* Nuclear Chemistry
  + Nuclear chemistry is the study of the structure of atomic \_\_\_\_\_\_ and the \_\_\_\_\_\_\_\_\_ change they undergo.
* Nuclear Reactions
  + Characteristics:
    - Isotopes of one element are changed into isotopes of another \_\_\_\_\_\_\_\_\_
    - Contents of the \_\_\_\_\_\_\_\_\_ change
    - Large amounts of \_\_\_\_\_\_\_\_ are released.

***Chemical vs. Nuclear Reactions***

|  |  |
| --- | --- |
| **Chemical Reactions** | **Nuclear Reactions** |
| Occur when bonds are \_\_\_\_\_\_\_\_\_\_ | Occur when nuclei emit particles and/or rays |
| Atoms remain \_\_\_\_\_\_\_\_\_\_, although they may be rearranged | Atoms often \_\_\_\_\_\_\_\_\_\_\_ into atoms of another element |
| Involve only \_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_ | May involve \_\_\_\_\_\_\_, \_\_\_\_\_\_\_\_\_, and \_\_\_\_\_\_\_\_\_ |
| Associated with \_\_\_\_\_\_\_\_ energy changes | Associated with \_\_\_\_\_\_ energy changes |
| Reaction rate influenced by temperature, particle size, concentration, etc. | Reaction rate **are not** influenced by temperature, particle size, concentration, etc. |

***Chemical Symbols***

* A chemical symbol looks like …
* To find the number of neutrons, subtract the atomic number from the \_\_\_\_\_\_\_\_ \_\_\_.

***Types of Radiation***

* Radioactive decay – when unstable \_\_\_\_\_\_ lose energy by emitting radiation to attain more \_\_\_\_\_\_\_ atomic configurations (spontaneous process)
  + \_\_\_\_\_\_– radioactive decay of an atomic nuclues that is accompanied by the emission of an alpha particle (α).
  + \_\_\_\_\_ – Radioactive decay in which an electron is emitted (β).
  + \_\_\_\_\_\_\_ – High energy photons that are emitted by radioactive nuclei (ϒ).

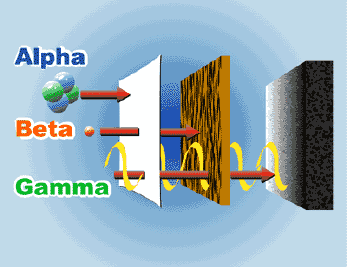
***Alpha Decay***

* Alpha decay – \_\_\_\_\_\_\_\_\_\_ of an alpha particle (α), denoted by the symbol , because an α particle has 2 protons and 2 neutrons, just like the \_\_\_ nucleus. Charge is +2 because of the 2 protons
* Alpha decay causes the \_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_ to decrease by 4 and the atomic number to decrease by \_\_.
* Atomic number determines the element. All nuclear equations are \_\_\_\_\_\_\_\_\_.
  + - Example: Write the nuclear equation for the radioactive decay of polonium – 210 by alpha emission.

***Beta decay***

* Beta decay – \_\_\_\_\_\_\_\_\_ of a beta particle (β), a fast moving \_\_\_\_\_\_\_\_\_, denoted by the symbol e- or . β has insignificant mass (\_\_) and the charge is \_\_ because it’s an electron.
* Beta decay causes \_\_\_ change in \_\_\_\_\_\_ number and causes the atomic number to increase by \_\_.
  + Example: Write the nuclear equation for the radioactive decay of carbon – 14 by beta emission.

***Gamma decay***

* Gamma rays – \_\_\_\_\_-\_\_\_\_\_\_\_\_ electromagnetic radiation, denoted by the symbol γ.
  + γ has no mass (\_\_) and no charge (\_\_). Thus, it causes no change in mass or atomic numbers.
* Gamma rays almost always accompany alpha and beta radiation.
  + However, since there is no effect on mass number or atomic number, they are usually omitted from nuclear equations.
    - Example: ϒ +

***Penetration of Radiation***

* Alpha and beta are particles \_\_\_\_\_\_\_\_ from an atom.  Gamma radiation is \_\_\_\_\_-wavelength \_\_\_\_\_\_\_\_\_\_\_\_ waves (photons) emitted from atoms.
  + The figures show the \_\_\_\_\_\_\_\_\_\_ of the different types of radiation.

|  |  |  |  |
| --- | --- | --- | --- |
| ***Type of Decay*** | ***Particle Emitted*** | ***Change in Mass #*** | ***Change in Atomic #*** |
| *Alpha* | *α He* | *-4* | *-2* |
| *Beta* | *β* | *0* | *+1* |
| *Gamma* | *γ* | *0* | *0* |