Name_____

Cycle 5: The Periodic Table – Study Guide

Part 1: Periodic Properties – describe and locate each of the following.

Main group elements: Groups 1,2,13-18 (S & P blocks).

Halogens: Group 17, 7 valence electrons, most reactive of non-metals, react well with alkali metals to form salts.

Alkali Metals: Group 1 (except hydrogen), most reactive metals, violent reaction with water, tarnish in air, burn brightly, soft/malleable.

Alkaline Earth Metals: Group 2. Like Group 1 only slightly less reactive.

Transition Metals: Groups 3-12, d-block, outer 2 shells of electrons can participate in chemical bonding, less reactive than alkali and alkaline earth metals, some rarely form compounds and can be found pure in nature.

Lanthanides: Rare earth metals, atomic numbers 58-71 (after lanthanum), f-block with Actinides, shiny metals, slightly less reactivity than alkaline earth metals. All considered Group 3 "Rare Earths"

Actinides: Rare earth metals, atomic number 90-103 (after actinium), f-block. All radioactive!

Noble Gases: Group 18, full set of valence electrons, low reactivity (once thought to be completely inert, but Kr/Xe compounds are known today).

Part 2: Periodic Table – Fill in the blanks

The Periodic Law states that when elements are arranged in order of atomic number, their chemical and physical properties tend to repeat. A period is a horizontal row of elements, while a group is a vertical column. Element properties tend to repeat every period so that elements in a group tend to have similar chemical and physical properties. For example, the alkali metals are all soft, tarnish in air, react violently with water, form oxides with the formula M_2O, and chlorides with the formula MCl which are ionic compounds that dissolve in water. Elements in a group tend to have the same number of valence electrons, while elements in a period have the same number of electron energy levels (or 'shells').

The entire periodic table and be grouped into 3 rough categories of materials. Metals comprise the majority of the elements of the periodic table, are good conductors of heat and electricity, and react with acids to form salts. While some may be brittle, like manganese, many tend to be shiny, ductile, malleable. An good example would be gold or calcium. An alloy is a mixture of two or more and can be used to eliminate some of the disadvantages of the pure elements; such as how brass is harder than copper and more resistant to corrosion. A nonmetal is an element that does not conduct electricity and can often react with metals to form salts. An example would be hydrogen or fluorine. All but one of these is located on the right hand side of the table. A metalloid is the third category and falls in between the other two with some properties of each. An example would be silicon or antimony.

In 1865, John Newlands created the first periodic table by arranging the known elements according to their properties and in order of increasing atomic mass. He noticed that all the elements in a row had similar properties and called this pattern the Law of Octaves. In 1869, Dmitri Mendeleev produced the first orderly arrangement of all 63 elements known at the time. He also arranged the elements by atomic mass and made columns based on chemical and physical properties, but he left gaps for unknown elements. Around 1913, Henry Moseley used X-ray spectroscopy to measure atomic numbers for the first time and refined the periodic table.

Alkali metals, repeat, hydrogen, alloy, calcium, Law of Octaves, group, gaps, energy levels, gold, atomic mass, Dmitri Mendeleev, antimony, John Newlands, Henry Moseley, metalloid, Periodic Law, period, atomic mass, valence electrons, metals, fluorine, nonmetal, silicon

Part 3: Electron Configurations

Label the periodic table above with the letters of each element block – s, p, d, and f.

Write the full electron configuration for each of the following.

1. Lithium $1s^2\ 2s^1$

2. Sulfur $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^4$

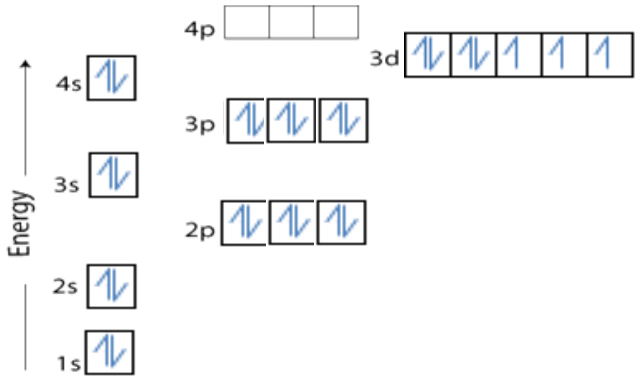
3. Strontium 1s2 2s2 2p6 3s2 3p6 4s2 3d10 4p6 5s2

Write abbreviated configurations for each of the following.

1. Argon [Ne] 3s2 3p6

2. Lead [Xe] 6s2 4f14 5d10 6p2

Fill in the electrons in the picture below for Cobalt, following the Aufbau principle.



A new element Q is discovered in a deep ocean trench. It is a clear, colorless gas under ordinary temperatures and pressures. It is unreactive with water, and does not form compounds directly with oxygen or any other known element. Which group of the Periodic Table would you assign this element to? Please cite one chemical and one physical property you used to determine this. **Group 18. Chemical property – doesn't form compounds. (on test, expect 'forms +3 ion' or similar). Physical property – clear colorless gas.**

Mark the trends for atomic size, ionization energy, and electron affinity across periods and down groups:

Ionization Energy: The energy you have to **give** to an atom to remove an electron from it. Increases across a period due to more protons in nucleus, same 'shielding' from inner electrons. Decreases down a group due to each shell being farther away from nucleus – inverse square low, lower attraction.

Electron Affinity: The energy **given off by** an atom when it accepts an extra electron. Increases (with exceptions to be dealt with later in AP) across a period due to more protons in nucleus, decreases down a group due to shells farther from nucleus.

Atomic Size: Decreases across a period because more protons in nucleus. Increases down a group because each shell is farther away. Anions (negative) larger than neutral atom because more electron-electron repulsion in valence shell – cations (positive) smaller due to less electron-electron repulsion in valence shell.