

Chemistry with new eyes:

A History of Chemistry for High School Teachers

Introduction

We live in a world filled with matter and we observe that it is constantly changing. One does not need to be a professional scientist to appreciate both the importance and the inherent interest in something that dominates our existence. But, common sense does not always lead us in the right direction when we think about matter. Aristotle was a brilliant philosopher and a keen observer of nature, but he could not produce a coherent picture of material reality. What observable aspects of our world and which concepts do lead us in the right direction? A consideration of the history of chemistry can be a big help in developing a clear view of chemical reality.

Early Man and Fire

While there is chemistry going on all the time in our world, one phenomenon that leads to chemical insights is fire. Humans did not need to invent this effect; lightning starts fires with regularity, both then and now. Wood burns and yields a dark product known as charcoal. What could be done with this “waste product” of disaster? One of its earliest uses was to produce Art.

While black pigments can produce representations of human reality, we live in an inherently colorful world. Rocks come in many different colors, and when they are subjected to a fire, many different colors can be created. Early artists used fire to create the pigments needed to represent their world.¹

Fire can also modify rocks in more dramatic ways, with a little help from charcoal. Iron ore can be reduced to metallic iron in a fire kindled with charcoal. This surely happened by accident initially, but soon chemists were perfecting the blast furnace to produce usable amounts of cast iron. The chemistry of metals (metallurgy) is one of the oldest forms of industrial activity, and the mining and smelting of metals is wonderfully summarized in the classic book, *De Re Metallica* (1556), which now exists in a good English translation by Herbert Hoover (1912). A presentation on the seven metals of antiquity (gold, silver, copper, iron, tin, antimony and mercury) almost always produces high levels of student interest.

Solutions to Boredom in Chemistry Classes

In spite of current attempts to fool consumers into thinking that food does not contain chemicals, all nourishment is composed of atoms and molecules. Some fruits and vegetables can be eaten right off the tree or out of the ground. But, some beverages were discovered by accident when a solution was left exposed to the atmosphere for an unknown period of time. A lively history of alcoholic beverages has been produced by the Program Chair of HIST: Seth Rasmussen.²

Everyone uses glass, but few people know what it is and how long it has been a part of human culture. Seth Rasmussen has also written a readable history of glass, from antiquity to the present.³ It makes this subject truly transparent. The Egyptians were especially adept at making colored glass and other colored solids. Did you know that one of the most beautiful red glasses is based on colloidal gold particles?

Polymers are everywhere, but most students do not see things in this light. While polymers have been a part of human culture for thousands of years, only in the early 20th century did chemists begin to appreciate that these materials were composed of macromolecules. Gary Patterson, the Chair of HIST has produced a history of polymer science that is intended for all teachers of chemistry.⁴

Sometimes the best fiction is based on solid facts. Alan Rocke has written a fantasy based on his seminal studies of 19th century chemistry.⁵ This era was filled with true characters.⁶ Chemistry comes alive when the people of chemistry are included with the details.

HIST Website for High School Teachers

After a successful workshop involving a few high school chemistry teachers, HIST has chosen to continue this effort by creating a website for all high school teachers. This essay is the first posting to this site, but the many essays produced for the workshop will soon be added. Additional essays of modest size (1000 words) will be posted on a regular basis for the next few years. They can be accessed at xxx.

References

1. Orna, Mary Virginia *The Chemical History of Color* (Springer, New York 2013).
2. Rasmussen, Seth C. *The Quest for Aqua Vitae* (Springer, New York, 2014.)
3. Rasmussen, Seth C. *How Glass Changed the World* (Springer, New York, 2012).
4. Patterson, Gary D. *A Prehistory of Polymer Science* (Springer, New York, 2012).
5. Rocke, Alan *From the Molecular World* (Springer, New York, 2012).
6. Patterson, Gary D. and Seth C. Rasmussen *Characters in Chemistry* (ACS Symposium Series, Volume 1136, 2013).