**Unit 6 – Nuclear Reactions: Webquest (Answer on a separate sheet of paper)**

**Part I:** <https://www2.lbl.gov/abc/Basic.html> **or https://tinyurl.com/yyw93mht**

1. What does the nucleus of an atom consist of?
   1. What force holds the nucleus of an atom together?

What fraction of an atom’s mass is contained in the nucleus?

* 1. Record the isotope notation symbol for Carbon. Include labels for each number.

1. What is the symbol for Alpha Radiation/Decay?
   1. What happens during the process of Alpha Radiation (decay)?
      1. Is the atomic number changed? How?
      2. Is the mass number changed? How?
   2. What is an Alpha Particle?
   3. Is energy released during Alpha Radiation/Decay?
   4. Write the nuclear equation for the Alpha Radiation/Decay of Seaborgium-263.
2. What is the symbol for Beta Radiation/Decay?
   1. What is a Beta Particle?
   2. What happens during the process of Beta Radiation/Decay?
      1. Is the atomic number changed? How?
      2. Is the mass number changed? How?
   3. Write the nuclear equation for the Beta Radiation/Decay of Carbon-14.
3. What is the symbol for Gamma Radiation/Decay?
   1. What is a Gamma Ray?
   2. What happens during the process of Gamma Radiation/Decay?
      1. Is the atomic number changed during Gamma Radiation/Decay?
      2. Is the mass number changed during Gamma Radiation/Decay?
   3. Write the equation for the Gamma Radiation/Decay of Dysprosium-152.
4. What is meant by the term Half-Life?
   1. Is the half-life the same for all isotopes of a given element?
      1. What is the Half-Life for Uranium-238?
      2. What is the Half-Life for Carbon-14?
5. What are the two types of Nuclear Reactions?
   1. What is fusion?
      1. Write the equation for the fusion of Hydrogen-2 and Hydrogen-3.
      2. Fusion is an energetically favorable reaction. Why does it not occur naturally on Earth?
      3. Stars perform nuclear fusion to create elements. What is the largest element created in a star?
      4. Where do elements like lead, gold, and silver come from?
      5. How much more energy does Nuclear Fusion release compared to Chemical Reactions
   2. What is fission?
      1. Write the equation for the fission of Uranium-235
      2. Why does fission occur?
      3. Fission can be described as a tug-of-war between what two forces of nature?
      4. When was the first man-made nuclear reactor created?

**Part II** - [**https://phet.colorado.edu/en/simulation/nuclear-fission**](https://phet.colorado.edu/en/simulation/nuclear-fission)

* Click on “play” and select the tab that says “fission: one nucleus”. Fire the neutron-gun.

1. What happens when the U-235 nucleus is hit with a neutron (the bullet)?

* Select the “chain reaction” tab at the top. Experiment with changing the settings and shooting the neutron-gun.

1. Click “reset all” and then set the initial number of U-235 nuclei to 100 and U-235 to 0.
   1. What happens when you fire the neutron-gun?
   2. Does this cause a chain reaction?
   3. Explain what a chain reaction is.
2. Click “reset all” and then set the initial number of U-238 nuclei to 100 and U-235 to 0.
   1. What happens when you fire the neutron-gun?
   2. Does this cause a chain reaction?
   3. Try multiple times to cause a chain reaction with the U-238.
   4. What is U-239? In what ways is it different from U-238?

**Part III** - [**https://phet.colorado.edu/en/simulation/alpha-decay**](https://phet.colorado.edu/en/simulation/alpha-decay)

* Click on “play” and select the “single atom” tab.

1. Observe the alpha-decay of Polonium-211. After each decay, press the “reset nucleus” button to watch the process again. (you can pause the video for observation)
   1. Write a description of alpha-decay for Polonium-211.
      1. What changes to the nucleus can you see?

**Part IV** - [**https://phet.colorado.edu/en/simulation/beta-decay**](https://phet.colorado.edu/en/simulation/beta-decay)

* Click on “play” and select the “single atom” tab.

1. Observe the Beta decay of Hydrogen-3. After the decay hit “reset nucleus” & watch the process again.
2. Observe the Beta decay of Carbon-14 (choose from the menu on the right of the screen). After the decay press “reset nucleus” and watch the process again. (you can pause the video for observation)
   1. Write a description of Beta Decay.
      1. What changes to the nucleus can you see?