Week 6 Packet – Honors Chem

This is *hopefully* all the handouts we will use this week in Honors Chem. Due to the challenging logistics of this year, please offer grace if I miss a handout or if things change during the week. **Please note** – You do not *have* to print. I am just providing the option to make things easier for those who want to print. All of these pages are on the class website, always! www.mychemistryclass.net

***I will put the glue ins for the notes on the front and/or back of the packet cover page like this – since you don't need the cover page for anything you can always just cut these out and glue them in. Trying to save some paper for those of you who are printing! ☺**

N-13

He: $1s^2$

Ne: $1s^2\ 2s^2\ 2p^6$

Ar: $1s^2 2s^2 2p^6\ 3s^2\ 3p^6$

Kr: $1s^2 2s^2 2p^6 3s^2 3p^6\ 4s^2\ 3d^{10}\ 4p^6$

Xe: $1s^2 2s^2 2p^6 3s^2 3p^6 4s^2 3d^{10} 4p^6\ 5s^2\ 4d^{10}\ 5p^6$

A short cut method of writing configurations

Since noble gases are "special" – reference all configurations against the PREVIOUS noble gas

1) Find the previous noble gas
2) Write that noble gas in brackets [ ]
3) List any remaining electron configuration left over until you get to the element you are trying to write

N-13

Ga: $1s^2 2s^2 2p^6\ 3s^2\ 3p^6\ 4s^2\ 3d^{10} 4p^1$

Ga^+: $1s^2 2s^2 2p^6\ 3s^2\ 3p^6\ 4s^2\ 3d^{10}$

Ga^{2+}: $1s^2 2s^2 2p^6\ 3s^2\ 3p^6\ 4s^1\ 3d^{10}$

Ga^{3+}: $1s^2 2s^2 2p^6\ 3s^2\ 3p^6\ 3d^{10}$

Ga^{4+}: $1s^2 2s^2 2p^6\ 3s^2\ 3p^6\ 3d^9$

N-13

Lithium

$1s^2\ 2s^1$

Nitrogen

$1s^2\ 2s^2 2p^3$

Sodium

$1s^2 2s^2 2p^6\ 3s^1$

Iron

$1s^2 2s^2 2p^6\ 3s^2\ 3p^6\ 4s^2 3d^6$

Barium

$1s^2 2s^2 2p^6 3s^2 3p^6 4s^2\ 3d^{10} 4p^6\ 5s^2\ 4d^{10}\ 5p^6\ 6s^2$

Krypton

$1s^2 2s^2 2p^6\ 3s^2\ 3p^6\ 4s^2 3d^{10} 4p^6$

Li: $1s^2\ 2s^1$

Li^+:

Ca: $1s^2 2s^2 2p^6\ 3s^2\ 3p^6\ 4s^2$

Ca^{2+}:

Cu: $1s^2 2s^2 2p^6\ 3s^2\ 3p^6\ 4s^2\ 3d^9$

Cu^+:

Cu^{2+}:

