**Percent Composition Worksheet**

1. Write the formula for each of the following compounds and determine the percent composition of each:
   - **a.** Nitric Acid
     Step 1: Calculate the molar mass of nitric acid.
     Step 2: Calculate the percent composition for each element in nitric acid: H, N and O

$HNO_3$

1 + 14 + 48 = 63

H $\frac{1\text{g/mol}}{63\text{g/mol}} = 1.59\%$ H

N $\frac{14\text{g/mol}}{63\text{g/mol}} = 22.2\%$ N

O $\frac{48\text{g/mol}}{63\text{g/mol}} = 76.2\%$ O

   - **b.** Antimony (V) Fluoride $SbF_5$

122 = 122
19(5) = 95
217

Sb $\frac{122}{217} = 56.2\%$

F $\frac{95}{217} = 43.8\%$

   - **c.** Mercury (II) Sulfate $HgSO_4$

Hg 201
S 32
O + 64
297

Hg $\frac{201}{297} = 67.7\%$

S $\frac{32}{297} = 10.8\%$

O $\frac{64}{297} = 21.5\%$

   - **d.** Lithium Bromide $LiBr$

7 g/mol
80 g/mol
87 g/mol

Li $\frac{7}{87} = 8.05\%$

Br $\frac{80}{87} = 91.95\%$

   - **e.** Anthracene, $C_{14}H_{10}$ $C_{14}H_{10}$

14(12) = 168
10(1) = 10
178

C $\frac{168}{178} = 94.4\%$

H $\frac{10}{178} = 5.62\%$

**f.** Ammonium Nitrate $NH_4NO_3$

$N = 2(14) = 28$
$O = 3(16) = 48$
$H = 4(1) = 4$
$80$

N $\frac{28}{80} = 35.0\%$

H $\frac{4}{80} = 5.0\%$

O $\frac{48}{80} = 60.0\%$

**g.** Iron (II) Thiocyanate $Fe(SCN)_2 = 172\ g/mol$

56
64
24
28
172

Fe $\frac{56\ g/mol}{172\ g/mol} = 32.6\%$

S $\frac{64\ g/mol}{172\ g/mol} = 37.2\%$

C $\frac{24\ g/mol}{172\ g/mol} = 14.0\%$

N $\frac{28\ g/mol}{172\ g/mol} = 16.3\%$

**2.** Calculate the percentage of the given element in each of the following compounds:

**a.** Nitrogen in Urea, $NH_2CONH_2$

Step 1: Calculate the molar mass of urea.
Step 2: Count the number of Nitrogen atoms in a molecule of urea.
Step 3: Calculate the total mass of nitrogen in a mole of urea.
Step 4: Calculate the percent of nitrogen in urea.

N = 28
H = 4
O = 16
C = 12
60 g/mol

$\frac{28\ g/mol}{60\ g/mol} = 46.7\%\ N$

**b.** Sulfur in Sulfuryl Chloride, $SO_2Cl_2$

S 32
O 32
Cl + 70
134 g/mol

$\frac{32\ g/mol}{134\ g/mol} = 23.9\%\ S$

**c.** Thallium in Thallium (III) Oxide, $Tl_2O_3$

Tl 408
O + 48
456

$\frac{408\ g/mol}{456\ g/mol} = 89.5\%\ Tl$

**d.** Oxygen in Potassium Chlorate, $KClO_3$

**3.** Calculate the mass of the given element in each of the following quantities:

**a.** Oxygen in 4.00 g of Manganese (IV) Oxide

Step 1: Write the correct chemical formula for Manganese (IV) Oxide.

Step 2: Calculate molar mass of manganese (IV) oxide.

Step 3: Convert grams of manganese (IV) oxide to moles using the molar mass.

Step 4: Determine the number of moles of oxygen in a mole of manganese (IV) oxide.

Step 5: Convert the moles of oxygen to grams using the molar mass of oxygen.

$MnO_2$

55
32
87 g/mol

$\frac{32\ g/mol\ O}{87\ g/mol\ MnO_2} = 36.8\%\ O$

$.368 = \frac{x}{4\ g} = 1.47\ g\ O$

OR

$4\ g\ MnO_2 \times \frac{1\ mol\ MnO_2}{87\ g} \times \frac{2\ mol\ O}{1\ mol\ MnO_2} \times \frac{16\ g\ O}{1\ mol\ O} =$

$1.47\ g\ O$

**b.** Silver in 325 g Silver Cyanide

$AgCN$

108
12
+ 14
134 g/mol

$325\ g\ AgCN \times \frac{1\ mol}{134\ g\ AgCN} \times \frac{1\ mol\ Ag}{1\ mol\ AgCN} \times \frac{108\ g\ Ag}{1\ mol} = 262\ g\ Ag$

**c.** Gold in 0.780 g of Gold (III) Selenide $Au_2Se_3$

$Au = 2(197) =$
$Se = 3(79) =$
631 g/mol

$0.780\ g \times \frac{1\ mol\ Au_2Se_3}{631\ g} \times \frac{2\ mol\ Au}{1\ mol\ Au_2Se_3} \times \frac{197\ g}{1\ mol\ Au} =$

$0.487\ g\ Au$

**d.** Chlorine in $5.0 \times 10^4$ g of 1,1-dichloropropane, $CHCl_2CH_2CH_3$

$5.0 \times 10^4\ g \times \frac{1\ mol}{112\ g} \times \frac{2\ mol\ Cl}{1\ mol} \times \frac{35\ g}{1\ mol} =$

C 12×3 = 36
H 8(1) = 8
Cl 35(2) = 70
112

$31250\ g\ Cl$

$3.1 \times 10^4\ g$

Key

## Hydrate Worksheet

1. Calculate the percentage of water in each of the following hydrates:
   a. sodium carbonate decahydrate, $Na_2CO_3 \cdot 10H_2O$

Na = 46 g/mol
C = 12 g/mol
O = 48 g/mol
$H_2O$ = 180 g/mol
} 286 g/mol

$\frac{180 \text{ g/mol } H_2O}{286 \text{ g/mol cmpd}}$ = 62.9% $H_2O$

   b. nickel(II) iodide hexahydrate, $NiI_2 \cdot 6H_2O$

Ni = 59
I = 254
$H_2O$ = 108
421

$\frac{108}{421}$ = 25.65% $H_2O$

   c. ammonium hexacyanoferrate(III) trihydrate (commonly called ammonium ferricyanide), $(NH_4)_2Fe(CN)_6 \cdot 3H_2O$

N = 8(14) = 112
H = 8(1) = 8
Fe = (1)(56) = 56
C = 6(12) = 72
$H_2O$ = 3(18) = 54
} 302 g/mol

$\frac{54}{302}$ = 17.88% $H_2O$

   d. aluminum bromide hexahydrate $AlBr_3 \cdot 6H_2O$

Al 27
Br 240
$H_2O$ 108
375 g/mol

$\frac{108}{375}$ = 28.8% $H_2O$

2. Calculate the percentage of hydrogen in the following compound iron(II) ammonium sulfate, $Fe(NH_4)_2(SO_4)_2 \cdot 6H_2O$

Fe = 56 = 56
N = 2(14) = 28
H = 20(1) = 20
S = 2(32) = 64
O = 14(16) = 224
} 392 g/mol

$\frac{20}{392}$ = 5.10% H

3. Calculate the percentage of oxygen in $CaSO_4 \cdot 2H_2O$

Ca = 40 = 40
S = 32 = 32
O = 6(16) = 96
H = 4(1) + 4
172

$\frac{96}{172}$ = 55.81% O