

Chemistry Curriculum

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State Standards

Colorado Model Content Standards: SCIENCE

Standard 1

Students apply the processes of scientific investigation and design, conduct, communicate about, and evaluate such investigations.

Standard 5

Students understand that the nature of science involves a particular way of building knowledge and making meaning of the natural world.

Standard 2

Physical Science: Students know and understand common properties, forms, and changes in matter and energy. (*Focus: Physics and Chemistry*)

- **Standard 3**

- Life Science: Students know and understand the characteristics and structure of living things, the processes of life, and how living things interact with each other and their environment. (*Focus: Biology, Anatomy, Physiology, Botany, Zoology, Ecology*)

- **Standard 4**

- Earth and Space Science: Students know and understand the processes and interactions of Earth's systems and the structure and dynamics of Earth and other objects in space. (*Focus: Geology, Meteorology, Astronomy, Oceanography*)

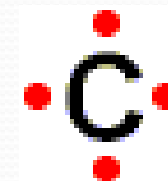
Standard 2 *Benchmarks*



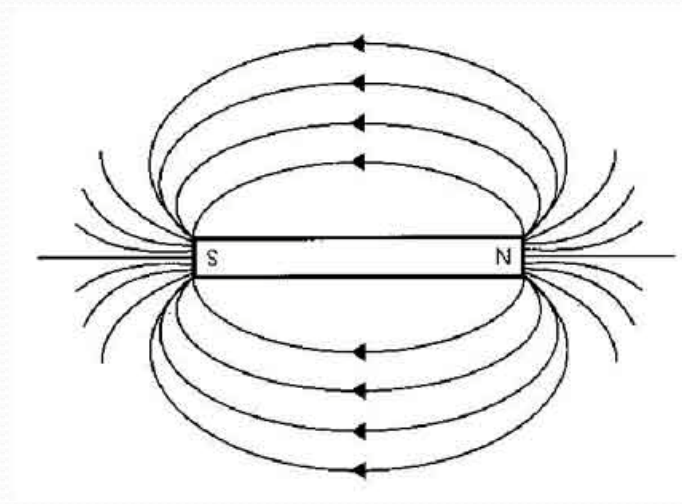
a. elements can be organized by their physical and chemical properties (Periodic Table)

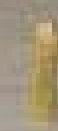


b. the spatial configuration of atoms and the structure of the atoms in a molecule determine the chemical properties of the substance



c. there are observable and measurable physical and chemical properties that allow one to compare, contrast, and separate substances (*for example: pH, melting point, conductivity, magnetic attraction*)





d. word and chemical equations are used to relate observed changes in matter to its composition and structure (*for example: conservation of matter*)

e. quantitative relationships involved with thermal energy can be identified, measured, calculated and analyzed (*for example: heat transfer in a system involving mass, specific heat, and change in temperature of matter*)

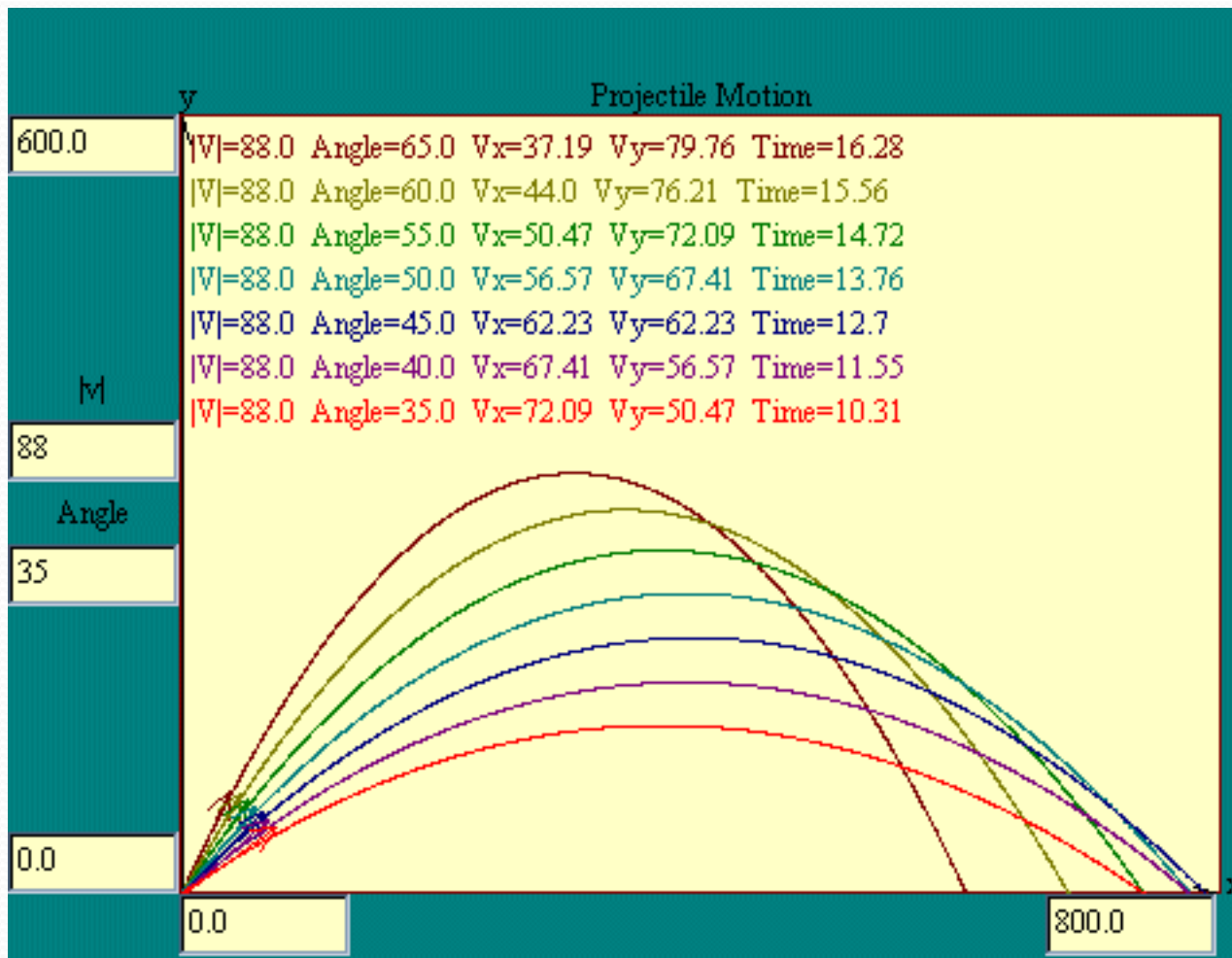
f. energy can be transferred through a variety of mechanisms and in any change some energy is lost as heat (*for example: conduction, convection, radiation, motion, electricity, chemical bonding changes*)



