Charge:**
    - **Mass:**
    - **Symbol:**
- **Neutrons**
    - **Location:**
    - **Charge:**
    - **Mass:**
    - **Symbol:**
- **Electrons**
    - **Location:**
    - **Charge:**
    - **Mass:**
    - **Symbol:**

USING THE PERIODIC TABLE

- **Blocks**
    - ***Label the arrows to the right!***



- **Atomic Number**
    - The number of _____ in the nucleus of each atom of that element.
    - Is the _____ of the element.
    - Also _____ the number of _____ in a **NEUTRAL atom.**
    - **Example**

Element	Atomic #	# protons	# electrons
Carbon			
Phosphorus			
Gold			

- **Mass Number**
    - The total number of _____ and _____ in the _____ of an isotope.
    - When looking at the periodic table, always round the mass number to the highest/lowest _____ number.
    - When looking at a problem, the number of protons & neutrons will help you to identify the mass number!
    - Can be written as _____ or _____.

- **Example**

Element	# protons	# neutrons	# electrons	mass #
Oxygen -		8		
	33	42		
Phosphorus -	15			

- **Changing Subatomic Particles**
  - **Changing Protons**
    - Changes the _____.
  - **Changing Neutrons**
    - Changes the _____, creating a new _____.
  - **Changing Electrons**
    - Changes the _____, creating an _____.
    - If an atom _____ it becomes _____ and is called a _____.
    - If an atom _____ it becomes _____ and is called an _____.

ISOTOPES

- Are atoms of the _____ element that have _____ masses due to varying numbers of _____.
- **Atomic Mass**
  - Is the _____ average of all the naturally occurring _____ of that element.
- **Calculating Atomic Mass (Example Below)**

Isotope	Symbol	Composition of the nucleus	% in nature
Copper-63	^{63}Cu	29 protons 34 neutrons	69.20%
Copper-65	^{65}Cu	29 protons 36 neutrons	30.80%

  - **Step 1:**
  - **Step 2:**

- **Example**
  - Calculate the atomic mass of bromine. The two isotopes of bromine have mass numbers and relative abundances of 79 (50.69%) and 81 (49.31%).

NUCLEAR CHEMISTRY

- _____ (unstable isotopes) want to _____ their nucleus to achieve _____.
- They can change the nucleus by emitting _____ (particles or waves from the nucleus).

- **Types of Nuclear Radiation**
  - **Alpha Particle (α)**
    - A helium nucleus – 2 protons and 2 neutrons.
    - **Example:** Polonium – 214
      - *Write the nuclear symbol.*
      - *Draw an arrow to show the process.*
      - *Write the alpha particle.*
      - *Subtract the mass and protons from Polonium & replace it with a new atom.*

  - **Beta Particle (β)**
    - A neutron decays into a proton and releases an electron.
    - **Example:** Carbon – 14
      - *Write the nuclear symbol.*
      - *Draw an arrow to show the process.*
      - *Write the beta particle (neutron turns to proton, electron gets ejected). Use "-1" for the atomic number of the e^-.*
      - *Add that new proton to the atomic number. Don't change the mass number.*

  - **Gamma Ray (γ)**
    - A high-energy photon is released (no mass change).
    - **Example:** Nickel – 61
      - *Write the nuclear symbol.*
      - *Draw an arrow to show the process.*
      - *Write the same nuclear symbol from the left side of the arrow (no mass change).*
      - *Add the gamma symbol.*

  - **Real-World Example**
    - Diagram Uranium – 238 as it undergoes three alpha decays.

- **Half – Life**
  - A _____ is the amount of _____ required for _____ the nuclei in a radioisotope sample to _____.
    - *If you have 5 grams of U-235, its <u>half-life</u> is the amount of time it takes for your sample to decay to 2.5 grams.*

  - **Formula:**

  - **Example:** Carbon-14 emits beta radiation and decays with a half-life of 5730 years.
    - How much time will have passed after 3 half-lives?

    - If the initial sample is 2.50 grams, how much C-14 remains after three half-lives?