

CHEMISTRY

Students should be able to use science and engineering practices and understand the following content:

Science and Engineering Practices

- Development of habits of mind that are necessary for scientific thinking and that allow students to engage in science in ways similar to those used by scientists and engineers
- Asking and answering questions about the natural world
- Developing and using models to (1) build understanding of phenomena, processes and relationships, (2) test devices or solutions, or (3) communicate ideas to others
- Conducting structured investigations to answer scientific questions, test predictions, and develop explanations
- Collecting and analyzing data from investigations to construct explanations and communicate results
- Using mathematical and computational thinking in collecting and communicating data
- Using technology to collect data and in communication of results

Chemistry (Atomic Structure and Nuclear Processes)

- Demonstrate an understanding of atomic structure and nuclear processes
- Describe and compare subatomic particles with regard to mass, location, charge, electrical attractions and repulsions, and impact on the properties of the atom
- Use the Bohr and quantum mechanical models to describe electron distribution in an atom
- Analyze and interpret emission spectra to support explanations of discrete energy levels
- Compare alpha, beta, and gamma radiation
- Explain radioactive decay and explain how the concept of half-life is used for determining the age of materials
- Compare nuclear fission and fusion
- Use mathematical and computational thinking to explain the relationship between mass and energy ($E=mc^2$)

Chemistry (Bonding and Chemical Formulas)

- Demonstrate an understanding of the structures and classification of chemical compounds
- Compare and contrast molecular and ionic compounds
- Use the periodic table to write and interpret the formulas and names of chemical compounds
- Analyze and interpret data to predict the type of bonds and shapes of simple compounds using Lewis dot structures and oxidation numbers
- Plan, investigate, generate, and interpret data to infer the types of bonds in simple compounds
- Develop and use models to illustrate structural isomerism in simple hydrocarbons
- Explain how the basic structure of common natural and synthetic polymers is related to their bulk properties (proteins, nucleic acids, starches, plastics)
- Calculate empirical formulas and percentage composition of compounds

Chemistry (States of Matter)

- Demonstrate an understanding of the structure and behavior of the different states of matter
- Develop and use models to explain the arrangement and movement of the particles in solids, liquids, gases, and plasma
- Analyze and interpret graphs of heating curves to explain how changes from one state of matter to another are energy dependent
- Conduct investigations and use models to explain behaviors of gases (pressure, volume, and temperature relationships)

Chemistry (Solids, Acids, and Bases)

- Demonstrate an understanding of the nature and properties of various types of chemical reactions
- Describe how substances dissolve in water by dissociation, dispersion, or ionization and the affect of intermolecular forces
- Describe effects of temperature on solubility
- Calculate molarity and percent of mass for solutions

Chemistry (Chemical Reactions)

- Demonstrate an understanding of the types, causes, and effects of chemical reactions
- Develop and use models to predict the products of chemical reactions
- Predict shifts in chemical equilibria
- Plan, investigate, and collect data to provide evidence that mass is conserved in chemical reactions
- Using mathematical and computational thinking to predict reactant amounts needed for a designated product yield

Chemistry (Thermochemistry and Chemical Kinetics)

- Demonstrate an understanding of conservation of energy and energy transfer
- Analyze and interpret energy diagrams
- Use mathematical and computational thinking to write thermochemical equations and draw energy diagrams
- Determine various factors that affect reaction rates
- Develop models to illustrate reaction rates for given chemical reactions

Activities:

- Go online and search for sites with chemistry tutorials and simulations.
- Visit a science center.
- Visit a medical facility where you can learn about ways in which chemistry is used.
- Investigate careers that involve chemistry.
- Cook or bake something and discuss the chemical changes that occur

Websites:

- American Chemical Society - <http://www.acs.org/content/acs/en.html>
- Chemistry Simulations - <https://phet.colorado.edu/en/simulations/category/chemistry>
- Exploratorium - <http://www.exploratorium.edu>
- NASA Science - <http://science.nasa.gov>
- Periodic Table <http://www.rsc.org/periodic-table>