g. light and sound waves have distinct properties; frequency, wavelengths and amplitude

h. quantities that demonstrate conservation of mass and conservation of energy in physical interactions can be measured and calculated

i. Newton's Three Laws of Motion explain the relationship between the forces acting on an object, the object's mass, and changes in its motion



CURRICULUM OVERVIEW #1: FROM MAGIC TO SCIENCE

- ◎ “From Magic to Science” studies the history of scientific development within a laboratory environment by supporting hands-on historic experiments with science reading and writing assignments.

This 12 week course introduces aspects of:

1. Prehistoric Science and Measurement
2. Astronomy and Space Exploration
3. Discovery and Invention
(Physics/Chemistry)
4. Biochemistry

EXIT



FROM MAGIC TO SCIENCE CON'T

- ◉ Weekly activities include:

1. Study Guides: short excerpts from text sources with written responses to reinforce vocabulary and concepts.
2. Labs: connected to themes such as density, alchemy (gold pennies), replacement reactions (silver mirror), and polymer science (slimes/soap).

3. Research: *Scientific American* and *Science News* articles that relate to the themes. Assessment materials reinforce concepts as well as introduce career applications.
4. Notes, vocabulary exercises, tests, and portfolio/binder checks.

FROM MAGIC TO SCIENCE CON'T

Some Useful High School Level Resources

Grun, B. *The Timetables of History*, 4th rev. ed. 2005.

Tallack, P. *The Science Book*. 2003.

Moore, P. *Little Book of Big Ideas: Science*. 2006.

Lab materials: Flinn Scientific, Woodrow Wilson Institute workshops, and other laboratory resources.

Curriculum Overview #2: “Chemistry” in AP Biology and Biological Concepts classes.

- AP Biology has a 4-5 week “Chemistry of Life” unit and Biological Concepts has a similar 7-8 week “Biochemistry” unit.

Biological “Chemistry” topics

1. Atomic Structure
2. Ionic and Covalent Bonds
3. Periodicity
4. Biochemistry: Carbohydrates, Proteins, Lipids and Nucleic Acids (polymer chemistry)
5. Enzyme Function and Active Sites
6. Membrane Transport (Sodium/Potassium pumps)
7. Photosynthesis and Respiration
8. Organic Functional Groups

Biological “Chemistry” activities

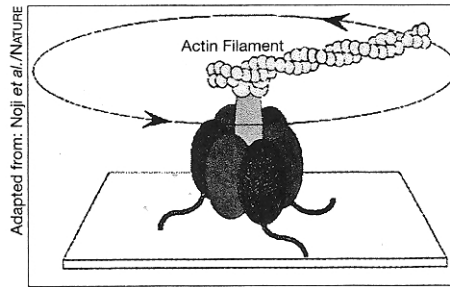
- Labs:
 - Precipitate Formation,
 - Identifying Organic Compounds,
 - Plant Pigment Chromatography,
 - Enzyme Catalysis,
 - AP Lab 1 “Diffusion and Osmosis”, AP Lab 5 “Cell Respiration”.

- Research: *Science News* articles such as “Molecular Motor Spins Out Energy for Cells”

Molecular motor spins out energy for cells

With parts that resemble pistons and a drive shaft, the enzyme F_1 -ATPase looks suspiciously like a tiny engine. Indeed, a new study demonstrates, that's exactly what it is. A movie of a single enzyme molecule in action shows that it spins like a motor to crank out ATP, the ubiquitous molecule that provides energy for biochemical processes in cells.

F_1 -ATPase is a subunit of a larger enzyme, ATP synthase, that spans the membranes of mitochondria, the energy-producing organelles in cells. Scientists from the Tokyo Institute of Technology



The enzyme F_1 -ATPase, attached to a glass slide, spins a fluorescent actin filament counterclockwise.

Additional “STEM” classes offered by Mr. Wiechern for 2008-09

- Genetics
 - PCR, RFLP, Gel Electrophoresis
 - Plasmid Insertion
- Microbiology
 - Sterile Technique
 - Gram Stain
- Anatomy
- Ecology



The End?