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 CO_2 which is heavier then the O_2 you breath in.

Percent Composition

- Every person Breaths in oxygen and breaths out carbon dioxide (CO_2)   If a person breaths out 50 grams of 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 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

% mass = Mass X / total mass * 100

- 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 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.
- 50g * .272 = 13.6g

C = 12/44 * 100 = 27.2%
O = 32/44 * 100 = 72.7%

- The rest of the mass is due to Oxygen which the person breathed in anyway.
- So this person breathed in 36.4g of O_2 and breathed out 36.4g O_2 and 13.6g of C in the form of CO_2.

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_2
  - How would I figure out how much CO_2 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_2.

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 BaO
b. beryllium oxide BeO
c. calcium oxide CaO
d. magnesium oxide MgO
e. strontium oxide 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.MnO
- II.MnO_2
- III. Mn_2O_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.MnO (54, 16 = Yes)
- II.MnO_2 (108, 32 = yes)
- III. Mn_2O_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 2½

5. Multiply by reciprocal of fraction to remove

   1 * 2 = 2P 2½ * 2 = 5 **P_2O_5**

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.