NS E2 (pg 1 of 1) Writing Chemical Formulas for Binary Ionic Compounds

Name___________________

Introduction – review of our class discussion

As you learned in Chap 11, metals like to lose electrons, and nonmetals like to gain electrons. Thus when metals and nonmetals come together, they can each reach electronic nirvana. Remember that the number of valence electrons determines the number of electrons that will be lost or gained. This is correlated to the column that the element is in on the Periodic Table. The Table is grouped this way because elements in the same column behave the same way chemically.

No atom can randomly throw off e– or gain e– unless there is some other atom around to accept or provide them. So Na is "standing on the corner, feeling lousy" with its 1 extra valence e– and along comes chlorine, "feeling lousy" since it would really like to have one more e–. They get together and make the transfer of e– with each atom becoming an ion (and then the opposite charges hold them together), making an ionic compound with the NaCl unit held together by an ionic bond.

Representative Elements – Binary Ionic Compounds

(Binary means two elements only)

Using Groups: metals 1A, 2A, 3A, nonmetals 5A, 6A, 7A

What if sodium wanted to hang around oxygen instead? Na would give up $1e^-$ and feel good, but not completely satisfy the oxygen who wants to get $2e^-$. So Na has to bring its "sister or brother" to hang with the oxygen atom to provide the total of $2e^-$ thereby satisfying the O, making the compound Na_2O

This is the start of writing the chemical formulas for ionic compounds. Remember that the column that the atom is in on the Periodic Table tells us how many valence electrons an atom has which impacts how many e- that atom wants to lose or gain which results in a particular ion. The short-hand way to write chemical formulas for ionic compounds (remember this is just metals + nonmetals) is to look at the combination of the two ions and combine the correct number of each ion so the total positive charge will be equal (though opposite) to the total negative charge.

The players (atoms)	**The ions they form**	**The method these atoms** (players) **must combine to ensure that the number of electrons transferred satisfies both players** (atoms).	**The resulting chemical formula** (the team)	**The name of the ionic compound**
Na & Cl	Na^+ Cl^-	Since the +/– charges are equal, only one of each ion is needed to satisfy; no subscripts	NaCl	Sodium chlor*ide*
Na & O	Na^+ O^{2-}	Two sodiums needed to make 2+ to balance 2–. Use the "criss-cross" method.	Na_2O	Sodium ox*ide*
Na & P	Na^+ P^{3-}	Three sodiums will provide a total of 3 electrons and ending up with a 3+ charge which balances the phosphorus' need for three electrons and a 3– charge. Use the "criss-cross" method.	Na_3P	Sodium phoph*ide*
Ba & F	Ba^{2+} F^-	Two fluorines needed to make 2– to balance the 2+. Use the "criss-cross" method.	BaF_2	Barium flour*ide*
Ba & S	Ba^{2+} S^{2-}	Since the +/– charges are equal, only one of each ion is needed to satisfy; no subscripts	BaS	Barium sulf*ide*
Ba & N	Ba^{2+} N^{3-}	Three bariums will provide a total of 6 electrons (6+ charge) which will satisfy two nitrogens that need a total of 6 electrons (6– charge). Use the "criss-cross" method.	Ba_3N_2	Barium nitr*ide*

A few reminders:

- At this point you have the tools needed to combine elements in columns 1A, 2A, and 3A with columns 5A, 6A, and 7A.
- Notice that the metal (+ ion, cation) is always written first, and the nonmetal (– ion, anion) is always written second.
- Be sure and pay attention to upper and lower case letters, Cs and CS do NOT have the same meaning.
- Remember that the placement of numbers around a symbol have very particular meanings
  - ✓ charges are written as superscripts (top right, X^{2+})
  - ✓ number of ions present in the formula are written as subscripts (lower right, X_3)

So what about the rest of the metals?

So far the discussion has included only some of the metals in the periodic chart, NS E4 will to look at the transition metals and the "other six" metals under the staircase ($_{31}$Ge, $_{50}$Sn, $_{51}$Sb, $_{82}$Pb, $_{83}$Bi, $_{84}$Po).