The Cross Rule for Writing Chemical Formulas

Recognize this:
1. the **combining capacity** of an element is defined as a **number** which represents the ability of the element to combine with another element and the combining capacity is given in the table of elements beside the element.
2. compounds with 2 elements in them end in '**ide**' (such as sodium chloride).

The rules for formula determination are:

1. Write each element with its combining capacity as a **superscript** up and to the right.

$$Ca^{2}\ Cl^{1}$$

2. Cross the numbers to the other element into a down **subscript** position.

$$Ca^{2}\ Cl^{1} \quad = \quad Ca_{1}\ Cl_{2}$$

3. Drop any value of 1 and reduce any common factors like in math.

$$Ca_1Cl_2 \text{ becomes } CaCl_2$$

4. When giving this formula an English name, be sure it ends in 'ide'

$CaCl_2$ is called **calcium chloride**

This rule works for all compounds if you are careful, although things get a bit more complex as we go further. The reasons for why these rules work are a topic in Grade 11 and 12 Chemistry. Don't rush it, do it exactly this way, and you will amaze yourself with your abilities in chemistry.

Name:_____

Formula Assignment #1
Compound Names and Formulas
Elements with ONE Combining Capacity ONLY

A. Name these Compounds

1. Li_2S _____
2. CaO _____
3. NaF _____
4. $CaBr_2$ _____
5. $MgCl_2$ _____
6. BBr_3 _____
7. Cs_2O _____
8. FrBr _____
9. Ag_2S _____
10. GeF_4 _____
11. Ga_2O_3 _____
12. $EsCl_3$ _____
13. Fm_2O_3 _____
14. Mg_3N_2 _____
15. Rb_2O _____
16. RaO _____
17. SrO _____
18. Tc_2O_7 _____

B. Write the correct chemical formula for these compounds by using the cross rule.

1. sodium chloride _____
2. magnesium fluoride _____
3. silver oxide _____
4. indium bromide _____
5. zinc bromide _____
6. neodymium oxide _____
7. thorium sulphide _____
8. actinium oxide _____
9. radium bromide _____
10. cesium oxide _____
11. hydrogen oxide _____
12. francium nitride _____
13. rubidium phosphide _____
14. potassium oxide _____
15. beryllium sulphide _____
16. lithium sulphide _____
17. hydrogen bromide _____
18. strontium nitride _____
19. calcium oxide _____
20. tantalum nitride _____

Name:_____

Formula Assignment #2
Compound Names and Formulas
Elements with TWO OR MORE Combining Capacities

A. Write the correct formula for the following compounds, all of which have been named using the modern Roman Numeral Method. The combinign capacity is given after the first element (metallic) in Roman Numerals.

1. copper (II) oxide _____
2. mercury (I) oxide _____
3. gold (III) chloride _____
4. thallium (III) bromide _____
5. bismuth (V) oxide _____
6. terbium (III) oxide _____
7. uranium (VI) oxide _____
8. protactinium (III) bromide _____
9. cerium (III) oxide _____
10. arsenic (V) sulphide _____
11. manganese (III) oxide _____
12. vanadium (II) bromide _____
13. niobium(V) oxide _____
14. titanium (III) oxide _____
15. titanium (III) nitride _____
16. iron (II) oxide _____
17. cobalt (II) phosphide _____
18. tin (II) oxide _____
19. thulium (II) bromide _____
20. copper (II) bromide _____

B. Determine the combining capacity of the first element by using the reverse cross rule. Name the compound using the Roman Numeral Method.

1. $SnCl_4$ _____
2. $BiBr_5$ _____
3. PoO_2 _____
4. PbI_2 _____
5. HgO _____
6. $HgCl$ _____
7. Au_2O_3 _____
8. $FeCl_2$ _____
9. PdF_4 _____
10. Os_2O_3 _____
11. $MoBr_3$ $MoBr_2$ _____
12. VCl_5 VCl_5 _____
13. Mn_2O_3 _____
14. CoO _____
15. Np_2O_3 _____
16. V_2O_5 _____

Name:_____

Formula Assignment #3
Compound Names and Formulas
Elements with ONE, TWO OR MORE Combining Capacities

A. Write the correct formula for the following compounds.

1. gallium oxide _____
2. mercury (I) chloride _____
3. tin (IV) bromide _____
4. indium oxide _____
5. cadmium sulphide _____
6. magnesium oxide _____
7. potassium nitride _____
8. iron (III) sulphide _____
9. gold (III) bromide _____
10. zinc oxide _____
11. silicon oxide _____
12. aluminum bromide _____
13. tin (II) sulphide _____
14. germanium (III) bromide _____
15. nickel (II) oxide _____
16. strontium astatide _____
17. aluminum oxide _____
18. copper (II) oxide _____
19. lawrencium fluoride _____
20. actinium oxide _____

B. Determine the combining capacity of the first element by using the reverse cross rule. Name the compound correctly. Only include the Roman Numeral in the name if the first element has 2 or more combining capacities.

