

Percent Composition  
And  
a scientific weight loss program

Schweitzer



# Percent composition



- If a human weighs 200 pounds, what is actually contributing to that mass.
- In other words how much of that 200 lbs is due to
  - Muscle
  - Fat
  - Bone
  - Fluids
  - Ect

# How does a person actually lose weight?

- When you run and you lose weight(mass). How did you actually lose mass?
- Sweating?
  - Yes, you will lose water but you will need to replace that to stay healthy and up right. So no real net loss.
- Breathing?
  - Yes, you actually breath out  $\text{CO}_2$  which is heavier then the  $\text{O}_2$  you breath in.

# Percent Composition

- Every person Breaths in oxygen and breaths out carbon dioxide ( $\text{CO}_2$ ) If a person breaths out 50 grams of  $\text{CO}_2$  how much of that mass is due to C and how much is due to O.
- To solve this problem we are going to determine the percent by mass of  $\text{CO}_2$

Important: This percentage is not specific to the sample size. A 10g sample will have the same ratio of C to O as a 1000g sample.

# Calculating percent composition

$$\% \text{ mass} = \text{Mass X} / \text{total mass} * 100$$

- $\text{CO}_2$
- Sample size = 1 mole
- C = 12 g    O = 2 \* 16 = 32g
- Total mass 1 mole = 44g
- C =  $12/44 * 100 = 27.2\%$
- O =  $32/44 * 100 = 72.7\%$

Any sample of  $\text{CO}_2$   
will have this same  
composition  
regardless of sample  
size!!!

# Determining mass of a sample

- Once again a person breaths out 50 grams of carbon dioxide. How much actual mass of carbon was lost.
- $50\text{g} * .272 = 13.6\text{g}$
- The rest of the mass is due to Oxygen which the person breathed in anyway.
- So this person breathed in 36.4g of  $\text{O}_2$  and breathed out 36.4g  $\text{O}_2$  and 13.6g of C in the form of  $\text{CO}_2$ .

$$\begin{aligned} \text{C} &= 12/44 * 100 = 27.2\% \\ \text{O} &= 32/44 * 100 = 72.7\% \end{aligned}$$

# Mr. Schweitzer's weight lose plan!

- Mr. Schweitzer wants to lose 10% of his body weight (230lbs).
  - 23lbs or 10.45kg or 10,454g is the amount that needs to be lost! Ouch... That is a lot of CO<sub>2</sub>
  - How would I figure out how much CO<sub>2</sub> I would have to breath out?
  - Ratios are a common way to solve problems like this!

# How to use a ratio!

- Ratio =  $\frac{\text{mass of C}}{\text{total mass}}$

Calculate

$$\frac{10454}{x} = \frac{27.2\%}{100\%}$$

Row only deals with C

Row only deals with total mass

•Ratio's work for all linear relationships.... Most of science...

•In other words if you work 1 hour and make 10 dollars you would make 20 in 2 hours.... 1000\$ in 100 hours.

•Linear relationship

•Cross multiply and divide

Mr. Schweitzer will have to breath out 38433 grams of CO<sub>2</sub>.



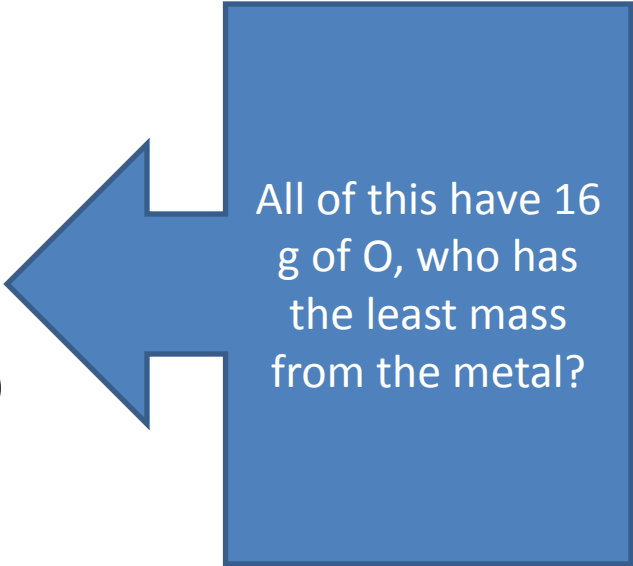
# Lets apply this concept to an AP Question.

- Which of these alkaline earth metal oxides has the greatest percent by mass oxygen?
  - a. barium oxide
  - b. beryllium oxide
  - c. calcium oxide
  - d. magnesium oxide
  - e. strontium oxide

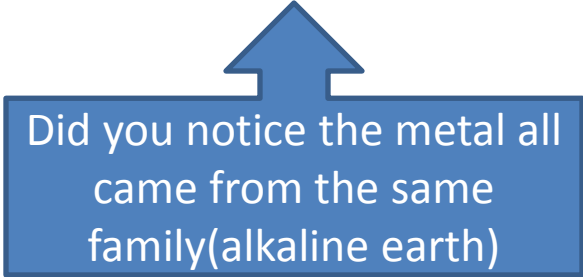
# Typical Questions

- Which of these alkaline earth metal oxides has the greatest percent by mass oxygen?

- a. barium oxide  $\text{BaO}$
- b. beryllium oxide  $\text{BeO}$
- c. calcium oxide  $\text{CaO}$
- d. magnesium oxide  $\text{MgO}$
- e. strontium oxide  $\text{SrO}$



All of this have 16 g of O, who has the least mass from the metal?



Did you notice the metal all came from the same family(alkaline earth)

# Typical Question

- Which oxides of manganese, Mn, have percent by mass of manganese that is greater than 50%.
- I.  $\text{MnO}$
- II.  $\text{MnO}_2$
- III.  $\text{Mn}_2\text{O}_3$
- a. II      d. II and III
- b. III      e. I, II, III
- c. I and III

# Typical Question

- Which oxides of manganese, Mn, have percent by mass of manganese that is greater than 50%.
- I.  $\text{MnO}$  (54, 16 = Yes)
- II.  $\text{MnO}_2$  (108, 32 = yes)
- III.  $\text{Mn}_2\text{O}_3$  (108, 48 = Yes)
- a. II      d. II and III
- b. III      e. I, II, III
- c. I and III

# Percent Mass = Formula

- Key Notes

- We are going to take the composition and convert back to a formula
- The composition is not determined by the size of the sample. Much like the Freezing point of water is not determined by the sample size.

- Example

- A white powder is analyzed and found to contain 43.64% phosphorus and 56.36% oxygen by mass.

-  $P_{?}O_{?}$  What are the ?'s.

# Lets reflect on this question?

Q: A white powder is analyzed and found to contain 43.64% phosphorus and 56.36% oxygen by mass.

1. Set a sample size. This does not matter. (100g is easiest)
2. Determine the mass of each element in the sample  
P: 43.64g      O: 56.36g
3. Convert to moles. This will give number of individuals!  
--  $43.64/30.97 = 1.409$  moles       $56.36/16. = 3.523$  moles
4. Simplify: Set smallest to 1 by dividing  
 $1.409/1.409 = 1$  P       $3.523/1.409 = 2.5$  or  $2\frac{1}{2}$
5. Multiply by reciprocal of fraction to remove  
 $1 * 2 = 2$ P       $2\frac{1}{2} * 2 = 5$       **P<sub>2</sub>O<sub>5</sub>**

# Where and how will you see this concept?

- Multiple choice: This concept is rarely given in this manner.
- Free response: It is seen quite frequently in an open written type of question just like the previous example.