**Station #1: Atomic Structure**

1. Determine the nuclear symbols and the number of protons, neutrons, and electrons for the following:
2. Silicon -- 28
3. Phosphorus -- 32
4. Phosphorus -- 36 (anion, 3-)
5. Chlorine -- 36
6. Uranium -- 238
7. Which of the following of the above substances are isotopes of each other?

**Station#2: Atomic Theory**

1. Draw and complete the following table:

|  |  |  |  |
| --- | --- | --- | --- |
| **Particle** | **Charge** | **Location** | **Mass** |
| Proton |   |   | 1 |
| Electron | negative |   |   |
| Neutron |   | Nucleus |   |

2. Write the symbols for the following types of radiation: alpha, beta, and gamma. Sketch a model to show the degree of penetration (strength) of these radiation types.

**Station #3: Average Atomic Mass**

1. A new element is found. 36.1% of it has a mass of 126; 10.1% has a mass of 127, and the remainder (53.8%) has a mass of 125. What is the average atomic mass for this element?
2. A sample of uranium is composed of all three of its isotopes. Uranium-237 makes up 1.78% of the sample, uranium-238 makes up 98.2% of the sample, and uranium-239 makes up 0.02% of the sample. What is the average atomic mass of this sample of uranium rounded to two decimal places?

**Station #4: Nuclear Reactions**

For the following reactions, supply the atomic number and complete the reaction by obeying the Law of Conservation of Matter:

1. 218Po → 4He + \_\_\_\_\_\_\_\_
2. 9Be + 4He → \_\_\_\_\_\_\_\_ + 1n
3. 22Na + \_\_\_\_\_\_\_\_ → 22Ne
4. 238U → \_\_\_\_\_\_\_\_ + 234Th
5. 37Ar +\_\_\_\_\_\_\_\_ → 37Cl
6. 40Ca + 39Si → 79Se + \_\_\_\_\_\_\_\_

**Station #5: Half-Life**

1. An isotope of cesium (cesium-137) has a half-life of 30 years. If 1.0 mg of cesium-137 disintegrates over a period of 90 years, how many mg of cesium-137 would remain?
2. Three grams of Bismuth-218 decay to 0.375 grams in one hour. What is the half-life of this isotope?
3. Prepare a sketch of a half-life graph. Be sure to label the axes and give the graph a title. What type of graph (or mathematical function) does a half-life phenomenon represent?

**Station #6: Quantum Theory**

1. Sketch a diagram of a wave and label the following of that wave: wavelength, frequency.
2. Design and sketch model using waves to show the relationship of wavelength and frequency. Determine this relationship as either direct or indirect.
3. Identify and sketch a diagram for the 3 major orbital shapes: s, p, d (f orbitals are too complicated).
4. Discuss the following with your group:
5. Heisenburg Uncertainity Principle
6. Wave-particle Duality

**Station #7: Bohr Model**

An electron falls from a higher energy level (n=4) to a lower energy level (n=2) what is the wavelength of light produced? What part of the Electromagnetic Spectrum does it fall under?

Which of the following electronic transitions would have the lower frequency:

(a) n = 6 to n = 2 (b) n = 5 to n =2

What color of visible light will each line emit?

\_\_\_\_\_\_\_\_\_\_\_\_ line *x,* 434 nm = 4.34 x 10-7 m

\_\_\_\_\_\_\_\_\_\_\_\_ line *y*, 656 nm = 6.56 x 10-7 m

\_\_\_\_\_\_\_\_\_\_\_\_ line *z*, 410 nm = 4.10 x 10-7 m

Is the energy absorbed equal to/ greater than/ less than the energy released?

**Station #8: Electron Configurations**

1. Write the electron configuration for Lithium, Manganese, and Iodine (write the noble gas configuration for one of those three.)
2. Draw the orbital diagrams for Magnesium, Sulfur, and Nickel

**Station #9: Periodic Properties**

1. Make a rough sketch of the periodic table and:
2. label and name 5 Periodic Families.
3. label the Periods
4. Shade in the metals, nonmetals, and metalloids. Use blue chalk for the metals yellow chalk for the non-metals, and green for metalloids.

2. Label and ID all the group with the correct Oxidation numbers

3. Name an element that belongs to:

 Alkali metals

 Alkaline earth metals

 Halogens

Noble gases

Transition metals

**Station #10: Periodic Trends**

1. For the following sets of elements rank them in increasing order of the indicated trend:

a. Atomic Radius (H, Li, Na, K Rb)

b. effective nuclear charge (K, Sc, Ga, Br, Kr)

c. Ionization energy (C, Ge, Sn, Pb)

d. electronegativity (I, Br, Cl, F)

1. List the oxidation numbers and valence electrons for the following:
2. Potassium - Valence: \_\_\_\_\_\_\_\_ Oxidation Number: \_\_\_\_\_\_\_\_
3. Nitrogen - Valence: \_\_\_\_\_\_\_\_ Oxidation Number: \_\_\_\_\_\_\_\_
4. Chlorine - Valence: \_\_\_\_\_\_\_\_ Oxidation Number: \_\_\_\_\_\_\_\_
5. Krypton - Valence: \_\_\_\_\_\_\_\_ Oxidation Number: \_\_\_\_\_\_\_\_

**Station #11: Ionic Nomenclature**

Use the Ion cards supplied at the table to create as many chemical compounds as possible. Once you have created a compound, name it.

No “Ion Card” Alternative

Copy this chart in chalk and complete as many as possible before time is called:

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  | Cl- | CO32- | OH- | SO42- | PO43- | NO3- |
| Na+ |  |  |  |  |  |  |
| NH4+ |  |  |  |  |  |  |
| K+ |  |  |  |  |  |  |
| Ca2+ |  |  |  |  |  |  |
| Mg2+ |  |  |  |  |  |  |
| Zn2+ |  |  |  |  |  |  |
| Fe3+ |  |  |  |  |  |  |
| Al3+ |  |  |  |  |  |  |
| Co3+ |  |  |  |  |  |  |
| Fe2+ |  |  |  |  |  |  |
| H+ |  |  |  |  |  |  |

**Station #12: Complete Nomenclature**

Use the *Amazing Race* Question Cards and answer all questions.

No question card alternative:

Complete the questions with the chalk:

1. For a compound to be classified as an acid, what element must be present?
2. What is the chemical formula for this compound: disulfur pentoxide?
3. What is the name for this compound: AgNO3
4. What is the chemical formula for this compound: acetic acid?
5. What is the name for this compound: ZnF2?
6. What is the charge (oxidation number) for potassium in potassium nitrate – KNO3?
7. What is the chemical formula for this compound: potassium nitride?
8. What is the chemical formula for this compound – manganese(II) chromate?
9. What is the name for this compound – VCO3?
10. What is the chemical formula for this compound – sulfuric acid?
11. What is the name for this compound – HNO3?
12. What is the chemical formula for this compound – iron(III) phosphate?
13. What is the charge (oxidation number) for **cobalt** in Co2CO3
14. What is the ionic charge on the chromium ion in the compound: Cr2O3?
15. What is the formula for hydrochloric acid?
16. Which of the following compounds contains the Mn2+?

a. Mn3N4

b. MnBr3

c. Mn2O3

d. Mn2P3

e. MnO

1. What is the name of CaBr2?
2. What is the name for Ti3N2?
3. What is the name for the following compound – LiC2H3O2?
4. What is the name for this compound: H2SO4?