iHonors Chemistry **Name _____**

Unit 5 Chemical Bonding Test **Block _____ Score ___/60 points**

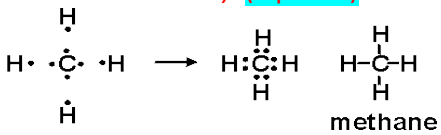
1.) Explain how ionic bonding occurs. Which subatomic particles are involved? Use Lewis dots to show how atoms on the periodic table form an ionic bond. Label which atom is the cation and which is the anion and show their ionic charges. (10 points)

Ionic bonding occurs when a **metal** **transfers** **valence electrons** to a **nonmetal** forming a **cation** and an **anion**. *(Lewis structure must show a curved arrow and not a connecting bond line. Student must also draw charges on ions and all lone pair electrons.)*

(1 point for each underlined word; 1 point for each atom including curved arrow; 1 pt for Lewis dots of each ion)

2.) Explain how covalent bonding occurs. Which subatomic particles are involved? Use Lewis dots to show how atoms on the periodic table form a covalent bond.

Covalent bonding occurs when **two nonmetal atoms** **share** **valence electrons**. *(Lewis dots must show single, double, or triple bonds. Lone pairs must be included.)* (6 points)



(1 point for each underlined word; 1 point for Lewis dots of each atom; 1 point for proper bond type.)

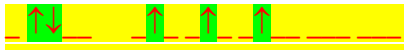
3.) Fill in the Aufbau arrows for Titanium. Then write the possible oxidation numbers and explain how each was obtained.

If Titanium loses the $4s^2$ electrons it will have a +2 charge.

If Titanium loses the $4s^2$ and second 3d electron it will be a +3.

If Titanium loses the $4s^2$ and both 3d electrons it will be +4.

Fill in the Aufbau arrows for Vanadium. Then write the possible oxidation numbers and explain how each was obtained.



If Vanadium loses the $4s^2$ electrons it will have a +2 charge.

If Vanadium loses the $4s^2$ and last unpaired 3d electron it will be a +3.

If Vanadium loses the $4s^2$ and 2^{nd} an 3^{rd} unpaired 3d electrons it will be +4.

If Vanadium loses the 4s2 and all unpaired 3d electrons it will be +5.

Elements in the d-block have many **unpaired electrons** so they are **eager to bond** in order to **become stable**. Therefore, they alter their oxidation state in order to form more bonds. (1 point)

4.) Explain why the oxidation number for the alkaline earth group is different than the oxidation number for the halogen group. What are the oxidation numbers for each group? Which subatomic particles are involved? Give an example *from each group* by showing the electron configuration for the atom and the ion. (8 points)

Alkaline earth metals have an oxidation number of **+2** because they **lose two electrons** in the s-block.

Example: Magnesium atom (Mg) = **$1s^2\ 2s^2\ 2p^6\ 3s^2$** Magnesium cation (Mg^{+2}) = **$1s^2\ 2s^2\ 2p^6$**

Halogens nonmetals have an oxidation number of **-1** because they **gain one electron** in the p-block.

Example: Fluorine atom (F) = $1s^2\ 2s^2\ 2p^5$ Fluorine anion (F^{-1}) = $1s^2\ 2s^2\ 2p^6$

5.) Draw the Lewis dot structures for the following atoms: (7 points)

P	Ca	Al	O	Br	Xe	K
·P·	·Ca·	Al·	·O:	·Br:	:Xe:	K·

6.) Based on the electronegativity chart provided below, which two atoms will create the *most* polar bond? Write their symbols and EN values, then calculate the difference in their electronegativity values. What type of bond is formed when they join? Explain the reason for your answer. (5 points)

H 2.1						
Li 1.0	Be 1.5	B 2.0	C 2.5	N 3.0	O 3.5	F 4.0
Na 0.2	Mg 1.2	Al 1.5	Si 1.8	P 2.1	S 2.5	Cl 3.0

Na = 0.2 **F = 4.0**

Electronegativity difference = **3.8**

An **ionic bond** is formed…

Because **sodium is a metal** and fluorine is a nonmetal and their **ΔEN >1.6**

Based on the electronegativity chart provided below, choose two atoms that will create the least polar bond type? Write their symbols and EN values, then calculate the difference in their electronegativity values. What type of bond is formed when they join? Explain the reason for your answer. (5 points)

1.) Fill in the chemical formulas for the following compounds and molecules. (10 points)

Ba_3As_2	_barium arsenide_	$Sn(SO_3)_2$	_tin IV sulfite_
P_4O_{10}	_tetraphosphorus decaoxide_	NH_3	_ammonia_
$NaHCO_3$	_sodium bicarbonate_	$Fe(ClO_2)_3$	_iron III chlorite_
AuP	_gold III phosphide_	BF_3	_boron trifluoride_
N_2O_3	_dinitrogen trioxide_	H_2SO_4	_sulfuric acid_

2.) Fill in the chemical names for the following compounds and molecules. (10 points)

chromium II oxide	_CrO_	potassium phosphate	_K_3PO_4_
sulfur dibromide	_SBr_2_	hydrobromic acid	_HBr_
aluminum chloride	_$AlCl_3$_	carbon monoxide	_CO_
methane	_CH_4_	xenon hexafluoride	_XeF_6_
copper II nitrite	_$Cu(NO_2)_2$_	titanium IV oxide	_TiO_2_

9) Indicate the number of atoms for each element in ammonium nitrate. (3 points)

NH4NO3 N = _2_ H = _4_ O= _3_