**Chemistry Mastery Checklist**

**Standard 2- quantum mechanics and nuclear chemistry**

**(Refer to pgs. 86-111 in your book for information to help with the topics)**

**Answers are in red!!!**

**Electrons and waves (pgs. 86-94):** You should be able to identify the relationship between wavelength and light energy and how they both correlate to quantized energy emissions (photons) with changing energy in electrons. **Make sure that you can show how the frequency and wavelength correlate to the energy of waves in the electromagnetic spectrum.**

1. **Which electromagnetic wave has the highest frequency?**

**Gamma rays**

1. **Which electromagnetic wave has the lowest frequency?**

**AM (Radio waves)**

1. **Which color of the visible light waves has the longest wavelength?**

**Red**

1. **Which color of visible light has the highest energy? Purple/Violet**
2. **Draw an illustration or describe how energy is absorbed or released in discrete units when electrons move from one energy level to another (think about our flame test lab and the staircase).**

**Refer to your notes on pg. 88**

**Electrons must absorb energy to move to higher levels but as they fall back to their ground state they give off energy in the form of light (photons). Different colors of light have different energy levels.**

**Electron configuration-** Refer to your worksheet on electron configuration for help with this section. You should be able to write out the electron configuration of an element (either abbreviate or un-abbreviated) and you should also be able to identify an element on the periodic table based on a given electron configuration.

1. What is the **un-abbreviated** electron configuration for the following elements?
2. Boron 1s22s22p1
3. Magnesium1s22s22p63s2
4. Bromine 1s22s22p63s23p64s23d104p5
5. Gold1s22s22p63s23p64s23d104p65s24d105p66s24f145d9
6. Write out the **abbreviated** electron configuration for the following elements?
7. Fluorine [He] 2s22p5
8. Tin [Kr] 5s24d105p2
9. Barium [Xe] 6s2
10. Iodine[Kr] 5s24d105p5
11. Identify what element is listed below based on the electron configuration given:
12. 1s22s22p63s23p64s23d4\_\_Chromium
13. 1s22s22p63s23p64s23d104p65s24d105p6\_

Xe

1. [Ar] 4s1\_Potassium
2. [Kr] 5s24d4\_\_Molybdenum
3. [Rn] 7s2\_Radium

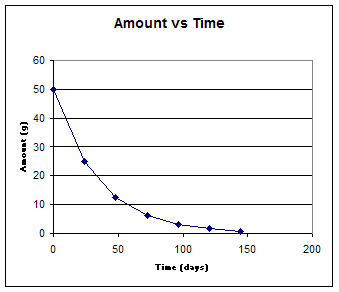
**Nuclear Chemistry (pgs. 95-97):** you should be able to compare the mass, energy and penetrating power of the different types of radiation (alpha, beta and gamma). You should be able to interpret graphical data relating the half-life and age of a radioactive substance.

Fill in the blanks of this chart with the correct information:

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Type of Radiation | Charge | Mass  (amu) | Notation | Penetrating Power |
| Alpha | + | 4 | 42He | Low- stopped by paper |
| Beta  (electron and  Positron) | -electron  + Positron | 0  0 | 0-1e  0+1e | Med- Stopped by aluminum foil |
| Gamma | No charge | o | 00y | **High**- Only stopped by lead and concrete |

**Half-Life Problems (show your work, pgs. 98-100):**

1. The half-life of Zn-71 is 2.4 minutes. If you had 100g to start out with, how many grams of zinc would be left after 7.2 minutes have elapsed? What fraction is that? 12.5g, 1/8
2. Os-182 has a half-life of 21.5 hours. How many grams of a 35g sample would have decayed after three half-lives? 30.6g decayed to leave 4.375g
3. 100g of an isotope with a half-life of 36 hours is present at time zero. Approximately how much time will have elapsed when 5g remains? Approx. 158 hrs
4. The graph below depicts the radioactive decay of an isotope of chlorine. Using this information answer the following questions:



1. What is the half-life of this radioactive isotope?

25 days

1. How much time would it take for this element to go through 4 half-lives?

100 days

1. How much of the original sample would be left after 4 half-lives?

3.125g

**Nuclear Decay:** Refer to page 302-303 in the textbook or your nuclear decay worksheet. You should be able to read a decay problem and fill in the missing information or predict the type of radiation that will be given off based on an equation.

1. After a period of time Uranium decays into Throrium-234. What type of radioactive emission would account for this change? **Remember** to write out the equation for this reaction.

23892U → 23490Th alpha decay

1. A sample of Chlorine-32 slowly decays into Sulfur. What type of emission can explain this decay? Write out your equation for this reaction.

**3217**Cl → 3216S + 0+1e positron emission

1. Identify the missing particle in the following nuclear reaction:

9943Tc ⇒ 9942Mo + o+1e

1. Identify the missing particle in the following nuclear reaction:

4219K ⇒ 4220Ca + o-1e

1. When neptunium-239 decays, plutonium-239 forms. Write an equation to show the type of radioactive decay that is involved.

23993Np → 23994 Pu + 0-1e (beta decay)