Lesson Title	Empirical Formula Determination
Length of Lesson	90 minutes
Created By	David Wilson
Subject	Chemistry / Physical Science
Grade Level	9-12th Grade
State Standards	2c, 3d / 5a
DOK Level	2, 3 / 1
DOK Application	Develop, Use / Write
National Standards	
Graduate Research Element	Identification of a chemical species based on the elemental composition is fundamental to most chemical analyses.

Student Learning Goal:

State Standards: (Chemistry)

2) Demonstrate an understanding of the atomic model of matter by explaining atomic structure and chemical bonding.

c. Develop a model of atomic and nuclear structure based on theory and knowledge of fundamental particles. (DOK 2)

3) Develop an understanding of the periodic table.

d. Use stoichiometry to calculate the amount of reactants consumed and products formed. (DOK 3)

State Standards: (Physical Science)

5) Investigate and apply principles of physical and chemical changes in matter.

a. Write chemical formulas for compounds comprising monatomic and polyatomic ions. (DOK 1)

Materials Needed (supplies, hand-outs, resources):

{**WARNING**: Please read the MSDS of any chemical before using it.}

[Chemicals needed]

$CuCl_2 \cdot 2H_2O$, 6.0M HCl, Al wire

[Quantities of the following supplies listed are per each group.]

ring stand, iron ring, clay triangle, crucible, crucible lid, watch glass, funnel, filter paper, balance, spatula, Bunsen burner, striker, dropper bottle for the acid, oven

Lesson Performance Task/Assessment:

1) Students will revisit the properties of hydrates.
2) Students will calculate the formula of a hydrate and the anhydrous sample based on experimental data.

Lesson Relevance to Performance Task and Students:
The students are learning the to write formulas. They are learning to calculate empirical and molecular formulas. They will have been through percent composition by the time they do this lab. So, this lab will give them practical experience in doing the calculations they are learning, and this is their initial introduction to the methods used to identify compounds.

Anticipatory Set/Capture Interest:
They will be reminded of the hydrate lab they did in which they identified the hydrate water content, but they did not determine the formula of the anhydrous salt. In this lab they will determine the entire formula.

Guided Practice:
At this point, the students will have gone over the calculations necessary to execute this lab. They will have gone over hydrates, and they will have already done a lab on hydrates.

Independent Practice:
The purpose of this lab is to give the students experience in applying the principles they will have learned up to this point. So, the entire lab is an exercise in independent practice.

Remediation and/or Enrichment:
Remediation: Individual IEP.
Enrichment: The students can classify the different reactions involved in this lab.

Check(s) for Understanding:
Post-lab questions and the data tested will be used to evaluate student understanding. See the attached lab handout.

Closure:
The post-lab questions and the class review of those questions will serve as the closure. See the attached lab handout.

Possible Alternate Subject Integrations:
This lesson is purely physical science.

Teacher Notes:
This lab takes one full day plus ~10 minutes the next day after drying the sample over night.