

BEMIDJI AREA SCHOOLS

PRINCIPALS OF CHEMISTRY

Grades 9-12

**Science is in curriculum review and subsequently new/different activities may be added/changed at the instructor's discretion. This list of activities is intended as a sample of the kinds of labs/activities/projects that are used to meet the Science Standards. It is NOT an all inclusive or exclusionary list of labs & activities.*

I. HISTORY AND NATURE OF SCIENCE

A. Scientific World View

Standard: The student will understand the nature of scientific ways of thinking and that scientific knowledge changes and accumulates over time.

The student will:

1. Be able to distinguish among hypothesis, theory and law as scientific terms and how they are used to answer a specific question.

Activities: *Introductory activities*
 Atomic Theory labs & activities

2. Be able to explain how scientific and technological innovations as well as new evidence can challenge portions of or entire accepted theories and models including but not limited to atomic theory.

Activities: *Atomic Theory labs & activities*

3. Recognize that in order to be valid, scientific knowledge must meet certain criteria including that it: be consistent with experimental, observational and inferential evidence about nature; follow rules of logic and reporting both methods and procedures; and, be falsifiable and open to criticism.

Activities: *Atomic Theory labs & activities*
 Standardized Lab Recaps for most labs

4. Explain how traditions of ethics, peer review, conflict and general consensus influences the conduct of science.

Activities: *Atomic Theory labs & activities*

5. Recognize that some scientific ideas are incomplete, and opportunity exists in these areas for new advances.

Activities: *Atomic Theory labs & activities*

B. Scientific Inquiry

Standard: The student will design and conduct a scientific investigation.

The student will:

1. Design and complete a scientific experiment using scientific methods by determining a testable question, making a hypothesis, designing a scientific investigation with appropriate controls, analyzing data, making conclusions based on evidence and comparing conclusions to the original hypothesis and prior knowledge.

Activities: *Urban Survivor Lab*
 Bubble Lab
 Other labs or activities to be decided

2. Distinguish between qualitative and quantitative data.

Activities: *Density of Pennies Lab*
 Chemical & Physical Change Lab
 Various other lab activities

3. Apply mathematics and models to analyze data and support conclusions.

Activities: *Density of Pennies Lab*
 Bubbles Lab
 Phase Change Lab
 Copper Sulfide Lab
 Formula of Copper Sulfate Lab
 Relating Moles to Coefficients Lab
 Stoichiometry Lab
 Gas Laws Lab exam

4. Identify possible sources of error and their effects on results.

Activities: *All lab activities*

5. Know that professional scientists and engineers have ethical codes.

Activities: *Atomic Theory labs & activities*
 Bubble Lab

6. Give examples of how different domains of science use different bodies of scientific knowledge and employ different methods to investigate questions.

Activities: *Atomic Theory labs & activities*

C. Scientific Enterprise

Standard: The student will understand the relationship between science and technology and how both are used.

The student will:

1. Compare and contrast the purposes and career opportunities of engineering, technology and science.

Activities: *Chemistry Career Project (to be developed)*

2. Provide an example of a need or problem identified by science and solved by engineering or technology.

Activities: *Atomic Theory labs & activities*

3. Provide an example of how technology facilitates new discoveries and the development of scientific knowledge.
Activities: *Atomic Theory labs & activities*
 Chemistry Career Project (to be developed)

4. Know that technological changes and scientific advances are often accompanied by social, political, environmental and economic changes.
Activities: *Atomic Theory labs & activities*
 Chemistry Career Project (to be developed)

5. Recognize that science and technology are influenced by cultural backgrounds and beliefs and by social needs, attitudes, values and limitations.
Activities: *Atomic Theory labs & activities*
 Chemistry Career Project (to be developed)

D. Historic Perspectives

Standard: The student will recognize the historical and cultural context of scientific endeavors and how they influence each other.

The student will:

1. Be able to trace the development of a scientific advancement, invention or theory and its impact on society.
Activities: *Atomic Theory labs & activities*

2. Provide examples of scientific advancements contributed by other civilizations and cultures.
Activities: *Atomic Theory labs & activities*

3. Compare and contrast the differences between scientific theories and theories from other bodies of knowledge, and the importance of each in a science discussion.
Activities: *Atomic Theory labs & activities*

II. PHYSICAL SCIENCE

A. Structure of Matter

Standard: The student will understand the nature of matter including its forms, properties and interactions.

