ARISE Curriculum Coordination to Science of Atoms and Molecules (SAM) Project

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This document is laid out by SAM activity. For each activity, there is a list of labs, demonstrations, articles, and/or worksheets that will help support it. Usually, it is assumed that these supplementary materials will help students prepare for the SAM activity, so as to get the most from it. It is not expected that teachers will use all of the materials cited; rather, the compilers have tried to convey the wealth of material available in the *ARISE Instructional Materials Guide, Part 1: Physics* and *Part 2: Chemistry* that supports the SAM activities.

SAM Activity: Molecular Geometry

SAM Theme Activities, Day 1:
The first day of the Molecular Geometry module of the SAM curriculum addresses the manner in which the attractions and repulsions that occur between negatively charged electrons and electron pairs and positively charged nuclei determine the shapes of simple molecules. Before visiting these pages, a student should understand a few very basic principles of electrostatics. The fundamental notion that oppositely charged particles repel each other while like charged masses attract is necessary. The charged nature of subatomic particles is a necessary element of background. While a quantitative study (Coulomb's Law calculations) is not necessary, the idea that a single proton and a single electron would produce an attraction equal in magnitude to the repulsion between two electrons at the same distance would be valuable. In addition to the knowledge of electrostatics and atomic structure, some vocabulary from geometry— three-dimensional shapes, etc. would support this unit. To extend these materials, it would be useful to include some discussion of electron configuration—to include electron configuration notation for small elements (periods 1 through 4 perhaps). Some discussion of the octet rule and its common exceptions would support specific examples from the module.
The electrostatics module of the SAM curriculum provides ample background in that topic and the Van der Waals unit provides a good introduction to those interactions.

With Day 1:

ARISE Chemistry Topic 16: Covalent Bonds, Molecular Shapes, and Intermolecular Forces (pdf)

Articles:

- *ChemMatters*, December 1992, pp. 7–11, “Buckyballs.”
- *ChemMatters*, April 1993, pp. 8–11, “Permanent Waves.”
- *ChemMatters*, October 1993, pp. 4–7, “Memory Metal.”
- *ChemMatters*, December 2002, pp. 4–6, “Images of Anthrax.”

SAM Theme Activities, Day 2:
The second day of the SAM project's study of molecular geometry explores more complex molecules such as lipids and proteins as they interact with DNA. In addition to the skills described in the introduction to day 1, a student working through the day 2 models should have a strong understanding of intermolecular forces, particularly the dipole–dipole interaction that occurs between nearby regions of concentrated electric charge. The ability to determine the number of bonding and non–bonding electron pairs by writing electron configurations or at least predicting the number of electrons present in the outer octet by examining a periodic table becomes even more indispensable during these topics. The electrostatics module of the SAM curriculum provides ample background in that topic and the Van der Waals unit provides a good introduction to those interactions.

With Day 2:

ARISE Chemistry Topic 4: Atomic Structure (pdf)

Articles:

- *ChemMatters*, December 2002, pp. 9–13, “Nanotechnology: The World of the Super Small.”

ARISE Chemistry Topic 16: Covalent Bonds, Molecular Shapes, and Intermolecular Forces (pdf)

Labs:

- *Flinn ChemTopic Labs*, Vol. 20, “Physical Properties of Proteins.” This lab is to identify possible physiological and environmental factors that lead to protein denaturation and activity.