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:*

1. *Colour each element a different colour*
2. *Draw the compound, showing the atoms*
3. *Write the total number of atoms of each element*

|  |  |  |
| --- | --- | --- |
| O2 | MgCl2 | NaNO3 |
| Co2S3 | PF4 | CH3CH2OH |

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

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Compound** | **Counting** | **Compound** | **Counting** | **Compound** | **Counting** |
| CaCO3 |  | Be3N2 |  | CCl4 |  |
| H2O |  | NaOH |  | MgBr2 |  |

|  |
| --- |
| **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.*

|  |  |
| --- | --- |
| Be3(PO4)2 | Mg(OH)2 |
| Ti2(CrO4)3 | ­ Ni(HS)3 |

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

|  |  |  |  |
| --- | --- | --- | --- |
| **Compound** | **Counting** | **Compound** | **Counting** |
| Cr(CN)3 |  | (NH4)3PO4 |  |
| Sc2(Cr2O7)3 |  | Mg(CH3COO)2 |  |

|  |  |  |
| --- | --- | --- |
| **Level 3: Coefficients and Addition** | | |
| * A coefficient in front of a compound or element indicates how many of that compound or element. | 3Al | 2MgCl2 |
| * 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?) | 3H2O + 2O2 | |

*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** |
| 2PF3 |  | 2H2O |  |
| 2S3 |  | 2H2O + 3O2 |  |
| 3Mg(OH)2 |  | 2Ca(HSO3)2 |  |

|  |
| --- |
| **Putting it All Together**  4Ni(NO­3)2  e.g. oxygen: |
| 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   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 3H2O | 1 | N/A | 3 | 1 x 3 = 3 |
| Oxygen in 4Ni(NO3)2 | 3 | 2 | 4 | 3 x 2 x 4 = 24 |
| Nickel in 2Ni(NO3)3 | 1 | N/A | 2 | 1 x 2 = 2 |
| Oxygen in N2O4 |  |  |  |  |
| Vanadium in 2V(HSO3)4 |  |  |  |  |
| Oxygen in 2V(HSO­3)4 |  |  |  |  |
| Hydrogen in 2V(HSO3)4 |  |  |  |  |
| Chromium in 4Mn2(CrO4)3 |  |  |  |  |
| Iron in 2Fe2S3 |  |  |  |  |
| Hydrogen in (NH4)3P |  |  |  |  |
| Carbon in 3Rb2CO3 |  |  |  |  |
| Carbon in Cr(CH3COO)3\* |  |  |  |  |
| Hydrogen in 2Mg(CH3COO)2\* |  |  |  |  |

\*CH3COO is the proper way to write the acetate ion. However, it can be thought of as C2H3O2. E.g. Ti(CH3COO)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.*

|  |  |
| --- | --- |
| 2BF3 + 3N2 | B: \_\_\_\_\_ F: \_\_\_\_\_ N: \_\_\_\_\_ |
| 3CO2 + 4H2O | C: \_\_\_\_\_ O: \_\_\_\_\_ H: \_\_\_\_\_ |
| 2C3H8 + H2SO4 |  |
| 3N2 + Ca(NO3)2 |  |
| P2Cl­4 + 2CuCl2 |  |
| 2S8 + Mn2(SO3)3 |  |
| H3PO4 + 3NaOH |  |
| 3C2H5OH + 5O2 |  |