

**KEY - PERCENT COMPOSITION PROBLEM SET**

Determine the percentage composition of each of the compounds below.

1)  $\text{KMnO}_4$  molar mass: 158.0 g/mol% composition: K: 24.7% Mn: 34.7% O: 40.5%2)  $\text{HCl}$  molar mass: 36.5 g/mol% composition: H: 2.7% Cl: 97.3%3)  $\text{Mg}(\text{NO}_3)_2$  molar mass: 148.3 g/mol% composition: Mg: 16.4% N: 18.9% O: 64.7%4)  $(\text{NH}_4)_3\text{PO}_4$  molar mass: 149.0 g/mol% composition: N: 28.2% H: 8.1% P: 20.8% O: 43.0%5)  $\text{Al}_2(\text{SO}_4)_3$  molar mass: 342.3 g/mol% composition: Al: 15.8% S: 28.1% O: 56.1%6) sodium nitrite formula:  $\text{NaNO}_2$  molar mass: 69.0 /g/mol% composition: Na: 33.3% N: 20.3% O: 46.4%7) calcium chlorite formula:  $\text{Ca}(\text{ClO}_2)_2$  molar mass: 175.1 /g/mol% composition: Ca: 22.9% Cl: 40.5% O: 36.6%8) dinitrogen pentoxide formula:  $\text{N}_2\text{O}_5$  molar mass: 108.0 /g/mol% composition: N: 25.9% O: 74.1%9) aluminum phosphite formula:  $\text{AlPO}_3$  molar mass: 106.0 /g/mol% composition: Al: 25.5% P: 29.2% O: 45.3%

**10) carbonic acid**

formula: **H<sub>2</sub>CO<sub>3</sub>** molar mass: **62.0** /g/mol

% composition:

**H:** **3.2%** **C:** **19.4%** **O:** **77.4%**

(over)

Solve the following problems:

1) How many grams of oxygen can be produced from the decomposition of 100 g of  $\text{KClO}_3$ ?

$$\text{Molar mass} = 122.6 \text{ g/mol}$$

$$\% \text{ oxygen} = 3(16.0) / 122.6 = 39.2\% \text{ O}$$

$$(0.392) (100 \text{ g}) = 39.2 \text{ g O}$$

2) How much iron can be recovered from 25.0 g  $\text{Fe}_2\text{O}_3$ ?

$$\text{Molar mass} = 159.6 \text{ g/mol}$$

$$\% \text{ iron} = 2(55.8) / 159.6 = 69.9\% \text{ Fe}$$

$$(0.699) (25 \text{ g}) = 17.5 \text{ g Fe}$$

3) How much silver can be recovered from 125 g of  $\text{Ag}_2\text{S}$ ?

$$\text{Molar mass} = 247.9 \text{ g/mol}$$

$$\% \text{ silver} = 2(107.9) / 247.9 = 87.1\% \text{ Ag}$$

$$(0.871) (125 \text{ g}) = 109 \text{ g Ag}$$

4) A 3.56 g sample of pure **iron** powder was heated in gaseous **chlorine**, and 10.39 g of an iron chloride was formed. What is the percent composition of this compound? (Calculate the % of iron, and the % of chlorine in this compound)

$$3.56 \text{ g Fe} / 10.39 \text{ g total} = 34.3\% \text{ Fe}$$

$$\text{so, \% chlorine} = 65.7\% \text{ Cl}$$

5) Calculate the percent composition of each of the following compounds:

A) acetone,  $\text{CH}_3\text{COCH}_3$

**Molar mass = 58.0 g/mol**

**%C = 62.1% C**

**%H = 10.3% H**

**%O = 27.6% O**

B) aspirin,  $\text{CH}_3\text{COOC}_6\text{H}_4\text{COOH}$

**Molar mass = 180.0 g/mol**

**%C = 60.0% C**

**%H = 4.4% H**

**%O = 35.6% O**

6) Copper is obtained from ores containing the following minerals:

Azurite,  $\text{Cu}_3(\text{CO}_3)_2(\text{OH})_2$  % Cu: **55.3%**

Chalcocite,  $\text{Cu}_2\text{S}$  % Cu: **79.8%**

Chalcopyrite,  $\text{CuFeS}_2$  % Cu: **34.6%**

Covelite,  $\text{CuS}$  % Cu: **66.4%**

Cuprite,  $\text{Cu}_2\text{O}$  % Cu: **88.8%**

Malachite,  $\text{Cu}_2\text{CO}_3(\text{OH})_2$  % Cu: **57.5%**

Calculate the % of each mineral that consists of COPPER. Which mineral has the highest copper content on a percent-by-mass (percent composition) basis? Why might this information be important to a mine developer?

**\*Highest % Cu is CUPRITE (88.8%).**

**\*\*A mine developer needs to know if there is enough Cu available in the ore to make it cost-efficient.**