1. $CaBr_2$ _____
2. K_2O _____
3. Fe_2O_3 _____
4. ZnF_2 _____
5. $CuCl$ _____
6. Ni_2O_3 _____
7. $AuCl$ _____
8. $HgBr$ _____
9. $AsCl_5$ _____
10. Eu_2O_3 _____
11. $NdBr_3$ _____
12. Cu_3N_2 _____
13. CoS _____
14. ZrO_2 _____
15. Li_2O _____
16. NaH _____

Name:_____

Formula Assignment #4
Compound Names and Formulas
Compounds with Polyatomic Ions

A. Write correct formula for these compounds. They all contain polyatomic ions.

1. ammonium chloride _____
2. sodium chlorate _____
3. sodium sulphate _____
4. potassium sulphite _____
5. calcium phosphate _____
6. calcium hydroxide _____
7. iron (III) hydroxide _____
8. copper (II) sulphate _____
9. sodium phosphite _____
10. lithium chlorate _____
11. gold (III) hydroxide _____
12. sodium carbonate _____
13. calcium hydrogen carbonate _____
14. ammonium nitrate _____
15. ammonium carbonate _____
16. ammonium sulphate _____
17. lithium phosphate _____
18. iron (III) sulphate _____
19. potassium hydroxide _____
20. ammonium hydroxide _____

B. Name the following compounds which contain polyatomic ions correctly.

1. $CaCO_3$ _____
2. $NaHCO_3$ _____
3. NH_4OH _____
4. H_2SO_4 _____
5. $NaNO_3$ _____
6. $Fe_2(CO_3)_3$ _____
7. $Al_2(SO_4)_3$ _____
8. HOH _____
9. $Ca(NO_3)_2$ _____
10. Li_2CO_3 _____
11. $Zn(OH)2$ _____
12. $Ca(OH)2$ _____
13. $Cr(OH)3$ _____
14. $Ca(ClO_3)_2$ _____
15. $Pb_3(PO_4)_2$ _____
16. $BaCO_3$ _____
17. $Be(OH)_2$ _____
18. Li_3PO_4 _____
19. $Fe_2(CO_3)_3$ _____
20. H_3PO_4 _____

Name:_____

Formula Assignment #5
Compound Names and Formulas
Compounds that use the Prefix System

Prefixes and their meanings
mono = 1, di or bi = 2, tri = 3, teta = 4, penta = 5, hexa = 6, hepta = 7, octo = 8, nona = 9, deca = 10

A. Write the correct chemical formula for these compounds. The prefix in front of the element indicates how many of that atom will be in the compound. DO NOT USE THE CROSS RULE FOR THESE COMPOUNDS.

1. carbon monoxide _____
2. carbon tetrachloride _____
3. carbon dioxide _____
4. sulphur dioxide _____
5. sulphur trioxide _____
6. diphosphorous trioxide _____
7. carbon tetrafluoride _____
8. lead dioxide _____
9. dihydrogen dioxide _____
10. selenium trioxide _____
11. boron trichloride _____
12. carbon tetraiodide _____
13. boron trichloride_____
14. carbon tetrafluoride _____
15. aluminum tribromide _____
16. selenium trioxide _____
17. nitrogen trifluoride _____
18. sulphur dichloride _____
19. nitrogen dioxide _____
20. dinitrogen tetroxide _____

B. The following elements exist in nature as diatomic molecules (2 atoms per molecule). Write the formula for each of these elements.

1. hydrogen gas _____H_2_____
2. chlorine gas _____
3. nitrogen gas _____
4. oxygen gas _____
5. fluorine gas _____
6. bromine gas _____
7. iodine solid _____

Name:_____

Formula Assignment #6
Compound Names and Formulas
Summary

A. Write correct formula for these compounds.

1. boron chloride _____
2. aluminum hydroxide _____
3. silver sulphide _____
4. iron (II) iodide _____
5. copper (I) oxide _____
6. tin (IV) nitrate _____
7. zinc bromide _____
8. nickel (III) oxide _____
9. ruthenium sulphide _____
10. titanic oxide _____
11. magnesium carbonate _____
12. calcium hydroxide _____
13. cesium sulphide _____
14. carbon tetrachloride _____
15. hydrogen gas _____
16. carbon disulphide _____
17. beryllium nitrate _____
18. sodium hydrogen carbonate _____
19. water _____
20. lanthanum oxide _____

B. Name the following compounds correctly.

1. H_2O _____
2. PbI_2 _____
3. $MgCl_2$ _____
4. Na_2O _____
5. $HgCl_2$ _____
6. Ag_2O _____
7. Na_3PO_4 _____
8. $CaCO_3$ _____
9. $FeCO_3$ _____
10. YBr_3 _____
11. Al_2O_3 _____
12. CO_2 _____
13. SiO_2 _____
14. NO_2 _____
15. H_2SO_4 _____
16. $NaClO_3$ _____
17. $AuCl_3$ _____
18. $BiCl_5$ _____
19. Rb_3N _____
20. $Ba(NO_3)_2$ _____