The student will:

1. Identify protons, neutrons and electrons as the major components of the atom, their mass relative to one another, their arrangement and their charge.
Activities: *Atomic Theory labs & activities*
 Nuts & Bolts Mini Lab
 Probability activity
 Atomic Structure activities
 Isotopes & Atomic Mass activity
 Flame Test Lab

2. Be able to explain the relationship of an element's position on the periodic table to its atomic number and atomic mass.
Activities: *Periodic Table activities*

3. Compare and contrast the properties of an element and its isotopes, and describe how isotopes can be used in research, medicine and industry.
Activities: *Atomic Theory labs & activities*
Isotopes & Atomic Mass activity
Periodic Table activities

4. Use the periodic table to identify regions, families, groups and periods.
Activities: *Periodic Table activities*

5. Explain how neutral atoms become ions.
Activities: *Periodic Table activities*
Atoms to Ions activity

6. Be able to explain how atoms form compounds through bonding.
Activities: *Periodic Table activities*
Comparing Compound Lab
Molecular Model Lab
Atoms to Ions activity
Fruit-loop Mini-lab
Other bonding activities

7. Compare and contrast the states of matter in terms of interactions between particles.
Activities: *Gas Laws Unit labs & activities*
Penny Mini-lab
Cutting Perfect Crystals Lab
Phase Change Lab

8. Differentiate between an atom and a molecule.
Activities: *Introductory Activities*
Classification of Matter Lab

9. Differentiate between an element and a compound.
Activities: *Introductory Activities*
Classification of Matter Lab

B. Chemical Reactions

Standard: The student will describe chemical reactions and the factors that influence them.

The student will:

- Describe chemical reactions using words and symbolic equations.
Activities: *Formula writing activities*
Copper Sulfide Lab
Relating Moles to Coefficients Lab
Equation Writing activities
Formula of a Copper Sulfate Hydrate Lab
Types of Reactions Lab
- Explain the influence of temperature, surface area, agitation and catalysts on the rate of a reaction.
Activities: *Rate of Solution Lab*
- Distinguish between a chemical reaction and a nuclear reaction.
Activities: *Chemical & Physical Change Lab*
Atomic Theory activities
- Explain how the rearrangement of atoms and molecules in a chemical reaction illustrates conservation of mass.
Activities: *Formula Writing activities*
Copper Sulfide Lab
Relating Moles to Coefficients Lab
Gas Laws Lab exam
Equation Writing activities
Formula of a Copper Sulfate Hydrate Lab
Stoichiometry Lab
Other quantitative labs
- Describe how combining acids and bases produce a neutral solution.
Activities: *Properties of Acids & Bases Lab & activities*
Titration lab(s)

C. Energy Transformations

Standard: The student will understand energy forms, transformations and transfers.

The student will:

- Know that potential energy is stored energy and is associated with gravitational or electrical force, mechanical position or chemical composition.
Activities: *Chemical & Physical Change Lab*
Phase Change Lab
Other introductory activities
- Differentiate between kinetic and potential energy and identify situations where kinetic energy is converted into potential energy and vice versa.
Activities: *Phase Change Lab*
Other activities

3. Be able to describe physical and chemical changes in terms of the law of conservation of energy.
Activities: *Chemical & Physical Change lab*
 Phase Change Lab
4. Compare and contrast the amount of energy released through chemical reactions and nuclear fission and fusion.
Activities: *Chemical & Physical Change Lab*
 Atomic Theory activities
5. Be able to describe applications of the different wavelengths of the electromagnetic spectrum.
Activities: *Atomic Theory activities*
 Flame Test Lab

D. Forces of Nature

Standard: The student will understand the forces of nature and their application.

The student will:

1. Recognize the factors that affect the presence and magnitude of gravitational, electromagnetic, **weak and strong nuclear forces.**
Activities: *Atomic Theory activities*

E. The Universe

Standard: The student will use astronomical data to reveal the structure, scale, and changes in the stars, galaxies and universe over time.

The student will:

1. Explain how nuclear fusion produces energy and other elements.
Activities: *Chemical & Physical Change Lab*
 Atomic Theory activities