N-12

1A	2A	3B	4B	5B	6B	7B	8B	9B	10B	11B	12B	3A	4A	5A	6A	7A	8A
Hydrogen 1 **H** 1.01																	Helium 2 **He** 4.00
Lithium 3 **Li** 6.94	Beryllium 4 **Be** 9.01											Boron 5 **B** 10.81	Carbon 6 **C** 12.01	Nitrogen 7 **N** 14.01	Oxygen 8 **O** 16.00	Fluorine 9 **F** 19.00	Neon 10 **Ne** 20.18
Sodium 11 **Na** 22.99	Magnesium 12 **Mg** 24.31											Aluminum 13 **Al** 26.98	Silicon 14 **Si** 28.09	Phosphorus 15 **P** 30.97	Sulfur 16 **S** 32.07	Chlorine 17 **Cl** 35.45	Argon 18 **Ar** 39.95
Potassium 19 **K** 39.10	Calcium 20 **Ca** 40.08	Scandium 21 **Sc** 44.96	Titanium 22 **Ti** 47.88	Vanadium 23 **V** 50.94	Chromium 24 **Cr** 52.00	Manganese 25 **Mn** 54.94	Iron 26 **Fe** 55.85	Cobalt 27 **Co** 58.93	Nickel 28 **Ni** 58.69	Copper 29 **Cu** 63.55	Zinc 30 **Zn** 65.39	Gallium 31 **Ga** 69.72	Germanium 32 **Ge** 72.61	Arsenic 33 **As** 74.92	Selenium 34 **Se** 78.96	Bromine 35 **Br** 79.90	Krypton 36 **Kr** 83.80
Rubidium 37 **Rb** 85.47	Strontium 38 **Sr** 87.62	Yttrium 39 **Y** 88.91	Zirconium 40 **Zr** 91.22	Niobium 41 **Nb** 92.91	Molybdenum 42 **Mo** 95.94	Technetium 43 **Tc** (98)	Ruthenium 44 **Ru** 101.07	Rhodium 45 **Rh** 102.91	Palladium 46 **Pd** 106.42	Silver 47 **Ag** 107.87	Cadmium 48 **Cd** 112.41	Indium 49 **In** 114.82	Tin 50 **Sn** 118.71	Antimony 51 **Sb** 121.76	Tellurium 52 **Te** 127.60	Iodine 53 **I** 126.90	Xenon 54 **Xe** 131.29
Cesium 55 **Cs** 132.91	Barium 56 **Ba** 137.33	Lanthanum 57 **La** 138.91	Hafnium 72 **Hf** 178.49	Tantalum 73 **Ta** 180.95	Tungsten 74 **W** 183.84	Rhenium 75 **Re** 186.21	Osmium 76 **Os** 190.23	Iridium 77 **Ir** 192.22	Platinum 78 **Pt** 195.08	Gold 79 **Au** 196.97	Mercury 80 **Hg** 200.59	Thallium 81 **Tl** 204.38	Lead 82 **Pb** 207.20	Bismuth 83 **Bi** 208.98	Polonium 84 **Po** (209)	Astatine 85 **At** (210)	Radon 86 **Rn** (222)
Francium 87 **Fr** (223)	Radium 88 **Ra** (226)	Actinium 89 **Ac** (277)	Rutherfordium 104 **Rf** (267)	Dubnium 105 **Db** (268)	Seaborgium 106 **Sg** (271)	Bohrium 107 **Bh** (272)	Hassium 108 **Hs** (270)	Meitnerium 109 **Mt** (276)	Darmstadtium 110 **Ds** (281)	Roentgenium 111 **Rg** (280)	Copernicium 112 **Cn** (285)	Nihonium 113 **Nh** (286)	Flerovium 114 **Fl** (289)	Moscovium 115 **Mc** (289)	Livermorium 116 **Lv** (293)	Tennessine 117 **Ts** (294)	Oganesson 118 **Og** (294)

*lanthanides	Lanthanum 57 **La** 138.91	Cerium 58 **Ce** 140.12	Praseodymium 59 **Pr** 140.91	Neodymium 60 **Nd** 144.24	Promethium 61 **Pm** (145)	Samarium 62 **Sm** 150.36	Europium 63 **Eu** 151.97	Gadolinium 64 **Gd** 157.25	Terbium 65 **Tb** 158.93	Dysprosium 66 **Dy** 162.50	Holmium 67 **Ho** 164.93	Erbium 68 **Er** 167.26	Thulium 69 **Tm** 168.93	Ytterbium 70 **Yb** 173.04	Lutetium 71 **Lu** 174.97
**actinides	Actinium 89 **Ac** (227)	Thorium 90 **Th** 232.04	Protactinium 91 **Pa** 231.04	Uranium 92 **U** 238.03	Neptunium 93 **Np** (237)	Plutonium 94 **Pu** (244)	Americium 95 **Am** (243)	Curium 96 **Cm** (247)	Berkelium 97 **Bk** (247)	Californium 98 **Cf** (251)	Einsteinium 99 **Es** (252)	Fermium 100 **Fm** (257)	Mendelevium 101 **Md** (258)	Nobelium 102 **No** (259)	Lawrencium 103 **Lr** (262)

Dougherty Valley HS Chemistry
Electron Configuration - Basic

Worksheet #3

Name: **Period:** **Seat#:**

An electron configuration is a method of indicating the arrangement of electrons about a nucleus. A typical electron configuration consists of numbers, letters, and superscripts with the following format:

1) A number indicates the energy level (The number is called the principal quantum number, and is represented by an n typically).
2) A letter indicates the type of orbital: s, p, d, f.
3) A superscript indicates the number of electrons in the orbital. Example $1s^2$ means that there are two electrons in the "s" orbital in the first energy level. That element would be Helium.

