Unit Plan: Chemical Names and Formulas

FOR THE TEACHER

Summary
The AACT high school classroom resource library has everything you need to put together a unit plan for your classroom: lessons, activities, labs, projects, videos, simulations, and animations. We constructed a unit plan using AACT resources that is designed to teach Chemical Names and Formulas to your students.

Grade Level
High School

Objectives
By the end of this unit, students should be able to
- Name binary and ternary ionic compounds given the formula.
- Write formulas when given names of ionic compounds.
- From the compound name, recognize if it contains a polyatomic ion and/or a metal with a varying charge.
- Summarize “rules” for naming ionic compounds.
- Explain why stable ionic compounds are formed from a combination of cations and anions.
- Explain why different quantities of ions combine to make different compounds.
- Distinguish between the general locations of metal atoms versus non-metal atoms on the periodic table.
- Write a chemical formula for a covalent compound.
- Name a covalent compound using the appropriate rules of nomenclature.
- Predict the number of atoms needed in a molecular formula.
- Explain the purposes of superscripts and subscripts in chemical formulas.
- Correctly determine if a bond is ionic or covalent.
- Identify which elements can bond to each other.
- Determine the proper naming system to use for ionic versus covalent compounds.
- Determine the number of valence electrons for an atom.
- Create the correct Lewis Dot Structure from a given molecular compound or formula.
- Exhibit understanding of the differences between polar, nonpolar, and ionic substances.
- Calculate the percent of water (by mass) contained in a hydrated salt.
- Determine an empirical formula from percent composition data of a substance.
- Determine the formula of a hydrate from collected laboratory data.

Chemistry Topics
This unit supports students’ understanding of
- Covalent Bonding
- Covalent nomenclature and formula writing
- Electronegativity
- Empirical Formulas
- Formula Writing
- Intermolecular forces
- Ionic Bonding
- Law of Definite Proportions
- Lewis Structures
- Melting Point
- Metals and Nonmetals
• Molecular Formula
• Molecular Structure
• Molecules
• Molecules & Bonding
• Naming Compounds
• Naming ionic compounds
• Percent Composition
• Polarity
• Polyatomic Ions

Time

Teacher Preparation: See individual resources.
Lesson: 8-12 class periods, depending on class level.

Materials
• Refer to the materials list given with each individual activity.

Safety
• Refer to the safety instructions given with each individual activity.

Teacher Notes
• The activities shown below are listed in the order that they should be completed.
• The number of activities you use will depend upon the level of students you are teaching.
• The teacher notes, student handouts, and additional materials can be accessed on the page for each individual activity.
• Please note that most of these resources are AACT member benefits.

Classroom Resources:

Introduction/Review
• Use the Bonding animation to reinforce your students understanding of ionic and covalent compounds the Bonding Animation. This animation allows students to students visualize how different chemical bonds form. Examples of ionic, covalent, and polar covalent bonds are animated, and students are given a set of compounds to predict the bonding types.
• The Ionic and Covalent Bonding Simulation allows your students to investigate both types of bond and interact with several combinations of atoms. After building the binary molecules, students determine the type of bond that is present by watching the sharing or exchange of electrons between to two atoms. They then observe the formula and dot structure of the ionic formula unit or covalent molecule. For covalent molecules, the shape and name of the molecular shape is also provided.
• Students compare properties of two visually similar substances, salt and sugar, in the Ionic vs. Covalent Compounds lab. Observations of each substance and analysis of chemical composition will allow students to draw conclusions regarding ionic and covalent compounds that could be used to help identify them.

Ionic Bonding
Introduction
• Introduction to Naming and Formula Writing for Ionic Compounds: In this activity, students will be introduced to ionic compound formulas and names. They will group prepared cut-outs to note similarities and differences among different classes of ionic compounds (i.e. binary and ternary, including metals with varying charges). The goal is not to be equipped to write names
and formulas for ionic compounds, but to recognize trends in naming. Includes name and formula cards.

- Students use ion cards with height that is related to charge to build ionic compounds with balanced charges in the Constructing Ionic Compounds activity. After constructing compounds, students then write the correct name and formulas for each. In addition to a student activity sheet, this lesson provides a set of ion cards to use during the lesson.

**Practice**

- Use the Bond with a Classmate activity assigns students an anion or cation so that they can form bonds with their classmates and record the formula and name of the compounds they create. By the end of this lesson, students should be able to write compound formulas in correct ratios by balancing charges on ions and write compound names using ionic naming rules with correct endings.

- The activity, Ionic Bonding Puzzle, provides students with ionic puzzle pieces with shapes that correspond to their charge to use to create neutral ionic compounds. Once the compound are made, they use electron dot diagrams to show the formation of the compounds and then write the name and formula for each.

**Covalent Bonding**

**Introduction**

- In the guided inquiry lesson, Naming Covalent Compounds, students engage their literacy skills to interpret tables and answer a series of guiding questions to discover the rules of naming and formula writing for simple covalent compounds. By the end of this activity, students will be able to write a chemical formula and the name of covalent compounds using the appropriate rules of nomenclature.

**Practice**

- Students use dice and element cards to name binary molecular compounds and then draw their Lewis Diagrams with the Molecular Compound Dice activity. The element cards can be downloaded, printed, and laminated for pairs of students to participate in this hands on activity.

- With the Formula Card Game activity, students play a card game to practice creating chemical formulas for chemical compounds. This lesson will allow students to identify elements that can bond to each other to form appropriate compounds with different combinations of elements.

- The activity, Mystery Gang Empirical Formulae can be used to give your students practice determining the empirical and molecular formula of a substance. This resource includes Case description cards, which give the percent composition and description of each substance, and Suspect Cards, which describe each suspect and the formula of the compound they used.

**Summary and Application**

- Use the Naming Compounds reference chart to help your students gain a better understanding of how to name ionic compounds, covalent compounds, and acids. The flowchart helps students follow the logic behind naming different types of compounds.

- Students determine whether unknown substances are covalent (polar or nonpolar) or ionic by testing their solubility in the Solubility & Compound Type lab. A list of suggested unknown solids and solutions is provided in this resource, which will help students better understand how polarity, intermolecular forces, and solubility are related.

**Extension:**

- If your school has a ceramics program, The What’s in a Name? What’s in a Glaze? lesson connects chemistry and ionic compounds with the art of pottery. During the lesson, students practice naming and writing the formulas for ionic compounds commonly found in components of glazes for ceramics.
• Extend study of ionic compounds to include the concept of ionic hydrates with the Formula of an Unknown Hydrate lab. This inquiry based lab requires students to design a laboratory procedure and then collect and analyze data to determine the formula of an unknown hydrated salt.

• Students are challenged to analyze the spectral graphs obtained by the Curiosity Mars Rover with the Chemical Analysis of Martian Rocks lesson plan. Based on their examination students will determine the component elements of each sample, as well as the relative abundance of each element. With this information the student will complete calculations to find the empirical formula and identify the composition of the unknown rock. Finally students will complete research to see if these rocks are actually like those on Earth.