

# 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: Electrostatics

Prior to Day 1:

[ARISE Physics Topic 4: Dynamics](#) (pdf)

“Newton’s 2nd Law and Newton’s 3rd Law,” Worksheet 4 D–1, *ARISE Instructional Materials Guide, Part 1 - Physics*

Labs:

- “Acceleration of a Constant Mass with a Variable Force,” *ARISE Instructional Materials Guide, Part 1 - Physics*. Rubber bands are used to produce several different amounts of force on a system. Acceleration is determined using a recording timer. Acceleration vs. force is plotted on a graph.
- “Acceleration of a Constant Force on a Variable Mass,” *ARISE Instructional Materials Guide, Part 1 - Physics*. Uses a rubber band stretched to a constant length to produce an acceleration. The changes in velocity are determined with a timer and a ruler and plotted on a graph.

[ARISE Physics Topic 9: Electric Forces](#) (pdf)

Electric Forces Worksheet, *ARISE Instructional Materials Guide, Part 1 - Physics*

Labs:

- Hewitt Lab 86, “Static Cling.” The student uses an electroscope to explore various aspects of positive and negative charge.
- Hsu Lab 15A, “Observing Electric Charge.” The student builds a simple electroscope and observes its behavior in the vicinity of various charged objects.
- “Conceptual Coulomb’s Law,” *ARISE Instructional Materials Guide, Part 1 - Physics*. The force between a pith ball and a charged plate is compared for a charge  $Q$ , a charge of  $Q/2$  and a charge of  $Q/4$  placed

on the pith ball (constant charge on the plate).

[ARISE Physics Topic 20: The Atom](#) (pdf)

The Atom Worksheet, *ARISE Instructional Materials Guide, Part 1 - Physics*

#### SAM Theme Activities, Day 1:

Day 1 of the SAM materials guides students through Coulomb force (electrostatic force) beginning with the conceptual basis and stepping through a simplified mathematical treatment of Coulomb's Law. While Coulomb's Law is given and not derived, simulations show the basis for the law. Students will learn about distance dependence through an interactive game and at the end of this day use their new knowledge to guide a charged particle through a maze.

#### Prior to Day 2:

[ARISE Physics Topic 1: Vectors](#) (pdf)

Vector Practice Worksheet, *ARISE Instructional Materials Guide, Part 1 - Physics*

Labs:

- Hewitt Lab 15, "Riding with the Wind." A dynamics cart fitted with a sail is used in conjunction with a fan and a spring scale to explore the resultant of two force vectors.

[ARISE Physics Topic 3: Kinematics](#) (pdf)

Hewitt: Concept-Development Book Activity 3.2

Labs:

- Hewitt Lab 5, "Conceptual Graphing." A sonic ranger (motion detector) is used to match graphs with actual motion.
- "Velocity and Acceleration," *ARISE Instructional Materials Guide, Part 1 - Physics*

[ARISE Chemistry Topic 17: Water and Aqueous Solutions](#) (pdf)

Labs:

- *ChemMatters*, December 1999, p. 8, "How Many Ways Can You See Red?"

Demonstrations:

- *Flinn ChemTopic Labs*, Vol. 12, "Sorting Out Solutions." A two-part demonstration to show the effect of hydrogen bonding and other intermolecular forces on the properties of solutions. When 50 ml of glycerol and 50 ml of water are mixed, the volume of the resulting solution should be 100 ml, but it turns out to be 4 percent less! Ethyl alcohol and water are miscible. Add an ionic solute to the solution, however, and the solution separates into two layers.

Articles:

- *ChemMatters*, December 1993, pp. 6–9, "Microwaves."

#### SAM Theme Activities, Day 2:

Day 2 of the SAM materials helps students start to understand non-idealized

situations involving charged particles. The activities help students see how Coulomb's Law applies in "real life" through investigations of charge polarization and electrostatic screening. The day ends with a thorough review of electrostatics at the atomic level.