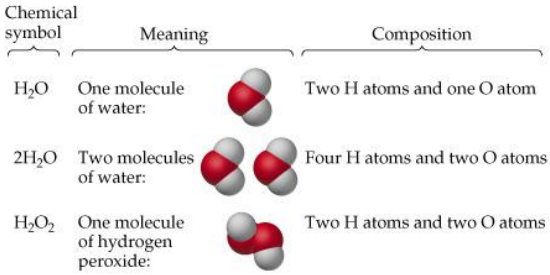
Name: _____ Date: _____ Period: _____

AcCounting for Atoms

Ah! Numbers! So many numbers! What does it all mean?

Just like in mathematics where there is an order of operations (BEDMAS), there is a method to correctly count the number of atoms in a chemical expression. Read on to see how this works!



LEVEL 1: ELEMENTS AND SUBSCRIPTS

- Every element symbol has a capital letter. Many elements have one or more lowercase letters after the capital letter.
- A subscript on the right of an element indicates the number of atoms of that element. If there is no subscript, there is only one of that element.

For each of the following:

a) Colour each element a different colour
b) Draw the compound, showing the atoms
c) Write the total number of atoms of each element

O_2	$MgCl_2$	$NaNO_3$
Co_2S_3	PF_4	CH_3CH_2OH

Write how many of each atom there is in each compound.

Compound	Counting	Compound	Counting	Compound	Counting
$CaCO_3$		Be_3N_2		CCl_4	
H_2O		NaOH		$MgBr_2$	

LEVEL 2: POLYATOMIC IONS, BRACKETS, AND SUBSCRIPTS

- For ionic compounds containing polyatomic ions, a subscript on the right of a bracket indicates how many of that polyatomic ion are in the compound.

Draw the following ionic compounds and write how many of each atom is present.

$Be_3(PO_4)_2$	$Mg(OH)_2$

$Ti_2(CrO_4)_3$	$Ni(HS)_3$

Write how many of each atom there is in each compound.

Compound	Counting	Compound	Counting
$Cr(CN)_3$		$(NH_4)_3PO_4$	
$Sc_2(Cr_2O_7)_3$		$Mg(CH_3COO)_2$	

LEVEL 3: COEFFICIENTS AND ADDITION		
• A coefficient in front of a compound or element indicates how many of that compound or element.	3Al	$2MgCl_2$
• A plus sign means the two elements/compounds are mixed together in a container. • Draw the elements/compounds separately. • Count elements one at a time (e.g. how much oxygen across the entire expression? How much hydrogen?)	$3H_2O + 2O_2$	

Draw each of the following chemical expressions. Then write the total number of each atom that is present.

Chemical(s)	Draw and Count	Chemical(s)	Draw and Count
$2PF_3$		$2H_2O$	
$2S_3$		$2H_2O + 3O_2$	
$3Mg(OH)_2$		$2Ca(HSO_3)_2$	

PUTTING IT ALL TOGETHER

For each element, you may need to multiply three numbers together.

- Coefficient in front of compound or element
- Subscript next to element
- Subscript outside of bracket containing element

e.g. oxygen: $4Ni(NO_3)_2$

If you see a plus sign, then count the atoms in all compounds or elements first. Finally, add the counts for all repeated elements together.

How many…?	**Subscript next to element**	**Subscript outside of bracket containing element**	**Coefficient**	**Multiply**
Oxygen in $3H_2O$	1	N/A	3	1 x 3 = 3
Oxygen in $4Ni(NO_3)_2$	3	2	4	3 x 2 x 4 = 24
Nickel in $2Ni(NO_3)_3$	1	N/A	2	1 x 2 = 2
Oxygen in N_2O_4				
Vanadium in $2V(HSO_3)_4$				
Oxygen in $2V(HSO_3)_4$				
Hydrogen in $2V(HSO_3)_4$				
Chromium in $4Mn_2(CrO_4)_3$				
Iron in $2Fe_2S_3$				
Hydrogen in $(NH_4)_3P$				
Carbon in $3Rb_2CO_3$				
Carbon in $Cr(CH_3COO)_3$*				
Hydrogen in $2Mg(CH_3COO)_2$*				

*CH_3COO is the proper way to write the acetate ion. However, it can be thought of as $C_2H_3O_2$. E.g. $Ti(CH_3COO)_3$ would have 1 Ti, 6 C, 9 H, 6 O.

For each of the following, count the total number of each unique element. If you need, draw the expressions on a separate page.

$2BF_3 + 3N_2$	B: _____	F: _____	N: _____
$3CO_2 + 4H_2O$	C: _____	O: _____	H: _____
$2C_3H_8 + H_2SO_4$			
$3N_2 + Ca(NO_3)_2$			
$P_2Cl_4 + 2CuCl_2$			
$2S_8 + Mn_2(SO_3)_3$			
$H_3PO_4 + 3NaOH$			
$3C_2H_5OH + 5O_2$			