

# AP Chemistry Daily Videos

## 1.3 Elemental Composition of Pure Substances

### Video #1

1. Give an example to illustrate what a "fixed ratio" means.
2. Is sucrose a pure substance? Why or why not?
3. Pause the video at 2:49 and attempt the problem, then evaluate how you did and identify any errors. What is the percent composition by mass of  $\text{N}_2\text{O}_4$ ?
- Ⓜ 4. Explain the following statement in your own words: "If different compounds have the **same smallest whole number ratio of atoms**, the composition by mass of those compounds is **the same**."

4:30

5.

| Term              | Definition | Example |
|-------------------|------------|---------|
| Empirical Formula |            |         |
| Molecular Formula |            |         |

6. Can the empirical and molecular formula be the same?
7. Pause the video at 6:17 and attempt the problem, then evaluate how you did and identify any errors. What are the empirical formulas of  $\text{H}_2\text{O}_2$ ,  $\text{Na}_2\text{SO}_4$ , and  $\text{C}_2\text{H}_4\text{O}_2$ ?

### Video #2

1. Pause the video at 0:50 and attempt the problem, then evaluate how you did and identify any errors. A compound was analyzed and found to contain 13.5 g Ca, 10.8 g O, and 0.675 g H. What is the empirical formula of the compound?
2. Pause the video at 3:15 and attempt the problem, then evaluate how you did and identify any errors. A compound is determined to be 43.6% P and the remainder oxygen. What is the empirical formula of the compound?

3. Pause the video at 5:25 and attempt the problem, then evaluate how you did and identify any errors. What is the empirical formula of a compound that is 28.7% K, 1.5% H, 22.8% P, and 47.0% O?

### Video #3

1. What is a combustion analysis?
2. Hydrate analysis?
3. Pause the video at 1:25 and attempt the problem, then evaluate how you did and identify any errors.

**MULTIPLE CHOICE:** A 23.0 g sample of a compound contains 12.0g C, 3.0g H and 8.0g O. Which of the following is the empirical formula of the compound?

A CH<sub>3</sub>O

B C<sub>2</sub>H<sub>6</sub>O

C C<sub>3</sub>H<sub>9</sub>O<sub>2</sub>

D C<sub>4</sub>H<sub>12</sub>O<sub>2</sub>

4. Pause the video at 2:11 and attempt the problem, then evaluate how you did and identify any errors.

**FREE RESPONSE:** A student is assigned the task of determining the moles of water in one mole of  $\text{MgCl}_2 \cdot n\text{H}_2\text{O}$ . The student collects the data shown below.

|   |          |
|---|----------|
| Mass of empty container                           | 22.347 g |
| Initial mass of sample and container              | 25.825 g |
| Mass of sample and container after first heating  | 23.982 g |
| Mass of sample and container after second heating | 23.976 g |
| Mass of sample and container after third heating  | 23.977 g |

(a) Explain why the student can correctly conclude that the hydrate was heated a sufficient number of times in the experiment.

(b) Use the data above to

- (i) calculate the total number of moles of water lost when the sample was heated, and
- (ii) determine the formula of the hydrated compound.

5. Pause the video at 6:14 and attempt the problem, then evaluate how you did and identify any errors.

When a 3.22 g sample of an unknown hydrate of sodium sulfate,  $\text{Na}_2\text{SO}_4 \cdot x\text{H}_2\text{O}$ , is heated,  $\text{H}_2\text{O}$  (molar mass 18g) is driven off. The mass of the anhydrous sodium sulfate (molar mass 142 g) that remains is 1.42 g. The value of  $x$  in the hydrate is:

A 0.013

B 1.8

C 6.0

D 10.

E 20.

6. Pause the video at 7:41 and attempt the problem, then evaluate how you did and identify any errors.

A sample of a compound that contains only the elements C, H, and N is burned completely in  $\text{O}_2$  to produce 44.0 g  $\text{CO}_2$ , 45.0g  $\text{H}_2\text{O}$  and some  $\text{NO}_2$ . A possible empirical formula of this compound is:

A CH<sub>2</sub>N

B CH<sub>5</sub>N

C C<sub>2</sub>H<sub>5</sub>N

D C<sub>3</sub>H<sub>3</sub>N<sub>2</sub>

E 20.

Source: AP Classroom