To write an electron configuration:

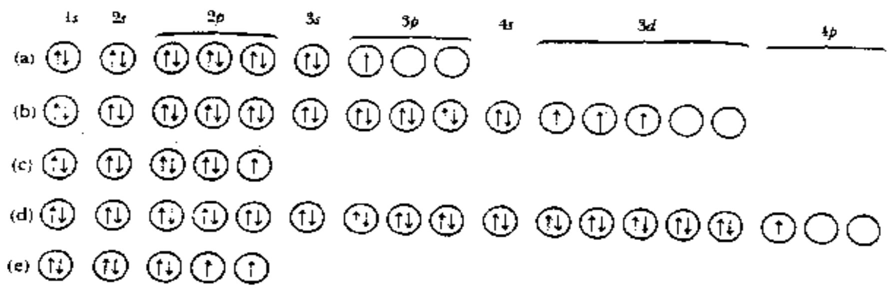
1) Determine the total number of electrons to be represented.
2) Use the Aufbau principal to fill the orbitals with electrons. The Aufbau principal requires that the electrons fill the lowest energy orbitals first. In other words, atoms are built from the "ground up." You can use an orbital diagram to help you determine the order that the orbitals come in. You can also use a periodic table to tell you the same information based on the patterns on the table.
3) List the energy level, orbital type, and number of electrons used for each orbital filled with electrons. This list is the "electron configuration."
4) The sum of the superscripts should equal the total number of electrons. For example: $1s^2 2s^2 2p^6 3s^2$ is Magnesium because it has 12 electrons (2+2+6+2=12)

Configuration Writing Practice

Write a "ground state" electron configuration for each neutral atom. Ground state means that all of the lowest possible energy levels are filled – in other words, it means that the Aufbau principle is being followed. If an atom is in an "excited state" it means that the atom was given extra energy and it caused some electrons to be pushed to higher energy levels/orbitals which actually breaks the Aufbau principle. We will learn more about "excited states" later in the chapter. Ground state configurations are often just called "normal" configurations.

Q#	Total # e-	Electron Configuration
1) Na		
2) Pb		
3) Sr		
4) U		
5) N		
6) Ag		
7) Ti		
8) Ce		
9) Cl		
10) Hg		

11) Write the corresponding electron configuration for each of the following pictorial representations. Name the element that each picture represents, assuming they are neutral atoms



Q	Total # e-	Name	Electron Configuration
a			
b			
c			
d			
e			

12) Indicate which groups of elements have an outer configuration indicated below. **you can just list which atomic numbers fulfill each requirement. Some chemists call these various elements the s-block, p-block, d-block and f-block*

s electron configuration	
p electron configuration	
d electron configuration	
f electron configuration	

13) Determine the element of the lowest atomic number whose “ground state” contains:

Three d electrons	
A complete d set/subshell	
Ten total p electrons	
An f electron	
13 d electrons	
23 p electrons	
7 s electrons	

14) How many total p electrons are there in the ground state of a phosphorus atom?

15) What is the maximum number of electrons that can be accommodated in an energy level of n=3? In other words, how many electrons can the third energy level hold all together?

Dougherty Valley HS Chemistry
Electron Configuration – Noble Gas Configuration

Worksheet #4

Name: **Period:** **Seat#:**

1) Neon

Orbital diagram																		
Electron configuration																		
E.C. using noble gas notation																		

2) Magnesium

Orbital diagram																		
Electron configuration																		
E.C. using noble gas notation																		

3) Chlorine

Orbital diagram																		
Electron configuration																		
E.C. using noble gas notation																		

4) Potassium

Orbital diagram																		
Electron configuration																		
E.C. using noble gas notation																		

