Project Summary:
Ion Models

Project: Ion models
School: North Eugene Academy of Arts
Class: Chemistry (30 students—a mix of sophomores and juniors)
Product: Two polymer plastic models representing a metal and non-metal element that can be combined to form an ionic compound

The goals of the project were to:

- Deepen students' understanding of ionic compounds
- Provide a hands-on introduction to chemical reactions in the making of polymers
- Encourage students' fluency with general chemistry concepts (such as interpreting the periodic table)
- Provide opportunities for students to think and act like a chemist (for example, by making precise calculations and measurements that affect a desired outcome)
- Foster habits of mind
- Explore the aesthetics of sculpture
- Practice the steps of moving from concept to the creation of three-dimensional forms

Tia Holliday finds that one of the most challenging topics for her students in chemistry is the interaction of metals and non-metals to form ionic compounds. "I think students find this material difficult because it's conceptually abstract," said Holliday. Typically, she uses chemistry models (color-coded balls and connecting rods) to represent the balance of negative and positive ions to create compounds, but students struggle to recall what these models mean and how they relate to the periodic table. Working collaboratively with Kate Ali, a sculptor and teaching artist with Arts Work in Education, Holliday designed a hands-on project to make the elements and their relationships more concrete. Students designed, sculpted and cast new chemistry models that represent the elements in ways relevant to the everyday world.

Each student was assigned a compound that consisted of a metal and a non-metal. Working in small groups, students brainstormed ways to symbolize how the elements are used or where they are commonly found (for example, a life vest to stand for chlorine or a banana to stand for potassium). Ali introduced the class to different sculpting styles and techniques, and gradually instructed them in the steps an artist uses to move from an initial concept to a final product. Students began by sketching their ideas to scale, indicating features essential to casting the model (such as the location of the pour spout) and to representing the element (such as holes to allow the final models to be connected to illustrate the ionic bond). Next, students sculpted their designs in clay. The clay models were small-scale (around 3 inches tall) and required diligence to capture detail. When the clay models were complete, students used them to make two-part molds, which was a two-part process of filling each side of the mold with a quick-setting polymer plastic. With the molds complete, students cast the final models using another type of quick-setting liquid plastic. Models of metal elements were tinted blue and non-metals were tinted red.

> *"I enjoyed the project very much. Hands-on experiences really let me see things better and it helps me remember things. This is something that had a huge impact on the way I learn chemistry."*
>
> —Kalen, student

The project was a bridge connecting two units of Holliday's content. "The students don't know it yet," said Holliday, "but as we discuss chemical reactions in the coming weeks we'll look closely at how polymers are formed and they will have already had experience working with them." Holliday and Ali led a group reflection and asked students to comment on the value of integrating sculpture into the chemistry curriculum. The class felt the project was successful in helping them learn and retain the information, and offered valuable suggestions on how to improve the project in the future. Holliday plans to use the final models with other classes (in place of the generic rods and balls) to demonstrate how ionic bonds are formed.

> *"Students might forget a lab the same day they do it, but I think they will always remember this experience. I also think they will always remember the characteristics of the elements and compounds they each had. This is important because this concept—the balance of positive and negative attraction—is basic to all the sciences."*
>
> —Tia Holliday

This summary was produced in partnership with E3: Employers for Education Excellence (www.e3oregon.org).