5) Iron

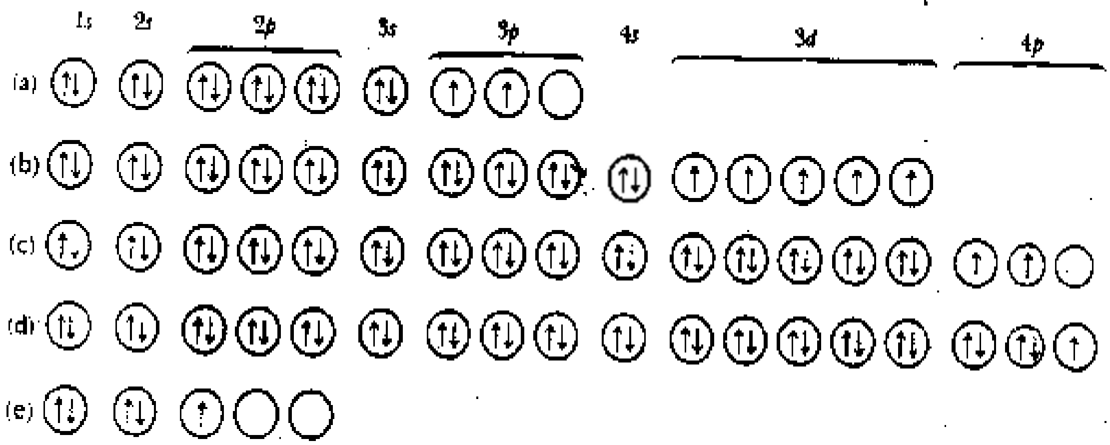
Orbital diagram																		
Electron configuration																		
E.C. using noble gas notation																		

6) Krypton

Orbital diagram																		
Electron configuration																		
E.C. using noble gas notation																		

Dougherty Valley HS Chemistry
Electron Configuration – Noble Gas Configuration

7) Write the corresponding NOBLE GASS configuration for each of the following pictorial representations. Name the element assuming that the configuration describes a neutral atom.



Q	Total # e-	Name	Noble Gas Configuration
a			
b			
c			
d			
e			

8) Which group of elements has a noble gas configuration that ends in ns^2?

Dougherty Valley HS Chemistry
Electron Configuration – Ions

Worksheet #5

Name: **Period:** **Seat#:**

An atom has the tendency to lose electrons (to another atom) or to gain electrons (from another atom) in order to make the outer shell (valence shell) complete with eight electrons. This is called a “full valence shell.” Not all orbitals are full with 8, but 8 is the common number to be considered full. Atoms with a complete outer shell are considered stable. Some atoms naturally have eight electrons in their outer shell and are very stable – these are the “Noble Gases” and they are typically unreactive or “inert.” He, Ne, Ar, Kr, Xe and Rn are these very stable Noble Gases. (Helium is an exception to the “8 is great” stability rule because it is stable with only two electrons in its outer shell.) **Complete the following chart:**

Element	Atomic number	Electron Configuration	Number electrons in each energy level	Number e^- probably lost or gained	# e- left after loss or gain	Charge on ion
O	8	$1s^2\ 2s^2 2p^4$	2, 6	Gain 2	10	–2
Na	11	$1s^2 2s^2 2p^6 3s^1$	2, 8, 1	Lose 1	10	+1
S						
K						
Al						
Cl						
Xe						
Ca						
F						
Br						
N						
Ar						
I						
Sr						

Dougherty Valley HS Chemistry
Electron Configuration – Ions

Write the ground state electron configurations for the following ions.
Remember that ions have a change in their total number of electrons. Positive ions have lost electrons, and negative ions have gained electrons. Use the chart you just made on the front to help you do this faster (you figured out the ion charge on the front and the starting configuration already!)

Element	Ion Symbol	Electron Configuration for the ION	Number electrons in The VALENCE SHELL now that it is an ion
O	O^{2-}	$1s^2\ 2s^2 2p^6$	8
Na	Na^+	$1s^2 2s^2 2p^6$	8
S			
K			
Al			
Cl			
Xe	NA	NA	NA
Ca			
F			
Br			
N			
Ar	NA	NA	NA
I			
Sr			

Dougherty Valley HS Chemistry
Electron Configuration – Ions

Write the ground state electron configuration for the following ions:

1) O^{+}	
2) C^{-}	
3) F^{+}	
4) Ar^{+}	
5) Look at the configurations that you wrote in Q#1 – are those ions that those atoms would ***want*** to make? Why or why not?	

Write the NOBLE GAS configuration for the following ions:

6) Cl^{-}	
7) P^{3-}	
8) Br^{-}	
9) Se^{2-}	
10) Na^{+}	
11) Ba^{2+}	
12) Fe^{3+}	
13) Ag^{+}	
14) Ni^{2+}	
15) Cr^{3+}	

Determine the number of unpaired electrons in the ground state of the following ions.
You can use an orbital diagram to help you, but you can also just use the periodic table!

16) F^{+}		**20)** Describe why atoms like to make certain ions. Also describe the pattern on the periodic table that lets us find the preferred ion quickly!
17) Sn^{2+}		
18) Bi^{3+}		
19) Ar^{+}		